The Redfern Inquiry

into human tissue analysis in UK nuclear facilities

Volume 1: Report

HC 571-I

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Return to an Address of the Honourable the House of Commons
dated 16 November 2010
for

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Volume 1: Report

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Prologue

1 Between 1960 and 1992, the United Kingdom Atomic Energy Authority (UKAEA) and its successor British Nuclear Fuels Limited (BNFL) undertook radiochemical analysis of organs removed at post mortem examination from the bodies of former employees. Most of the men had worked at Sellafield[1] but some had been employed at other nuclear sites, including Springfields, Capenhurst, Winfrith, Dounreay and Aldermaston. In most cases, a wide variety of organs was removed: a selection comprising the lungs, the liver, the kidneys, the spleen, several ribs, several vertebrae and the femur (thigh bone) was typical.

2 The discovery of the work which had been conducted by the UKAEA and BNFL led to the establishment of this Inquiry. That work had involved the removal of organs from 76 men; the Inquiry has been able to explore the facts of those cases in considerable detail. In the course of the investigation, it became apparent that other organisations had undertaken research of a similar nature and the scope of the Inquiry was widened to cover the relevant activities of the Atomic Weapons Establishment (AWE), the National Radiological Protection Board (NRPB) and the Medical Research Council (MRC), dating back to the 1950s.

3 The Inquiry was therefore able to investigate the way in which data were acquired for research projects by analysis of organs taken from more than 6,500 bodies. Chapters in the Report are devoted to each organisation.

Background

4 From the beginning of the UK nuclear industry in the early 1950s, it was recognised that the processing of radioactive materials posed radiobiological hazards which had not previously been encountered. Almost from their inception, the UKAEA and later BNFL monitored radiation levels to which their staff were exposed and conducted research projects of various types.

5 Radiation, such as alpha particles emitted by uranium and plutonium, may be harmful to health. Radiological protection therefore involves the determination, with reasonable accuracy, of the amounts of radionuclides in various tissues of the body. However, alpha particles travel only very short

1 Until 1981 the site now called Sellafield was known as Windscale (strictly, Windscale and Calder works); for convenience, it is referred to as Sellafield throughout the Report

distances and cannot be detected from outside the body. While the worker is alive, it is necessary to resort to indirect methods of quantifying internal radionuclides, such as radiochemical analysis of urine samples (urinalysis). These indirect methods of measurement are subject to much uncertainty.[2]

6 An alternative, direct method of measuring radionuclide content is to analyse organs taken at post mortem. Direct measurements may then be compared with those derived from indirect monitoring methods during life. Such comparison enables indirect measurements such as urinalysis to be interpreted with greater confidence and hence for better radiological protection to be provided. This desire for greater understanding led to the analyses of organs obtained at post mortem from nuclear workers. The analytical process involves the complete destruction of the organ.

7 Dr David Macgregor was appointed BNFL's Company Chief Medical Officer in 2003. His responsibilities included oversight of all BNFL's medical and epidemiological research projects. In May 2005, he was notified of a proposed project which involved re-examination of data obtained from radiochemical analysis of organs removed from former nuclear employees at post mortem examination.

8 Dr Macgregor was aware that such research had been conducted at Sellafield in the past: he had seen a paper published in 1980 by one of his predecessors, Dr Geoffrey Schofield, in the *British Journal of Radiology* in which the results obtained from analysis of organs taken from 29 former BNFL employees were set out. The new proposal led to his obtaining more information as to the extent of the earlier work. He identified Sellafield employees from whom organs had been taken at post mortem and obtained their occupational health records. He noted that in many, the cause of death could not have been related to radiation and that there was no evidence to suggest consent to the removal and radiochemical analysis of organs; he noted also that the coroner appeared frequently to have notified the Medical Department at Sellafield of the deaths and considered this to be odd. As his review of the records progressed, the full extent of the old research became apparent; more than 60 former Sellafield employees had been involved.

9 Dr Macgregor discussed his concerns with management at BNFL and with the trade unions. Further investigation was proposed but before it could be put in train the press became aware of the issue, which in turn attracted the attention of the Government. Dr Macgregor was invited to inform the

2 See chapter 2, "Science"

Secretary of State at the Department of Trade and Industry, the Rt Hon Alistair Darling MP, of his discovery.

Announcement of the Inquiry

10 On 18 April 2007, Mr Darling announced to the House of Commons that he had invited me to chair a confidential inquiry into the removal of body tissue from nuclear workers, most of whom had worked at Sellafield between 1962 and 1991. Mr Darling ended his statement:

> *this is clearly a difficult situation covering events that took place up to 45 years ago. Nonetheless we owe it to the families as well as to the general public to find out what happened and why.*

11 The Inquiry was established as a confidential government inquiry. Its evidence was to be heard in private and its processes were to be inquisitorial.

Terms of Reference

12 On 26 April 2007, Mr Darling announced the Inquiry's Terms of Reference.

a. *Having regard to the provisions of the Human Tissue Act 1961, the Coroners Rules 1984, the Coroners Act 1988 and predecessor legislation, to enquire into the circumstances in which, between 1961 and 1992, organs/tissue were removed from 65 individuals, and were sent to and analysed at Sellafield.*
b. *In particular, to establish so far as practicable:*
   i) *when, where, by whom and by what means the taking of organs/tissue was requested and authorised;*
   ii) *whether the taking of organs/tissue was based on informed consent by the family and/or surviving relatives;*
   iii) *the purpose to be achieved by the retention and analysis of the organs/tissue removed; the generic results of analysis; and the identity of all publications in which the results were presented and commented upon;*
   iv) *whether the families or surviving relatives were informed of the results of the analysis, or the identity of the relevant publications;*
   v) *when and by whom the retention, storage, transportation, analysis, reporting and disposal of the organs/tissue was authorised;*

vi) the circumstances in which the organs/tissue were retained, stored, transported, analysed, reported upon and disposed of;

vii) the general purpose to be served by such retention, storage, analysis and publication of the results;

viii) when this activity ceased, and the circumstances in which it ceased.

c. To consider such other issues in connection with the above matters as the Secretary of State may direct.

d. To report to the Secretary of State as soon as possible.

e. To make recommendations.

13 Mr Darling continued:

> *Since my statement to the House* [on 18 April 2007]*, the UK Atomic Energy Authority (UKAEA) and the Atomic Weapons Establishment (AWE) have begun to examine their records to identify if tests on autopsy tissues were carried out at any of the sites for which they are, or have been responsible, other than Sellafield. The UKAEA tell me that they believe such work was carried out at Harwell, at least until the early 1980s, and possibly at other UKAEA sites, potentially involving work related to individuals who had not been employed at nuclear sites. The AWE believes that there could have been additional testing on their employees. In light of this information, and in line with what I told the House last week, I have therefore asked Michael Redfern QC to make this additional information part of his considerations.*

Revised Terms of Reference

14 The Inquiry's preliminary investigations revealed that even before 1961, organs had been removed at post mortem examination and analysed in order to establish radionuclide content. The first such research in the nuclear industry appeared to have started around 1955. It was also apparent that the Inquiry's original Terms of Reference required extension to allow investigation of the part played by the hospitals in which the post mortem examinations had been conducted.

15 I therefore requested that the Inquiry's Terms of Reference be extended to allow this earlier research to be investigated and to remove the specific reference to Sellafield. On 26 February 2008, the Rt Hon John Hutton MP,

Secretary of State for Business, Enterprise and Regulatory Reform (BERR),[3] announced a revised first paragraph of the Terms of Reference:

a. *Having regard to the provisions of the Human Tissue Act 1961, the Coroners Rules 1984, the Coroners Act 1988 and predecessor legislation, to enquire into the circumstances in which, from 1955, organs/tissue were removed from individuals at NHS or other facilities, and sent to and analysed at nuclear laboratory facilities.*

Sponsors

16 The Inquiry was initially sponsored by the Department of Trade and Industry (DTI). When BERR was created, in June 2007, it assumed sponsorship; BERR was in turn replaced in October 2008 by the Department of Energy and Climate Change (DECC). The revised Terms of Reference mentioned the NHS and so the Department of Health became a co-sponsor in February 2008.

Families

17 The Inquiry was keen to hear evidence from as many as possible of the families of the men from whom organs had been taken. A Families' Support Group was established in Cumbria, funded by the Inquiry.

18 Fourteen such families came forward to give evidence. The Inquiry is satisfied that they were representative of the families as a whole.

Stakeholders

19 The Inquiry had five principal stakeholders, each of which had been involved, directly or indirectly, with radiochemical analysis of human tissue in nuclear facilities.

3 On its creation in June 2007, BERR had assumed sponsorship of the Inquiry

The United Kingdom Atomic Energy Authority

20 The UKAEA was created in 1954 to assume responsibility for all aspects of atomic energy in the UK. For more information, see chapter 6, "The United Kingdom Atomic Energy Authority".

British Nuclear Fuels Limited

21 BNFL was formed in 1971 from the UKAEA production group, which included Sellafield, Springfields and Capenhurst. Many of the radiochemical analyses investigated by the Inquiry were conducted by BNFL in its laboratories at Sellafield. For more information, see chapter 5, "British Nuclear Fuels Limited".

The Atomic Weapons Establishment

22 The AWE was created in 1950 as the Atomic Weapons Research Establishment (AWRE). Its premises were near Aldermaston. Since 1973, it has been part of the Ministry of Defence (MoD). Its name was changed to the AWE in 1987. It is responsible for the maintenance of the UK's nuclear deterrent. For more information, see chapter 9, "The Atomic Weapons Establishment".

The Health Protection Agency

23 The National Radiological Protection Board (NRPB) was created in 1970 to conduct research into and to provide advice on protection from radiation hazards. Apart from occasional minor research contracts, it had no financial or commercial links to the nuclear industry. Its remit was scientific and its role was not dependent on the existence of a nuclear industry. In 2005, the NRPB became the Radiological Protection Division of the Health Protection Agency (HPA). For more information, see chapter 8, "The National Radiological Protection Board".

The Medical Research Council

24 The MRC was formed in 1913 (as the Medical Research Committee and Advisory Council); its remit includes all forms of medical research. It funds scientific and public health research in universities, hospitals and other institutions. Since the Second World War, it has advised the Government on

the hazards of radiation and it is one of the principal supporters of research into the biological effects of ionising radiation. For more information, see chapter 11, "Strontium and the Medical Research Council".

Other interested parties

25 The Inquiry was keen to hear evidence from as many relevant witnesses as possible in addition to the families and its principal stakeholders. The passage of time since the events under investigation meant that many of those whose evidence could have been of great assistance had died. Other interested parties from whom the Inquiry did receive evidence included the following.

Pathologists

26 The pathologists were the doctors who performed post mortem examinations at NHS facilities and removed organs at those examinations for radiochemical analysis. The Inquiry received evidence from 17 of those pathologists.

Coroners

27 The Inquiry heard evidence from two coroners under whose authority post mortem examinations had been conducted at which organs were removed for radiochemical analysis.

Hospital management

28 The hospital management was responsible for the mortuaries in which organs were removed at post mortem for analysis. For more information, see chapter 12, "West Cumberland Hospital": the Inquiry heard evidence from various members of the management of that institution.

Trade unions

29 The Inquiry received evidence from officials and former officials of several unions at BNFL. The unions had provided their members and their members' families with legal assistance, which in some cases involved representation at inquests and legal action against the employers. The Inquiry also heard evidence from a solicitor who had acted on behalf of members of the General and Municipal Workers' Union. For more information, see chapter 7, "The Trade Unions and the Compensation Scheme".

The Inquiry

30 The Inquiry began its investigations in May 2007. It had offices in Whitehaven and in central Manchester. Oral evidence was heard at the County Court in Whitehaven and at the Civil Justice Centre in Manchester.

The team

31 The Inquiry team comprised a solicitor, with senior and junior assistant solicitors, counsel and a small secretariat. The secretariat was supplied by the civil service. The lawyers were appointed through government procurement processes.

32 The team was small but had the expertise and experience necessary to deal with the complexities of an Inquiry investigating events going back to the early days of the nuclear industry in the 1950s. Weighing and balancing the evidence required energy, vigour and no little skill and dedication.

Preliminary meetings

33 Meetings were held with the families, the trade unions and the coroner for West Cumbria. A preliminary meeting with all five principal stakeholders was held in London on 12 December 2007. The Inquiry organisation, schedule of proposed activity, procedures and other issues were explained. The Inquiry then held meetings with each principal stakeholder and conducted several site visits.

List of Issues

34 On 13 December 2007, after consultation with the stakeholders and other interested parties, an agreed 16-page List of Issues was produced.[4] This list provided the formal framework upon which the Inquiry was based.

Fairness and impartiality

35 The Inquiry recognised that it was of paramount importance to be fair and impartial. Despite the antiquity of much of the evidence, the Inquiry strove to avoid hindsight. It was careful always to consider actions taken by individuals in the light not of 21st-century mores but of those which prevailed at the time. Candour was encouraged and assistance offered whenever reasonably requested.

Information technology

36 All the documents disclosed to the Inquiry – some 150,000 pages – were scanned and stored in a computerised document management system known as Lextranet, to which access was gained by secure internet connection. Individual stakeholders were allowed access to restricted subsets of these documents to assist them in preparing their evidence and submissions. Every page of documentary evidence was available during the oral hearings and could be displayed instantly on screen.

37 A computer system (LiveNote) was used to provide transcripts of oral hearings in real time. The transcript of each day's evidence was available shortly after the close of proceedings and was copied to solicitors who had assisted the witnesses heard that day.

Evidence

Documentary evidence

38 The document search was of particular importance because so many of the key witnesses were dead. Helpfully, the nuclear industry routinely retained the bulk of the documents it produced: the UKAEA's archives, for example, contain some eight kilometres of shelving. The majority of relevant

4 See appendix C

documentation had therefore been preserved but as those documents of interest were not always readily identifiable, it was necessary for vast quantities of documents which ultimately proved irrelevant to the Inquiry's investigations to be searched.

39 In contrast, perhaps as a result of recurrent NHS reorganisations, the organisation and availability of documents from the North Cumbria Acute Hospitals NHS Trust, whose records would have been of particular interest to the Inquiry as they should have covered West Cumberland Hospital in Whitehaven, left much to be desired.

40 The principal stakeholders each undertook extensive document searches and disclosed the results to the Inquiry. Certain types of document were common to the UKAEA, BNFL and the AWE:

- personnel files;
- medical and occupational health records;
- dosimetry assessments (internal, external and whole body monitoring);
- records of compensation claims (whether litigation or under the Compensation Scheme for Radiation-Linked Diseases[5]);
- legal files and/or expert reports describing radiochemical analyses relating to inquests;
- bioanalytical laboratory files;
- minutes of a great many committee meetings, including board and departmental management committees, health and safety committees and technical and research committees;
- large numbers of internal memoranda and file notes of telephone conversations;
- correspondence with other nuclear organisations.

The HPA, which had acquired the files of the NRPB, disclosed many documents in the last five categories above;[6] its very comprehensive laboratory log books were of particular value. Most documents relevant to the MRC were already in the public domain but it freely disclosed internal memoranda, minutes and correspondence.

41 A comprehensive index of the UKAEA's archive of paper documents was held on computer, in a form which allowed detailed and complex searches to be undertaken relatively easily. Documents belonging to other organisations were often held in many different places, making searches more difficult and

5 See chapter 7, "The Trade Unions and the Compensation Scheme"

6 The NRPB had not employed radiation workers; its personnel and occupational health files were therefore of no relevance to the Inquiry

time-consuming. For example, the AWE/MoD had to search document stores at many sites, including Aldermaston, the Defence Scientific and Technology Laboratory and the Institute of Naval Medicine and obtained documents from the Treasury Solicitor's Department.

42 BNFL's documents were held in repositories and archives; by BNFL's solicitors; and at various BNFL sites, including Sellafield, Risley, Daresbury, Springfields, Dounreay and Capenhurst. The Inquiry gained the impression that files relating to BNFL's management and what might be regarded as its core activities were in general well-structured and well-indexed. In contrast, the organisation by Dr Macgregor's predecessors of those documents relevant to the post mortem studies, which lay at the heart of the Inquiry's investigations, was rather haphazard. A considerable amount of time and effort, which BNFL readily provided, was required to locate and collate them; the Inquiry is satisfied that it has seen all relevant documents, save for occasional individual pages which it accepts have been lost over time.

43 The Inquiry undertook its own searches, which included the archives of the principal stakeholders, the Record Offices at Whitehaven and Carlisle, and The National Archives at Kew. Particular attention was paid to West Cumberland Hospital, where the Inquiry performed careful searches of record stores, the Chairman's office and the Animal House,[7] where several organs removed at post mortem examination were found in display cases (although none proved to be relevant to the Inquiry). The Inquiry inspected files held by stakeholders' solicitors and also coroners' archives in West Cumbria (including all post mortem reports from the 40-year period between 1956 and 1995) and Oxford. Many coroners passed papers on named individuals to the Inquiry upon request.

44 Several NHS trusts, including Newcastle, Edinburgh and Oxford, provided documents. The Inquiry had access to the Department of Health's archives at Nelson, which included papers from the Black Committee[8] and the Committee on Medical Aspects of Radiation in the Environment (COMARE). The vast majority of papers once held by trade unions are no longer in existence but some, held mainly by their solicitors, were examined: these were legal files relating to members' radiation-linked claims. Library and internet searches were carried out as part of an extensive literature review, particularly in the search for reference to identifiable data. The

7 A part of the hospital once used to house animals for research and now used as a storage area for the pathology department

8 Black, Sir Douglas, *Investigation of the Possible Increased Incidence of Cancer in West Cumbria. Report of the Independent Advisory Group*, Cmnd 667(122) (HMSO, 1984)

Compensation Scheme for Radiation-Linked Diseases disclosed many of its files.

45 The Inquiry found of assistance documents related to the families disclosed by CORE (Cumbrians Opposed to a Radioactive Environment).

46 Finally, the Inquiry was able to review voluminous documentation disclosed by the United States Transuranium and Uranium Registries.[9]

47 In addition to the searches conducted by the stakeholders, the Inquiry team itself spent the equivalent of 210 working days searching documents at 18 sites. In total, some 150,000 pages of documentation were carefully considered. The Inquiry is satisfied that every effort has been made to obtain documents likely to have been relevant to its Terms of Reference.

Witness evidence

Principal stakeholders

48 The five principal stakeholders provided opening statements which were of great assistance to the Inquiry. Each also gave a closing statement. Oral submissions were made by senior employees and/or representatives of each of the principal stakeholders; before those oral submissions, the Inquiry wrote to each stakeholder, setting out in detail those areas in which its evidence would be of particular value and its assistance was sought.

Individual witnesses

49 Each individual from whom the Inquiry wished to hear evidence was asked in writing to meet the solicitor or one of the assistant solicitors so that a witness statement could be taken. Before the meeting, witnesses were provided with a list of issues relevant to their evidence. Afterwards, a draft witness statement was produced and submitted to the witness for approval or amendment. Witnesses who wished to receive legal advice, if necessary from a lawyer present during the interview, were encouraged to do so.

50 Many witnesses were invited to supplement their statements by evidence given orally at the Inquiry's hearings, when issues raised could be explored in more detail.

9 See chapter 10, "Registries"

Notice of potential criticism

51 If, after consideration of the documents, the Inquiry thought it possible that a witness might be the object of criticism in the Report, the letter which invited that witness to interview would set out the nature of and reasons for the potential criticism (a Salmon letter[10]).

52 The Salmon letters enabled witnesses who faced possible criticism to understand the issues which were likely to be raised at the interview and any hearing and afforded them the opportunity to prepare their responses to those issues. Any matter set out in a Salmon letter but not discussed at the interview or hearing has not been used as the basis of criticism in this Report.

Oral hearings

53 Many of the families of the deceased men, and several other relevant witnesses, lived in Cumbria; as far as possible their oral evidence was heard, for their convenience, in Whitehaven. However, the majority of the oral evidence was heard in Manchester.

54 At the hearings, witnesses were introduced to the members of the Inquiry before being questioned first by Counsel to the Inquiry and then by the Chairman and solicitor. Finally, if they were legally represented, questions for clarification of their evidence could be put by their lawyers.

Expert evidence

55 The Inquiry had the benefit of expert evidence on radiation physics, the biological effects of radiation and radiation monitoring. It had the privilege of debating medical ethics and the law with two distinguished academics in that field, whose diametrically opposite views on topics such as consent, religious considerations, removal of organs at post mortem examination and consent for posthumous organ retention were cogently expressed.

56 Expert evidence was received on pathology, including practice at post mortem and the specialism's importance in the understanding and treatment of disease processes, the monitoring and audit of clinical services and the compelling need for ongoing research; and from experts in medical

10 As defined in the report of the Royal Commission on Tribunals of Inquiry, 1966, under the chairmanship of Lord Justice Salmon

education, which included topics such as communication with patients and relatives and the skill of tactfully breaking bad news.

57 Oral evidence on coronial practice in general was heard from two coroners, who dealt with the minutiae of all aspects of coronial process. Particular attention was paid to the need for coronial governance and audit. The Inquiry also held meetings with other coroners to discuss their own practices.

Other witnesses

58 A full list of the witnesses who gave oral evidence to the Inquiry may be found at appendix E.

Witness representation

59 All witnesses who gave evidence, orally or in writing, had or were offered legal representation, provided by the Inquiry, the principal stakeholders or their own professional indemnity insurers as appropriate.

60 The families who contacted the Inquiry and registered their interest received legal advice from Ms Kate Oldfield, of Davis Blank Furniss solicitors. She assisted them in drafting their questions to the Inquiry, in finalising witness statements and at meetings with the Inquiry. Ms Oldfield was present when the families gave oral evidence.

Confidentiality

61 The Inquiry process has been confidential throughout, albeit that it was always intended that this Report would be published. Where necessary, evidence has been summarised to preserve confidentiality. Witnesses who gave oral evidence were instructed not to reveal any evidence or document relating to their examination.

Patient information

62 Inevitably, the question arose whether confidential medical records of deceased former nuclear employees could be disclosed to the Inquiry without their families' agreement.

63 Disclosure of such records was sought from, among others, Dr Nicholas Lewis, who provides occupational health services to the AWE.[11] He was asked to disclose medical records of deceased former employees of the AWE which it was thought might be relevant to the Inquiry. While willing to assist the Inquiry, Dr Lewis was concerned that disclosure might breach his duty of confidence. Whether that duty persists after the patient's death is legally unclear; the General Medical Council advises that it does. Dr Lewis therefore applied to the High Court for a declaration that such disclosure would be lawful. The defendant to the application was the Secretary of State for Health; I was formally involved as an interested party.

64 The application was heard by Mr Justice Foskett, who accepted that it was at least arguable that the duty of confidence survived the death of the patient. However, he considered even if that were so, the duty should be overridden by the wider public interest in the Inquiry's objectives. He therefore granted the application[12] and made the declaration sought, which was widened to include the medical records of deceased employees of each of the Inquiry's principal stakeholders. He held also that it would be lawful for the Inquiry to disclose those records to stakeholders who had formerly employed the individuals (to allow them to respond to matters raised by the Inquiry). The order[13] incorporates stringent conditions to ensure the maintenance of confidentiality.

Counselling

65 The nature of the Inquiry meant that families had to deal with distressing information many years after they thought they had buried their deceased relatives intact. Counselling facilities were provided by Barnardo's throughout the Inquiry hearings and remain available upon demand.

11 Via a company, Trident Medical Services, of which he is a director

12 *Lewis v Secretary of State for Health* [2008] EWHC 2196 (QB), [2008] LS Law Med 559

13 See appendix D

Conclusion and recommendations

66 The Inquiry directed particular attention towards coronial and pathology practice, the number of deceased persons involved, the extent of organ removal and what was done with those organs which had been removed, the uses to which the resulting data were put, issues of knowledge and consent and the role of management. These matters have been considered especially in the context of the need for good communication and the provision of relevant information to families of the deceased.

67 Evidence was received from over 100 witnesses; formal statements were taken from 86; and 66 gave oral evidence at the Inquiry's hearings. The Inquiry has been careful to give appropriate consideration to all the evidence, whatever its source.

68 The deaths over the years of so many of the key players rendered the contemporaneous documents of crucial importance. Where there was conflict between those documents and the oral evidence, the document has usually been preferred unless the oral evidence was particularly compelling.

Stakeholder assurances

69 Each of the main stakeholders assured the Inquiry that it was no longer engaged in research involving the removal of organs and that since 1992 all its research had been lawful and ethically approved.

Acknowledgements

70 I extend my thanks to those who gave of their time to become involved in our procedures or appear before the Inquiry. I also extend my thanks to those who provided written evidence to the Inquiry but did not appear.

Dr David Macgregor

71 Dr Macgregor acted in accordance with the highest standards of his profession in drawing attention to the radiochemical analysis of organs carried out at Sellafield before his tenure as Company Chief Medical Officer.

His actions led directly to the establishment of the Inquiry. He deserves the thanks not only of the Inquiry but also of those whose relatives proved to have been involved in the research: with the help of his employers, he set up and ran with great efficiency a telephone helpline, personally visiting many of those whose suspicion that their relative might have been involved proved to be well-founded.

Document search

72 I thank all the principal stakeholders for their hard work and diligence in searching their archives and finding the huge volume of paperwork which has proved so valuable to the Inquiry's investigations. In particular, I thank BNFL and the UKAEA, who provided discrete reading rooms in their premises for the Inquiry team.

73 I am grateful to Mr Robert Baxter, archivist at the Cumbria Record Office in Whitehaven, for the assistance he gave my team in its searches of the coronial archives.

Hearings

74 I would like to thank Her Majesty's Courts Service Administration Department for its friendly co-operation and the provision of outstanding facilities, which did so much to assist witnesses who travelled from all over the country to give evidence to the Inquiry.

75 I am particularly grateful to Ms Emma Watmore, the LiveNote stenographer/editor, and her support team for the sustained quality of their work.

Experts

76 I thank the distinguished witnesses who gave the Inquiry the benefit of their expertise: Mr Peter Lemmey and Dr Sandy Mather of the Human Tissue Authority; Professor Margaret Brazier and Professor John Harris in the field of medical ethics and law; Mr Steve Ebdon-Jackson and Dr David Simister, nuclear physicists; Mr André Rebello and Mr Nigel Meadows, Her Majesty's coroners; and Professor Ian Barnes, National Clinical Lead for Pathology, and Professor Anthony Freemont and Professor Christopher Foster, consultant pathologists. The Royal College of Pathologists was of great assistance.

77 I am grateful to Dr Emyr Benbow, consultant pathologist, who kindly allowed members of the Inquiry team to gain valuable insight by attending a post mortem examination.

Inquiry team

78 The Secretary to the Inquiry, Keith Smith, ensured its smooth running throughout its duration despite the lengthy period under review, the number of stakeholders, the fact that many potentially relevant witnesses were deceased and any document search was bound to be incomplete. He handled all these issues with consummate skill. I was particularly assisted by his acute political acumen and calm consideration.

79 I am grateful to the Deputy Secretary, Carol Wilby, and her administrative assistants for their loyal support and willingness to sacrifice their personal time when necessary throughout the Inquiry process.

80 I am particularly grateful to Counsel to the Inquiry, Jeremy Roussak, for his analysis, skill, endeavour and good humour in the busiest and most concentrated periods of the Inquiry, particularly during the painstakingly arduous editorial process in which he excelled.

81 The Solicitor to the Inquiry was Stephen Jones. His unique experience and expertise in inquiry work was invaluable, particularly in addressing issues which took place as long as half a century ago. His organisational skills and ability to produce immaculate statements, whatever the background of the witness, were immensely helpful. He has been ably assisted by his senior and junior assistant solicitors, Chris Gawne and Ashley Dee. Their enthusiasm and commitment have been infectious.

Conclusion

82 This is the first in-depth analysis into the nuclear industry touching upon the retention of human organs for research. The team at my disposal has enabled a deep insight into the problems addressed by our Terms of Reference, reflected in what I hope is a full report, based soundly and fairly upon the available evidence.

Michael Redfern QC

Science

Chapter 2

Science

Chapter 2

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Introduction

1 It has been known for many decades that radiation can be hazardous to health. The nuclear industry and those working in the field of radiological protection have devoted much effort to minimising the risk to the health of both nuclear workers and the public at large, and much research has been conducted into the effects of radiation and how exposure to radiation can be monitored and minimised. In order to appreciate what was done and why it may have been considered useful to do it, it is necessary to have some understanding of the structure of matter and the nature of radiation.

Structure

2 The basic building block of matter is the atom. An atom itself may be visualised as a loosely-structured cloud of electrons around a very tiny, dense central core, the nucleus. The extent of the electron cloud is some 10,000 times that of the nucleus. The electrons carry a negative charge. With one exception, the nucleus contains positively-charged particles (protons) and neutral particles (neutrons). The sole exception is the nucleus of the hydrogen atom, which contains a single proton and no neutrons.

3 An atom contains equal numbers of protons and electrons and so carries no overall electric charge. Atoms in which the number of electrons does not equal the number of protons are called ions and may be positively-charged (if one or more electrons have been lost) or negatively-charged (if one or more electrons have been gained).

4 Protons and neutrons have roughly the same size (a diameter of about 1 femtometre: 10^{-15}m) and mass (about 10^{-24}g). They are much larger than electrons, which are too small to be measured, and their mass is some 1,900 times as great.

5 An element is a material composed of atoms which all have the same number of protons in their nuclei: it is this property which identifies the element. For example, atoms of carbon have 6 protons, atoms of oxygen have 8 protons and atoms of plutonium have 94 protons. The number of protons is known as the atomic number of the element. There are 92 naturally-occurring elements, and an additional number (currently 26), of varying degrees of stability, have been identified as by-products of processes in nuclear reactors or in laboratory-induced nuclear reactions. Each has been

allocated a one- or two-letter chemical symbol: for example, carbon is C; oxygen is O; and plutonium is Pu.

6 Neutrons help to hold the nucleus together as they interact with the other neutrons and protons, using the strong nuclear force to overcome the electrical repulsion which the positively-charged protons exert on each other. The nuclei of all but the lightest elements contain more neutrons than protons. The sum of the numbers of protons and neutrons in the nucleus of an atom is known as its mass number.

7 The mass of a nucleus is slightly less than the sum of the masses of its component protons and neutrons. This mass deficit represents the binding energy, which is the energy that holds the parts of the nucleus together. It appears as a deficit in mass because of the equivalence of mass and energy in accordance with Einstein's famous equation $E=mc^2$ (where E is energy, m mass and c the speed of light).

8 Nuclei which contain a particular number of protons and neutrons constitute a particular nuclear species or nuclide. Nuclides with the same number of protons but different numbers of neutrons are called isotopes.[1] Different isotopes of an element have different mass numbers. They are distinguished in writing by adding the mass number to the name or chemical symbol: uranium-238 or ^{238}U. The atomic number may also be included: $^{238}_{92}$U. Those elements with atomic numbers between 89 and 103 (which include uranium and plutonium) are known as actinides; those elements with atomic numbers greater than that of uranium (92) are known as the transuranic elements.

9 Many elements occur naturally in several different isotopic forms, although one form often predominates. Hydrogen, for example, occurs usually as ^{1}H but ^{2}H (usually called deuterium, from which heavy water is formed) and ^{3}H (tritium) also exist: the three forms each have one proton in the nucleus, identifying the element as hydrogen, and respectively zero, one and two neutrons. Carbon occurs naturally as ^{12}C, ^{13}C and ^{14}C, the nucleus containing 6 protons and 6, 7 or 8 neutrons: the ratio of the amounts of ^{14}C and ^{12}C is used in the process of carbon dating.

10 The chemical properties of an element are determined not by any property of the nucleus but by the number of electrons in the atom. Since each atom of an element has the same number of electrons whatever its isotopic form, all isotopes of a particular element have identical chemical properties. The

1 The terms "isotope" and "nuclide" are often, albeit technically incorrectly, used interchangeably

elements are commonly listed in tabular form, the periodic table, in which elements with similar chemical properties appear near each other.

11 Atoms of the same or different elements may come together to form molecules. For example, nitrogen gas consists of molecules each containing two atoms of nitrogen, written N_2; oxygen gas may contain molecules composed of two oxygen atoms (O_2) or three (ozone, O_3). Chemical compounds consist of molecules containing more than one element, such as water (H_2O), table salt (sodium chloride, NaCl) and carbon dioxide (CO_2).

Radiation

12 Radiation is classified as ionising and non-ionising. Cosmic rays, X-rays and emissions from radioactive materials are examples of ionising radiation. Light, microwaves, radio and television signals and radar are examples of non-ionising radiation.

13 Ionising radiation has sufficient energy to detach electrons from their atoms, producing ions, or to split molecules into charged components. Some of the energy is transferred to the irradiated material in the form of heat. Living tissue may be damaged by ionising radiation. There are no known direct benefits to health of ionising radiation, although it is of enormous value in medicine, being used in both diagnosis of disease (plain X-rays and computed tomography (CT) scanning, for example) and its treatment (such as radiotherapy).

14 Non-ionising radiation can be beneficial to health: for example, light from the sun is used by the body in the manufacture of vitamin D. Without non-ionising radiation (heat and light) from the sun, life on earth would not exist. In excessive quantities, non-ionising radiation can be harmful if it penetrates the body: for example, non-ionising ultraviolet radiation can cause cataracts in the lens of the eye.

Radioactivity

15 Atomic nuclei may be stable or unstable. Stable nuclei do not change over time. Of the 118 elements so far identified, 80 have one or more stable isotopes. Some have only one: tin has ten, more than any other element. In all, there are over 300 known stable isotopes.

16 Unstable nuclei (also known as radionuclides) will change in time. They do so by emitting one or more forms of nuclear radiation, the most common being alpha, beta and gamma radiation. In the case of the emission of alpha or beta radiation, a daughter nuclide is yielded by a process called decay.

Alpha particles

17 An alpha particle consists of two protons and two neutrons. When a nucleus decays by alpha emission, its atomic number decreases by two and its mass number by four. Since the nucleus has lost protons, a different element is formed. For example, plutonium-239 ($^{239}_{94}\mathrm{Pu}$) decays by alpha emission, producing uranium-235 ($^{235}_{92}\mathrm{U}$).

18 Because they are charged, move at high speed and have relatively large mass, alpha particles are strongly ionising. This strong ionisation means the particles slow rapidly as they pass through matter and travel for short distances before coming to rest. Alpha particles will travel for only a few centimetres in air and would be stopped by a sheet of tissue paper. Alpha particles emitted from radionuclides outside the body do not penetrate the outer layer of the skin (which is composed of dead cells). As alpha particles slow down, much of the kinetic energy from their movement is transformed into heat, although the amounts of energy involved are small. Weak X-rays may also be emitted.

Beta particles

19 A beta particle may be either an electron or its antiparticle, the positron. A nucleus decays by beta emission either when one of its neutrons transforms into a proton and an electron and the electron is ejected, or when a proton transforms into a neutron and a positron, ejecting the positron. The beta particle is usually emitted at very great speed. Since the nucleus has effectively gained or lost a proton, a new element is created, but since the total number of protons and neutrons in the nucleus remains unchanged in either type of beta decay, the new element has the same mass number as the old one. For example, carbon-14 ($^{14}_{6}\mathrm{C}$) decays by emission of an electron, producing nitrogen-14 ($^{14}_{7}\mathrm{N}$); and fluorine-18 ($^{18}_{9}\mathrm{F}$) decays by emission of a positron, producing ($^{18}_{8}\mathrm{O}$). Fluorine-18 is one of the positron-emitting radionuclides used in medical diagnostic PET (positron emission tomographic) scanners.

20 Beta particles are very small and very light (about 1/8000th the mass of an alpha particle). They are able to penetrate materials and travel for long distances, primarily due to their high speed. They interact less than alpha particles with the materials through which they pass and, although they are charged, they are much less strongly ionising than alpha particles.

Gamma rays

21 A gamma ray is a high-energy form of electromagnetic radiation. When a nucleus has decayed by emission of an alpha or a beta particle, it often has additional energy that is subsequently (often in a very short time) released as one or more gamma rays. The nucleus is left in a lower-energy form, but is otherwise unchanged, having the same atomic and mass numbers. It remains the same chemical element. Technetium-99m, a radionuclide very widely used in medical imaging, decays by emission of a gamma ray to form technetium-99.

22 When a positron and an electron collide, they are annihilated and two gamma rays are produced, with opposite direction.

23 Gamma rays have no charge and no mass. They are very highly penetrating but not strongly ionising.

Energy

24 The unit used to quantify the energy of forms of radiation such as alpha and beta particles and gamma rays is the electron volt (eV). When a radionuclide decays, it emits a particle or ray of characteristic energy: for example, the energy of the gamma ray emitted by technetium-99m is 141keV (kilo electron volts) and that of the alpha particle emitted by plutonium-239 is 5.2MeV (mega electron volts). Higher energy radiation is more likely to cause damage to tissue.

Decay chain

25 It is often the case that the daughter nuclide produced by the decay of a radioactive element is itself unstable and will in due course decay further. This process is then repeated until eventually a stable daughter nuclide is formed. The sequence of nuclides produced in this way is called a decay chain. Such chains can have many steps: for example, radioactive uranium-238 decays to stable lead-206 in 14 steps in which unstable

isotopes of elements such as thorium, palladium, radon and bismuth are created and in turn decay.

Radioactive half-life

26 Radioactive decay is a random process. A collection of unstable nuclei will not all decay at the same time. The time after which half the atoms in a quantity of a radioactive element will have decayed is called the radioactive half-life of that element. The more unstable the nuclei of a radioactive isotope, the higher the rate at which its atoms will decay and hence the shorter its radioactive half-life. A given isotope has a constant radioactive half-life. Radioactive half-lives vary enormously, from small fractions of a second to billions of years. For example, plutonium-239, the isotope of most interest to the Inquiry, has a half-life of more than 24,000 years. The process of radioactive decay is random but the very large number of atoms present in even small amounts of material mean that radioactive half-life, although a statistical concept, can be determined with accuracy.

27 For example, the half-life of iodine-131 is 8 days. So if one starts with, say, 32 grams of ^{131}I, after 8 days half will have decayed (by beta emission into xenon-131) and there will be 16g of ^{131}I left; after a further 8 days, 8g of ^{131}I will be left; after a further 8 days, 4g; and so on.

Nuclear fission

28 Some large nuclei may decay not by emission of a small particle but by splitting into two nuclei of roughly equal size, a process known as nuclear fission. Typically, several high-energy, or fast, neutrons and some gamma rays are emitted at the same time. The resulting fission products have less mass than the original nucleus; the difference is converted into energy which is exhibited in the kinetic energy of the particles and fission fragments produced as they fly apart. This energy is converted into heat when the particles slow down.

29 Fission may occur spontaneously in heavy isotopes such as uranium-238 and plutonium-239. However, spontaneous fission is a rare event even for these nuclides: it is much more common for them to decay by emission of an alpha particle. Other heavy isotopes, such as uranium-235, will undergo fission more readily after absorbing a slow (low-energy) neutron. Since when they do undergo fission they release further neutrons, a self-sustaining or

chain reaction (called criticality) may be produced, some of those released neutrons provoking fission of nearby nuclei. This chain reaction may be controlled, as in a nuclear reactor, or uncontrolled, as in an atomic bomb, depending on the ratio of the released neutrons which cause further nuclear fission to those which simply escape or are absorbed by other nuclei without fission.

30 In a nuclear reactor, the uranium or plutonium fuel is held in the core, which also contains a moderator such as graphite or heavy water.[2] The function of the moderator is to slow down the fast neutrons emitted in the course of nuclear fission, making slow neutrons which will provoke fission of other nuclei. Control rods, which absorb neutrons, may be inserted into and withdrawn from the core to provide control over the chain reaction. A coolant, water or gas, takes heat away from the core and is used to produce steam, which in turn drives turbine generators to produce electricity.

31 In order to produce more efficient nuclear fuel for reactors, it is common to change the naturally-occurring proportions of the isotopes of uranium. Natural uranium, for example, is found as uranium-235 and uranium-238, with only 0.7% being the more useful uranium-235. In enriched uranium intended for use in reactors, the proportion of uranium-235 is increased to about 2.5%. Weapons-grade uranium, for use in atomic bombs, contains over 90% uranium-235. Plutonium is produced as a by-product from uranium-fuelled nuclear reactors; it may then be chemically separated from the uranium for use in a plutonium-fuelled reactor or in an atomic weapon.

Quantifying radiation

32 Four useful concepts in the quantification of radiation are activity, absorbed dose, equivalent dose and effective dose. Various units have been used over the years to measure the same thing. Most countries outside the US use the relatively new SI (Système International) units. Old units appear frequently in UK documents seen by the Inquiry, which pre-date the widespread use of SI units. They are still used in the US.

2 In heavy water, the hydrogen is in the form of deuterium (^{2}H) rather than of ordinary hydrogen (^{1}H)

Activity

33 Activity is a simple count of the number of transformations (such as emission of an alpha particle) over unit time. The SI unit of activity is the becquerel (Bq), named after the French physicist Henri Becquerel. It is equal to one transformation per second. The becquerel is a very tiny unit: one gram of plutonium-239, for example, has an activity of 2 gigabecquerels (2×10^9 Bq), emitting 2 billion alpha particles every second. The old, very much larger, unit of activity was the curie (Ci, named after Marie Curie), which was equal to 3.7×10^{10} (37 billion) Bq.

Absorbed dose

34 The absorbed dose is a measure of the energy the ionising radiation deposits in matter. The SI unit of absorbed dose is the gray (Gy, after the English physicist Harold Gray), equal to one joule per kilogram. The old unit was the rad, equal to one hundredth of a gray.

Equivalent dose

35 Different forms of ionising radiation transfer energy to body tissues in different ways and so have different biological effects on those tissues. Alpha particles have much greater mass and are slower moving and more strongly charged than beta particles. This means that they transfer their energy more rapidly, causing greater and more localised damage. A given absorbed dose of alpha particles is more harmful than the same dose of beta particles.

36 To take account of this variation, different forms of radiation are ascribed a radiation weighting factor. The dose of radiation (in Gy) is multiplied by this quality factor to give the equivalent dose, measured in sieverts (Sv, after the Swedish physicist Rolf Sievert). The radiation weighting factor for alpha particles is 20; for beta and gamma particles it is one; and for other forms of radiation it is from five to 20. Once this correction has been applied, the effect of the different type of radiation has been taken into account, so 1Sv of alpha radiation (0.05Gy) is deemed to cause the same amount of damage to tissue as 1Sv of beta or gamma radiation (1Gy). The sievert is a large unit and actual measurements are commonly given as millisieverts (mSv) or microsieverts (μSv). The old unit of equivalent dose was the rem, equal to one-hundredth of a sievert.

Effective dose

37 Different organs in the body have different susceptibility to radiation-induced damage. In general, as discussed later in this chapter, tissues in which there is a high turnover of cells, such as the gonads (testes and ovaries) and bone marrow, are more vulnerable to the effects of radiation than those with low cell turnover.

38 The effective dose, which like the equivalent dose is measured in sieverts, applies a tissue correcting factor which depends on the organ exposed to radiation. These correcting factors, which are estimated by the International Commission on Radiological Protection (ICRP), are shown in table 2.1.[3] As they are estimated rather than directly measured, they are changed from time to time as more knowledge of the effects of radiation becomes available.

3 International Commission on Radiological Protection publication 103, 2007

Table 2.1: Tissue weighting factors

Organ	Factor
Bone marrow	0.12
Breast	0.12
Colon	0.12
Lung	0.12
Stomach	0.12
Gonads	0.08
Bladder	0.04
Liver	0.04
Oesophagus	0.04
Thyroid	0.04
Bone surface	0.01
Brain	0.01
Salivary glands	0.01
Skin	0.01
Rest of body	0.12
Whole body	1.00

39 As will be discussed later in this chapter, some radionuclides tend to be concentrated in particular organs after they have been taken into the body. For example, plutonium in the body tends to end up in the lung, the liver and the inner part of long bones, from where it can irradiate the bone marrow. So if the equivalent doses of radiation to those tissues are, say, 300, 100 and 50mSv, the harm would be equal to a whole body effective dose of:

$$(300 \times 0.12) + (100 \times 0.05) + (50 \times 0.12) = 47\text{mSv}.$$

40 An acute whole-body dose of 1Sv would cause nausea and vomiting; 2Sv would cause hair loss, bleeding and possible death; 3Sv would kill half the recipients within 30 days; and 6Sv would almost certainly be fatal. These are enormous doses of radiation and it is, fortunately, extremely rare for people to be exposed to such very high levels. Even after the disaster at Chernobyl, only 134 of the 600 workers on the site received doses of radiation high enough to cause acute radiation sickness and only 28 died of the condition.[4] Concern over radiation mostly relates to the long-term effects of repeated exposure to small doses, either acutely or over extended periods of time, at levels measured in milli- or microsieverts per year, which can lead to malignancy such as thyroid cancer and leukaemia: such increased incidence has been found in those living near Chernobyl at the time of the disaster.[5]

Background radiation

Naturally-occurring background radiation

41 We are surrounded by ionising radiation. The main sources are cosmic rays and gamma rays from naturally-occurring radionuclides such as uranium, potassium-40 and radon. The average level of natural background radiation varies from place to place but worldwide is around 2.4mSv/year (2.6mSv/year in the UK). The sources of this radiation and the range of exposure are set out in table 2.2.[6]

4 United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), *The Chernobyl accident: UNSCEAR's assessments of the radiation effects*, at www.unscear.org/unscear/en/chernobyl.html

5 See paragraph 60

6 Figures taken from the UNSCEAR *Report to the General Assembly of the United Nations*, 2000

Table 2.2: Radiation dose from natural sources

Source	Effective dose (mSv)	Typical range (mSv)
External exposure		
Cosmic rays	0.4	0.3–1.0
Terrestrial gamma rays	0.5	0.3–0.6
Internal exposure		
Inhalation (mainly radon)	1.2	0.2–10
Ingestion	0.3	0.2–0.8
Total	**2.4**	**1–10**

42 Cosmic rays are mainly high-energy protons, whose origins in space are uncertain. Some lower-energy cosmic rays originate from the sun. The atmosphere absorbs most cosmic rays, so flying on an aircraft exposes passengers to higher levels of cosmic radiation (about 5μSv/hour) than would be experienced on the ground (about 0.03μSv/hour at sea level, rising to 0.1μSv/hour in a mountain city such as Mexico City).

43 Radon is a colourless and odourless gas produced by the decay of naturally-occurring radium. It alone accounts for about half the average dose of background radiation in the UK. It can become concentrated in the atmosphere inside buildings and hence inhaled, exposing the lungs to alpha radiation from it and from its daughter radionuclides. In the US, radon is considered to be the second most important cause (after smoking) of lung cancer.[7]

Man-made background radiation

44 Man-made environmental exposure as a result of fallout from nuclear bomb tests[8] is estimated to have peaked at 150μSv/year in 1963 and, following the cessation of above-ground nuclear testing, to have fallen to about 5μSv/year by 2000. The average exposure to the public arising from the nuclear

7 US Environmental Protection Agency, *A Citizen's Guide to Radon*, at www.epa.gov/radon/pubs/citguide.html

8 For more detail on the research associated with this fallout, see chapter 11, "Strontium and the Medical Research Council"

industry is less than 0.2μSv/year, or less than 0.1% of natural background radiation. Those living close to nuclear power plants, and in particular close to Sellafield, may be exposed to higher doses.

Medical radiation

45 Many medical investigations involve exposing the patient to ionising radiation, for example plain X-rays, some forms of body scanning[9] and tests such as bone scans. The dose received in the course of a single test ranges from less than 0.02mSv (for a simple procedure such as a plain chest X-ray) to 10mSv (for a chest or abdominal CT scan). Doses of radiation administered to patients undergoing radiotherapy, where destruction of malignant tissue is of course the aim of the intervention, are enormously higher and are aimed at the cancer with great care.

Occupational exposure

46 People may be exposed to radiation from natural or artificial sources in the course of their work. Increased exposure to natural radiation sources may occur, for example, in miners, since radon may be present in mines, and in aircrew, from cosmic rays.

47 Exposure to artificial sources of radiation occurs in medical staff, in particular to those conducting diagnostic procedures such as angiography, which may require them to be close to the patient. Of particular relevance to the Inquiry, of course, is the occupational exposure of those working in the nuclear industry.

External and internal exposure

48 A person may be exposed to radiation arising from outside or inside the body. Cosmic rays, medical X-rays and gamma rays are examples of external sources of radiation. Alpha emitters such as plutonium are not dangerous if they remain outside the body, since alpha particles do not penetrate the

9 Such as CT, but not magnetic resonance (MR) imaging, which uses only magnetic fields

outer layer of the skin and that layer consists mainly of dead cells (although some alpha emitters may also emit beta or gamma rays that are harmful).

49 Internal exposure arises when radionuclides are taken into the body. This may happen when they are swallowed, breathed in or absorbed through the skin, for example as a result of a penetrating injury. Alpha emitters can be particularly dangerous once inside the body as they may lie in close contact with sensitive tissues such as bone marrow. In 2006, Alexander Litvinenko was allegedly murdered by being given the alpha emitter polonium-210 in food or drink.

50 Whether a particular radionuclide is absorbed after being swallowed or inhaled depends on its chemical form. Plutonium nitrate, for example, is soluble in water. Plutonium to which nuclear workers might be exposed is commonly in the form of plutonium dioxide (PuO_2), which is highly insoluble.

- PuO_2 which enters the body after an accident which damages both the protective glove and the skin tends to remain in the wound. Small particles may travel to local lymph nodes.
- PuO_2 released into the air as dust may be inhaled. Large particles will be filtered out of the inhaled air in the nose; smaller particles will be caught by clearance mechanisms in the lung. These particles will subsequently be swallowed, pass through the intestines without being absorbed and be eliminated in the faeces. Very small particles may lodge deep in the lung, where they will remain.

51 Particles of PuO_2 retained in the lymph nodes or the lung emit alpha radiation, potentially damaging nearby cells. They dissolve very slowly, over many years. The plutonium they contain enters the bloodstream. Some is then excreted in urine and the remainder lodges in various organs, particularly liver and bones. Plutonium is found on the inner aspect of long bones such as the femur, where the radiation it emits can damage red bone marrow, potentially causing blood disorders such as myeloma and leukaemia. The radiological half-life of the relevant isotopes of plutonium is very long, so that the activity of the plutonium remains essentially constant over the individual's life.

52 Other chemical compounds of plutonium, such as the nitrate or fluoride, are much more soluble in water than the dioxide. If taken into the body, they are better absorbed into the bloodstream and more readily eliminated.

Biological half-life

53 The biological half-life of a substance is the length of time taken for the body to eliminate half of that substance. Elimination may be by excretion, for example in urine or bile, or by metabolism, breaking down the substance into other chemical compounds. Elements, such as plutonium, can obviously be eliminated only by excretion. The biological half-life of a radionuclide may be very long: plutonium which has become bound to bone has a biological half-life of about 100 years.

54 The effective half-life of a radionuclide is a function of its biological and radioactive half-lives. If a radionuclide is rapidly eliminated from the body, its radioactive half-life may be irrelevant when calculating the dose of radioactivity the body will receive. By contrast, if a radionuclide has a very short radioactive half-life (for example, technetium-99m, which has a half-life of just over six hours), it loses its radioactivity so rapidly that its biological half-life becomes relatively unimportant.

Biological effects of radioactive elements

55 Living tissue is made up of cells. Nearly all cells have a nucleus, seen under a microscope as a dense, dark blob. Although the same term is used, there is no comparison between the nucleus of a cell and that of an atom: the nucleus of a cell is enormously larger and far more complex in structure, containing billions of atoms. Among its contents is the cell's genetic code, deoxyribonucleic acid (DNA).

56 Ionising radiation damages cells by producing highly-reactive free radicals, for example by splitting a water molecule (H_2O) into negatively charged hydroxyl (OH^-) and positively charged hydrogen ion (H^+) components. These free radicals can react with and damage molecules within the cell, such as DNA. To a large extent, cells are able to repair such damage. If the damage cannot be repaired, the cell will probably die. Most organs and tissues of the body are not affected by the deaths of even quite large numbers of cells, but if the dose of radiation is sufficiently large, detectable damage to organs may occur. This effect is deterministic: that is, it will be similar in all individuals exposed to radiation in excess of a threshold dose. An example is the effect of radiation in causing cataracts in the lens of the eye.

57 In contrast, a cell whose DNA has been modified by radiation damage which is incompletely repaired may survive and transmit the modification to its

daughter cells. This effect is stochastic: that is, it occurs randomly. It is generally agreed that there is no lower limit of exposure to radiation beneath which there is no danger of such stochastic effects.

58 The mechanism by which cancers arise is the subject of a great deal of research and is as yet not fully understood. Exposure to any of a variety of agents can induce cancers: these agents include tobacco smoke, asbestos fibres, chemical compounds such as benzene and ionising radiation. Ionising radiation may act synergistically with other factors, so that, for example, the likelihood of radiation derived from radon causing lung cancer is greater in smokers than in non-smokers. The development of cancer is a complex, multi-step process that takes place over many years and ends with uncontrolled cell growth. At its heart lies a change in the DNA of a single cell, which, becoming cancerous, reproduces itself to form the tumour mass.

59 Sperm and eggs are particularly susceptible to damage by radiation. Damage to these cells from ionising radiation may cause genetic abnormalities in the irradiated individual's children.

60 Irradiation of the thyroid gland causes it to decrease its production of the hormone thyroxine, so radioactive iodine, which is concentrated in the thyroid, can be given as a treatment for an overactive thyroid gland. Radioactive isotopes of iodine discharged from the nuclear reactor at Chernobyl have been blamed for an increased level of hypothyroidism and up to 4,000 cases of thyroid cancer[10] found in people who were living near the site at the time of the disaster.

Monitoring

61 Conventional wisdom is that there is no level of radiation exposure which may be regarded as "safe", although the likelihood of harm from minor occupational exposure must be assessed in the context of much higher levels of natural background radiation and other hazards common to all industrial workplaces. Radiation workers are protected from the harmful effects of radiation primarily by restricting the exposure: radioactive material is contained behind shields and manipulated inside glove boxes, protective clothing such as lead aprons is worn and so on. The legal duty placed on employers is to reduce exposure *"as far as reasonably practicable"*, although employers are liable for any harm caused by radiation whether or not they

10 UNSCEAR, see note 4, above

are at fault.[11] Since in even the best-protected environment there may be accidental leaks of radioactive material, it is necessary to monitor both radiation levels in the working environment and the radiation to which individual workers have been exposed.

The working environment

62 Radiation in the working environment is measured in a variety of ways, including the use of static air samplers, devices which draw air through a filter which can be removed and tested. Details of this type of monitoring are outside the scope of the Inquiry.

External exposure

63 It is a fairly straightforward exercise to monitor a worker's exposure to external radiation. The worker wears a radiation detector. This can be a plastic container holding a piece of film (commonly called a "film badge") which will become fogged by radiation, or a more modern electroluminescent detector. Most detectors are worn on clothing but small devices exist which can be worn on different parts of the body (such as the fingers, if the hands are particularly likely to be exposed). Measurement of external exposure is accurate, sensitive, cheap and quick.

Internal exposure

64 Internal radiation exposure from radionuclides which have been taken into the body is more difficult to measure. Those radionuclides which emit gamma rays (such as technetium-99m) can be detected quite easily: hence their use in medical imaging. However, heavy metal radionuclides such as uranium and plutonium, which are the elements of most interest in the nuclear industry, decay by emission of alpha particles. Since these alpha particles travel for only very short distances in the body and do not penetrate the skin, they cannot be directly detected by equipment located outside the body. It is therefore necessary to use indirect methods to estimate employees' body content of these elements, and in particular of plutonium. Compared to those used to measure external exposure, such methods are of poor accuracy, insensitive, expensive and slow. The discussion which follows describes techniques which were in use at the time

11 Nuclear Installations Act 1965, ss7 and 12

of the events under investigation by the Inquiry; it does not attempt to be fully up to date.

65 Monitoring before the mid-1980s was aimed at assessing the amount of plutonium retained in a worker's body, and comparing it with the *maximum permissible body burden* (MPBB) as determined by the ICRP. The concept of the MPBB has since been replaced by more accurate methods of determining the risk posed by retained radiation, which are outside the scope of this chapter.

66 One method of indirect internal monitoring was the use of personal air samplers. These were small, battery-powered devices, worn on clothing, which drew air over a filter. The filter was then removed and any radioactivity it contained measured. Personal air samplers were useful for detecting raised levels of radioactivity in the air, but gave no direct indication of the amount of plutonium which had actually been inhaled.

67 When it was suspected that staff might have been exposed to plutonium, for example by escape of an aerosol of powder, noseblow and faecal samples were taken and the plutonium they contained estimated.[12] Such estimates could give an indication of the amount of plutonium to which the individual had been exposed, but they were of course actually estimates of what had *not* been retained.

68 An individual might suffer a wound contaminated by plutonium, usually from a sharp object which had pierced a protective glove. These injuries were treated by surgically removing as much contaminated tissue as possible.

69 Two further techniques which allowed estimation of the plutonium retained in the body were in use at the relevant times: the analysis of urine (urinalysis) and whole body monitoring.

Urinalysis

70 Plutonium which has been inhaled and found its way deep into the lung, or plutonium remaining in a wound despite surgical treatment, will very slowly dissolve and be transported round the body in the blood. As mentioned above, some will become attached to bone or be retained in the liver or other organs. A very small proportion, however, will be excreted in

12 The techniques involved in estimating plutonium content are described later in this chapter

the urine. If urine samples are collected and the plutonium they contain is measured, an indirect estimate may be made of body plutonium content.

71 The difficulty posed by the interpretation of plutonium levels in urine is that they cannot be correlated with the plutonium in the body, since that cannot be measured directly. In 1959 Wright Langham, an American researcher, published a paper[13] describing the results of urinalysis in subjects who had agreed to be injected with a known, very small, quantity of plutonium (5µg). All were thought to have life expectancies of less than ten years because of incurable illness. After administration of plutonium, urine samples were collected intermittently for a period of up to a year and a formula was derived which allowed body burden of plutonium to be estimated from the levels found in the urine.

72 The Langham formula was widely used in the nuclear industry, although concerns were expressed over its accuracy when used at times more distant – sometimes far more distant – from the original exposure than one year. In 1985, Professor Stephen Jones, then working for British Nuclear Fuels Limited (BNFL) at Sellafield, published a paper[14] describing a refinement of Langham's formula. He had obtained urinalysis data from two of Langham's subjects who had unexpectedly survived for much longer than anticipated and were able to provide samples some 10,000 days after they had received their original dose of plutonium. His work indicated that use of the Langham formula had indeed, as was widely believed, led to considerable over-estimation of the body burden of plutonium. Professor Jones was able to verify his revised version of the Langham formula against data derived from post mortem analysis of organs taken from former Sellafield employees.[15]

Whole body monitoring

73 The alpha particles emitted by plutonium in a person's lungs cannot penetrate the chest wall. However, some of any such plutonium will be plutonium-241, which decays into americium-241. Americium-241 emits weak gamma rays which do emerge from the body and can, at least in theory, be detected in a whole body monitor (more accurately described as a chest monitor).

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13 Langham WH, Bassett SH, Harris PS and Carter RE, Distribution and excretion of plutonium administered intravenously to man, *Health Physics*, 1980 (reprint), 38(6): 1031–60

14 Jones SR, Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake, *Radiation Protection Dosimetry*, 1985, 11(1): 19–27

15 See paragraph 76

74 The very small quantities of radiation emitted by someone with even the maximum permissible quantity (under ICRP regulations) of plutonium in his chest would be swamped by normal background radiation. The whole body monitor therefore consisted of a chamber inside which the subject and the detectors could be shielded from that background radiation. The walls of the chamber were made of steel taken from battleships constructed in the pre-nuclear era, so they would not themselves be radioactive. The subject would lie on a couch and the large detectors would be positioned close to his chest. Counting of emitted X-rays would take place over a period of about 40 minutes to an hour.

75 The usefulness of the whole body monitor was limited because the level of radiation arising from plutonium in the subject's chest was extremely low, of the order of one count per minute, and since radiation decay is a random event, the accuracy of the measurements at such low levels was poor. In addition, much of the low-energy gamma radiation emitted by radionuclides in the lungs was absorbed by the soft tissues and ribs of the chest wall before it could be detected.[16] A further complicating factor was that even minute quantities of radioactive contaminant – far too small to have any harmful effect and which would be quickly washed away – on the subject's clothing or in his hair would emit more radiation than the plutonium in his chest, leading to falsely high readings.

Post mortem analysis

76 The definitive method of establishing how much plutonium an individual has in his body is to take the body after his death and to use radiochemical analysis actually to measure the plutonium it contains. The process would destroy the body and so for obvious reasons is seldom practicable. However, plutonium tends to be concentrated in only a few organs – principally the lungs, liver and bones – and analysis of these organs could provide information which might be of use in calibrating other methods such as urinalysis. Professor Jones was able to use some of the post mortem data held at Sellafield to validate his refinement of the Langham formula.[17]

16 Whole body monitoring is more useful in the detection of other radionuclides, such as uranium, since they or their daughter radionuclides emit gamma radiation of rather higher energy which penetrates the chest wall better and is more easily detected outside the body

17 See paragraph 72

Obtaining organs

77 Organs would be obtained at post mortem examination. By law, permission to remove organs was required, at least after 1961.[18] The organs would generally be deep-frozen to avoid decomposition before they could be analysed.

78 Since the levels of plutonium it was expected to find would be extremely low, large quantities of tissue would be necessary in order for the results to be reasonably accurate. One or both lungs and at least half the liver would be taken; several ribs, the sternum, a femur and wedges from several vertebrae would be used to obtain an estimate of skeletal burden.

Method

79 The method of analysis was described in a paper[19] published by four employees of the National Radiological Protection Board in 1985:

> *Briefly, the materials were reduced to ash in a muffle furnace by raising the temperature to 500°C over a period of several days. Plutonium-242 was added to the ash as a tracer for the chemical yield determination. The mixture was boiled gently with 8M nitric acid … Plutonium was adsorbed from the 8M nitric acid solution by anion-exchange chromatography. After washing the column with 8M nitric acid and then hydrochloric acid, Pu was eluted with hydrochloric acid containing 0.1% hydriodic acid. The effluent was evaporated to dryness and I* [iodine] *expelled by repeated evaporations with hydrochloric acid. The Pu was evaporated to dryness with nitric acid … A second anion-exchange process … improved the quality of the Pu source to be used for α spectrometry. Finally the halide-free Pu sample was electroplated on to a stainless steel disc … The α activity was then examined by α spectrometry.*

Witnesses who had worked for other organisations such as BNFL described methods of extracting plutonium which differed in detail, but the techniques were broadly similar. The procedure required complex, expensive equipment and considerable time and expertise on the part of the operator: few laboratories capable of undertaking such analysis existed in the UK.

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18 See chapter 3, "Law and Guidance"

19 Popplewell DS, Ham GJ, Johnson TE and Barry SF, Plutonium in autopsy tissues in Great Britain, *Health Physics*, 1985, 49(2): 304–9

80 Not all the plutonium contained in the organs would be extracted by the chemical process described. The organs might contain plutonium-238, -239, -240 and -241 but would not contain plutonium-242. Since all the isotopes had identical chemical properties, the proportion of the plutonium-242 added to the ash which was found in the final spectrometry would be the same as the proportion of the other isotopes in the organ which were found in the final spectrometry. The technique of spectroscopy allowed the various isotopes to be separately quantified, so allowance could be made for the losses sustained in the course of the chemical extraction process.

Results

81 The results of the analyses were generally set out as follows.

- If the sample constituted the whole of the organ, the activity contained in the organ was known directly.
- If the sample constituted part of the organ (for example, about half the liver or one lung) and the weight of the whole organ was known (because it had been recorded in the course of the post mortem examination), the activity contained in the organ could be calculated easily. The flaw in this approach was that it assumed that plutonium was evenly distributed within the organ and hence that the sample provided was representative of the remainder of the organ, which might not have been the case.
- If the sample constituted part of the organ and the weight of the organ was not known, either because it had not been recorded at the post mortem examination or because it could not be accurately measured (such as the bone), standardised organ weights defined by the ICRP Standard Man were used.

82 In many cases the levels of activity in the samples were towards or even below the lower limit of detection. Results are generally a few hundred millibecquerels: one mBq represents one single atomic decay every 1,000 seconds (16.7 minutes).

Law and Guidance

Chapter 3

Law and Guidance

Chapter 3

Contents

Introduction

1 This chapter sets out the law as it stood at the time of the events with which the Inquiry has been concerned. It is limited in scope, confined to the law which was relevant to the activities under investigation. Fuller discussions of coronial law may be found in appropriate textbooks.[1]

2 The law governing the conduct of post mortem examinations, the removal of organs from bodies and the analysis of those organs was complex and incomplete.

- The role of the coroner was defined by statute, passed in 1887, and by rules made in 1953 under the statute. The statute and the rules addressed the taking of organs from bodies only in the context of advancing the coroner's investigation into how the deceased had died. It was not envisaged that the coroner would have any involvement in the provision of organs for any other purpose.
- The taking of organs for medical purposes, education and research was governed by the common law, which had developed over the centuries, and later by statute enacted in 1961.

3 It has been said to be a characteristic of the English legal system that all activities are lawful unless expressly prohibited by law. A consequence of this underlying freedom of action is that until a particular mischief has come to light and been prohibited, declared lawful or allowed subject to restriction, it cannot be considered to be illegal. Many of the activities considered by the Inquiry, and the circumstances in which those activities took place, had never come to the attention of lawmakers. The Inquiry has discovered that there were extensive gaps in the law, which simply had never concerned itself with those activities. The result is that some of the things done, which may be hard or impossible to justify from an ethical standpoint, cannot be considered to have been unlawful.

4 The law develops. Some gaps remain but many have been closed by subsequent legislation.

1 In particular, Matthews P, *Jervis on Coroners* (Sweet and Maxwell, 12th edn, 2002; 3rd supplement, 2006); and Dorries C, *Coroners' Courts: A Guide to Law and Practice* (Oxford University Press, 2nd edn, 2004)

Post mortem examination

5 Post mortem examination, also known as autopsy and often referred to simply as "a post mortem", can be of enormous assistance in finding out exactly how someone has died. Information gathered at such examinations has helped in the advancement of medical science, improving the treatment available to patients. Although the widespread use during life of advanced imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI) has led to fewer surprising findings at post mortem, examination of the body after death remains the definitive way in which the cause of death can be established and understanding of disease processes and of the effects of treatment improved.

6 Nevertheless, a post mortem is an invasive procedure. The prospect of a post mortem can cause distress to the deceased person's relatives, especially coming as it does immediately after the trauma of bereavement. Many witnesses to the Inquiry – relatives, coroners and pathologists – emphasised the need for discussions regarding post mortems to be handled with the greatest skill, tact and sensitivity.

7 Authorisation is always required before a post mortem may be done. It can be obtained in two ways:

- the coroner may authorise a coronial post mortem if he decides to investigate the cause of death;
- the deceased person's relatives may give permission for a hospital post mortem, usually in response to a request by the hospital doctors who have looked after him during his last illness.

8 Any post mortem examination begins with a careful external inspection of the body. The body cavities – chest, abdomen and often head – are then opened, sometimes by the pathologist but more often by specially trained mortuary technicians, and organs such as heart, lungs, liver, kidneys and brain are removed so that they can be examined closely and weighed. The organs should then be returned to the body and the incisions closed, leaving the body ready for burial or cremation. The extent of the examination may vary depending on the circumstances: for example, it may be unnecessary in some cases to look at the brain.

9 Fluids, tissue or whole organs may be taken from the body in the course of the post mortem and retained for later analysis. Small pieces (known as blocks), perhaps the size of a postage stamp and a few millimetres thick, are routinely taken from a variety of organs to allow histological examination under a

microscope. Some organs, such as the brain, must be fixed, a time-consuming procedure which may take several weeks, before they can be properly examined and if such detailed examination is necessary they may be removed whole and not returned before the body is released for burial or cremation.

The coroner

Introduction

10 The judicial office of coroner is one of the oldest in the country, dating back at least to the 12th century. It was initially a royal appointment with wide-ranging powers. In more modern times, the coroner has been appointed by the local authority for the area. His powers and duties are governed entirely by statute and by rules made under those statutes.

11 The relevant Acts and Rules when the majority of the deaths considered by the Inquiry took place were:

- the Coroners Act 1887 and the Coroners (Amendment) Act 1926, both of which were superseded by the Coroners Act 1988;
- the Coroners Rules 1953, superseded by the Coroners Rules 1984, which were in turn amended by the Coroners (Amendment) Rules 2005.

12 When a death is reported to the coroner, he must decide whether it requires investigation. He must investigate[2] if he has reason to suspect that the death:

- was violent or unnatural;
- was sudden and the cause is unknown;
- happened in prison;
- happened in circumstances in which any Act of Parliament requires him to hold an inquest.

Scope of the coroner's investigation

13 Under the Coroners Act 1887 the coroner could not conclude his investigation except by holding an inquest with a jury, and both coroner and jury had to view the body at the first sitting of the inquest.[3] The Coroners

2 Coroners Act 1887, s3(1); later, Coroners Act 1988, s8(1)

3 Coroners Act 1887, s4(1)

(Amendment) Act 1926 permitted the coroner in some circumstances to certify the death without inquest[4] and to hold the inquest without a jury.[5] It also relaxed the requirement that the jury view the body,[6] although the coroner himself was not relieved of this requirement until as late as 1980.[7]

14 The extent of the coroner's investigation was defined by section 4 of the Coroners Act 1887:

> *(3) After viewing the body and hearing the evidence the jury shall give their verdict … setting forth … who the deceased was, and how, when, and where the deceased came by his death, and if he came by his death by murder or manslaughter, the persons, if any, whom the jury find to have been guilty of such murder or manslaughter, or of being accessories before the fact to such murder.*

After 1926, a coroner was permitted to hold an inquest sitting alone and without a jury but the scope of the inquiry remained unchanged.

15 The Coroners Rules 1953 made clear that the coroner's role was limited to determining those facts. Rule 26 repeated the provisions set out above and rule 27 provided:

> *Neither the coroner nor the jury shall express any opinion on any matters other than those referred to in the last foregoing Rule: Provided that nothing in this Rule shall preclude the coroner or the jury from making a recommendation designed to prevent the recurrence of fatalities similar to that in respect of which the inquest is being held.*

16 The ability to name the person responsible for the death of a deceased person who had been the victim of murder or manslaughter (and hence to charge him with the crime) was removed in 1977.[8]

17 Section 11 of the Coroners Act 1988 and rules 36 and 43 of the Coroners Rules 1984 are worded differently but make essentially the same provisions as set out above, omitting the references to criminal offences.

18 Since the scope of the coroner's investigation at inquest is restricted to determining who the deceased was and how, when and where he came by

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4 Coroners (Amendment) Act 1926, s21(2)

5 Ibid, s13(1)

6 Ibid, s14(1)

7 Coroners Act 1980, s1

8 Criminal Law Act 1977, s56(1)

his death, it is obvious that he is equally restricted if, following initial investigation, he decides not to hold an inquest.

Procedure

19 In many of the cases which are reported to the coroner, the death is obviously natural and no further investigation is required. The coroner completes a form, known as Form A, and has no further involvement. The death is certified by the deceased person's doctor.

20 If the death is not obviously natural, further investigation is required. An early step in such investigation is usually for the coroner to ask a pathologist to perform a post mortem. The coroner does not have to consult the deceased person's family about his decision to hold a post mortem or to take their views, if he is made aware of them, into account; a coronial post mortem can take place even if the family actively object. While it would be prudent for the coroner to keep the family informed, there is no statutory requirement for him to do so.

21 It is often apparent that the death was probably due to natural causes and that this is likely to be confirmed at post mortem. In such cases, the coroner may request a pathologist to perform a post mortem[9] and, if the pathologist confirms that the death was due to natural causes, the coroner can complete a Form B, provide a death certificate and conclude his involvement without holding an inquest. If, on the other hand, the pathologist's report does not indicate a natural cause for the death, the coroner proceeds to hold an inquest.

22 In the remaining cases, it is immediately apparent that an inquest will be necessary, for example because the death was violent or might have been caused by an industrial disease and so have been unnatural. The coroner asks a pathologist to perform a post mortem.[10]

23 In 2008, there were 502,600 deaths in the United Kingdom. Of these, 234,800 (47%) were reported to the coroner, of which:

- 126,400 (54%) did not undergo coronial post mortem, of which
  - 123,900 (98%, or 53% of cases reported to the coroner) were either referred back to the reporting doctor for certification or dealt with under the Form A procedure;

9 Coroners (Amendment) Act 1926, s21; later, Coroners Act 1988, s19

10 Coroners Act 1887, s21 and Coroners (Amendment) Act 1926, s22; later, Coroners Act 1988, ss20 and 21

  - 2,500 (2%, or 1% of cases reported to the coroner) proceeded to inquest;
- 108,400 (46%) underwent coronial post mortem, of which
  - 79,900 (74%, or 34% of cases reported to the coroner) were dealt with under the Form B procedure;
  - 28,500 (26%, or 12% of cases reported to the coroner) proceeded to inquest.[11]

Attendance at coronial post mortem

24 Rule 4 of the Coroners Rules 1953 set out various people and organisations whom the coroner had to inform of the date, time and place of any post mortem examination performed under his jurisdiction. These included the relatives (but only if they had previously advised the coroner that they wished to attend the post mortem), the deceased person's doctor and, if the death had occurred in hospital, the hospital. Those people and organisations could then choose to be represented at the post mortem by a doctor or, if they were medically qualified, to attend the post mortem themselves. Rule 4(4) allowed the coroner to notify anyone he chose, without restriction, of the date, time and place of the post mortem and to permit him also to attend the post mortem. Rule 5 forbade anyone attending a coronial post mortem with the coroner's permission from interfering with the post mortem.

25 Nothing in the Coroners Rules 1953 expressly forbade anyone from attending a coronial post mortem without the coroner's knowledge or permission, although such a prohibition might be inferred from the provisions of rules 4 and 5.

26 Rules 7 and 8 of the Coroners Rules 1984 are to essentially identical effect as rules 4 and 5 of the 1953 Rules.

Special examination

27 In addition to requesting a post mortem, the coroner can ask for parts of the body to be tested or analysed in some way (a "special examination"). The coroner's power to request a special examination derived initially from section 22 of the Coroners (Amendment) Act 1926:

11 Statistics published by the Ministry of Justice: www.justice.gov.uk/publications/docs/coroners-deaths-reported-2008.pdf; the figure for total deaths is estimated

> *the coroner may,* ***at any time after he has decided to hold an inquest****, request any legally qualified medical practitioner to make … a special examination by way of analysis, test or otherwise of such parts or contents of the body or such other substances or things* ***as ought in the opinion of the coroner*** *be submitted to analyses, tests or other special examination* ***with a view to ascertaining how the deceased came by his death****.* [emphases added]

28 The three emphasised passages make clear that:

- the special examination may be requested only after the decision has been made to hold an inquest;
- it is for the coroner to decide what material is to be subjected to special analysis and what form that analysis should take;
- any such test may be done only if it is considered likely, or at least possible, that the result will assist in determining the cause of death.

Section 20 of the Coroners Act 1988 is to the same effect.

29 In practice, of course, it is unlikely that the coroner himself would have the expertise to decide what special examination would be of assistance in determining the cause of death. He would rely on advice given to him by the pathologist or other suitable expert.

30 There is no statutory definition of a special examination. The Inquiry considers that whether a particular form of examination is "special" or not is a factual, rather than a legal question, the answer to which may change over time as the once-exotic becomes commonplace. All the pathologists from whom the Inquiry heard evidence considered, for example, that basic histology is an integral part of any post mortem and had been so at all relevant times. It was routine and could not be considered "special". At the other extreme, there can be no dispute that radiochemical analysis of organs to determine how much plutonium they contain – a lengthy, complex and highly skilled procedure – does constitute a special examination.

Special examination if no inquest to be held

31 If the coroner has asked for a post mortem[12] because it might show the death to have been natural and hence that an inquest is unnecessary, he has no power to request any special examination, since he has not decided to hold an inquest.

12 Coroners (Amendment) Act 1926, s21; later, the Coroners Act 1988, s19

32 Section 21 of the Coroners (Amendment) Act 1926 provided that:

> *for the purposes of the* [post mortem] *examination the coroner and any person directed or requested by him to make the examination shall have the like powers, authorities and immunities as if the examination were a post mortem examination directed by the coroner at an inquest upon the body of the deceased.*

The wording of section 19 of the Coroners Act 1988 is almost identical.

33 It was submitted to the Inquiry that this wording did in fact permit special examination to be done under those circumstances:[13] that since one of *"the purposes"* of the post mortem was to determine whether or not an inquest was necessary, any investigation which would aid these purposes was authorised. This interpretation would require the term *"post mortem examination"* as used in that section to encompass special examination, which is not the case when the term is used anywhere else in the various Coroners Acts and Coroners Rules. The Inquiry does not accept that it can be right. A coroner has the power to request a special examination only after he has decided to hold an inquest and not before. The Inquiry is reinforced in that conclusion by the use of the phrase *"at any time after he has decided to hold an inquest"*, which appears in relation to special examination in section 22 of the Coroners (Amendment) Act 1926 and in section 20 of the Coroners Act 1988. If the coroner could lawfully request a special examination before he had taken the decision to hold an inquest, that phrase would be devoid of any meaning.

34 In reality, there is little doubt that the practice of coroners requesting special examinations to be done before they had decided to hold an inquest was widespread. Equally, there is little doubt that it was an effective approach, allowing an inquest to be avoided in many cases where the result of the special examination clarified the cause of death. It was a pragmatic response to a defect in the law but it was nevertheless a response which was not lawful. The Coroners and Justice Act 2009 effectively addresses the problem by making no distinction between post mortem and special examination and removing any constraint on the time at which either may be requested.

13 This is a view which has previously been noted to be held by some coroners: see Dame Janet Smith DBE, *The Shipman Inquiry, Third Report: Death Certification and the Investigation of Deaths by Coroners*, Cm5854, 2003, at paragraph 7.28

Preservation of material

35 At a coronial post mortem the pathologist must preserve material, such as tissues or organs, which he considers might be useful in determining the cause of death. Rule 6 of the Coroners Rules 1953 provided:

> *A person making a post mortem examination shall make provision, so far as possible, for the preservation of material which in his opinion bears upon the cause of death for such period as the coroner thinks fit.*

Rule 9 of the Coroners Rules 1984 is in identical terms.

36 If, therefore, the pathologist considers that analysis of the whole or a substantial part of one or more organs might help in determining the cause of death, he must keep them rather than return them to the body.

- If the analysis is sufficiently simple to be regarded as a routine part of the post mortem – for example, histological examination under a microscope – the pathologist may undertake it without further instruction.
- If the analysis is sufficiently complex or unusual as to constitute a special examination, the pathologist must await instruction from the coroner as to how to deal with the material he has retained. He has no authority to commission any special investigation himself.

37 The coroner's role comes to a definitive end at the conclusion of an inquest.[14] The Inquiry considers it obvious that he cannot authorise preservation of organs when he is precluded from conducting any further investigation.

38 In contrast, if the coroner decides after receiving the report of a post mortem that an inquest is not necessary, and accordingly issues a death certificate, he does retain some power to re-open his investigation, for example if new evidence were to come to light.[15] Although it is arguable that in those circumstances the coroner could continue to think fit that organs be preserved, he cannot request any special examination since he has not decided to hold an inquest. It would therefore be irrational of him to hold that view for more than a short period (to allow, perhaps, for judicial review of his decision not to hold an inquest).

14 Further investigation by a coroner would be permitted only after the intervention of the High Court, whether by judicial review or by order made under s6 of the Coroners Act 1887 (later, Coroners Act 1988, s13)

15 *Terry v East Sussex Coroner* [2002] QB 312, CA

39 In *Dobson and Dobson v North Tyneside Health Authority and anor*[16] Lord Justice Peter Gibson said:[17]

> [the pathologist] *was under an obligation imposed by rule 9 of the Coroners Rules 1984 to make provision for the preservation of material which in his opinion bore upon the cause of death but only for such period as the coroner thought fit … once the cause of death had been determined by the coroner with* [the pathologist's] *help and the time for challenge of that determination had passed, there* ***could be*** *no continuing obligation under the rule to preserve that material.* [emphasis added]

40 The finding was not that there *"was"* no continuing obligation, given the facts of the case; rather, the Court of Appeal found that there *"could be"* no obligation to preserve the material. This must mean that there could also be no possibility that the coroner might think fit that it be preserved. If the converse were true, and if it were possible for the coroner lawfully to think fit that the material should be preserved, it would be possible also for an obligation to arise for the pathologist to preserve it in accordance with the coroner's wishes.

41 At the times of all the deaths with which the Inquiry has been concerned, the pathologist who retained organs at a coronial post mortem was under no formal obligation to inform the deceased person's relatives – or even, curiously, the coroner – that he had done so. This anomaly was removed by the Coroners (Amendment) Rules 2005.[18]

Use of material for non-coronial purposes

42 There are no circumstances in which a coroner can authorise the use of tissue or organs taken from a body at coronial post mortem for any purpose, such as medical education, treatment or research, which is not directly related to establishing the individual's cause of death. If organs are to be used for such purposes, consent must be obtained from the deceased person's relatives under the provisions of the Human Tissue Act in force at the time. These Acts are discussed later in this chapter.

16 [1997] 1 WLR 596

17 Ibid, at 601

18 See paragraph 110

The coroner's role in civil litigation

43 Organs lawfully removed from the body in the course of a post mortem may be retained only if it is thought that further examination of those organs might be of assistance in determining the cause of death. Otherwise, they must be returned to the body at the conclusion of the post mortem. If neither the coroner nor the pathologist believes that further examination might be of assistance in determining the cause of death, the coroner cannot authorise removal and retention merely because he thinks that the organs might be of relevance to pending litigation.

44 It was submitted to the Inquiry that a coroner can authorise continued retention of organs which have been lawfully removed in the course of a coronial post mortem if he thinks that there is a possibility of civil litigation between the deceased person's family and his former employers, because the wording of rule 6 of the Coroners Rules 1953 (or rule 9 of the Coroners Rules 1984) does not limit the time during which a coroner might think fit for material to be preserved. The proposition appears in various editions of *Jervis on Coroners*, the bible of coronial law to which coroners would refer:

> *If there is any possibility of civil or criminal proceedings resulting from the death in which the material might be of use, the coroner would be wise to preserve the material until it is clear that the material can be of no further use.*[19]

This comment, from the edition published in 1957, appears in virtually identical terms in subsequent editions of *Jervis on Coroners* published in 1986 and 1993.

45 A footnote in Dorries' *Coroners' Courts*,[20] a more recent textbook, is in similar vein, may be derived from the comments in *Jervis on Coroners*, and was cited in support:

> *if the coroner or pathologist became aware that some civil litigation concerning the death was likely, retention for a rather longer period might be wise.*

46 The proposition appears to be contrary to authority. It is doubted in the current edition of *Jervis on Coroners*, published in 2002.[21] The Inquiry

19 *Jervis on the Office and Duties of Coroners* (9th edn, 1957), p116

20 Dorries, *Coroners' Courts* (1st edn, 1999), p108, footnote 58; also in the 2nd edn (2004), p121, footnote 35

21 *Jervis on Coroners* (12th edn, 2002), paragraphs 6–59

considers that such retention would be beyond the scope of the coroner's authority.[22]

Inquest verdicts

47 At the time of all the inquests considered by the Inquiry, a coroner sitting alone or with a jury almost invariably decided that the deceased had "come by his death" as the result of one of a list of standard reasons. The list included verdicts such as natural causes, industrial disease, accident (or misadventure) and unlawful killing. In order to reach a decision on most of the verdicts, the coroner or the jury had simply to decide whether that particular verdict was more likely than not to be right.[23]

48 If the coroner or the jury were unable to decide that any one verdict was more likely than not to be right, an open verdict could be returned. In the context of inquests considered by the Inquiry, this was most commonly done when the coroner or jury could not decide whether the cancer which led to the death had developed spontaneously (in which case the appropriate verdict would have been death from natural causes) or had been caused by exposure to radiation (when it would constitute an industrial disease).

Liability for the death

49 It is not the function of an inquest to determine civil liability for the death. Rule 34 of the Coroners Rules 1953 provided:

> *No verdict shall be framed in such a way as to appear to determine any question of civil liability.*

50 Rule 42 of the Coroners Rules 1984 repeats the old rule 34 and adds a prohibition on any apparent determination of criminal liability on the part of any named person.

22 The position as regards criminal proceedings has been modified by the Criminal Procedures and Investigations Act 1996

23 The exceptions were suicide and unlawful killing, which could be returned only if the coroner or jury were sure ("beyond reasonable doubt") that the evidence justified it

The Anatomy Acts

51 Parliament passed the first Anatomy Act in 1832 in order to provide a method by which medical schools could legally obtain human bodies for dissection and use in anatomy lectures. The Act was passed in response to public concern, and indeed riots, over the activities of grave-robbers ("resurrectionists") and the murderers William Burke and William Hare.

52 As regards acquisition of bodies, the Act envisaged two possible situations.

- The person having lawful possession[24] of the body could authorise its use for anatomical examination unless he knew that the deceased person had formally declared that he did not wish this to happen or a relative required it to be buried without such examination.[25]
- If the deceased person had formally declared that he wished his body to be used after death for anatomical examination, the person having lawful possession of the body had to direct such examination to be made, unless a close relative of the deceased person required the body to be buried without it.[26]

There was no requirement for the person lawfully in possession of the body actively to seek out the views of the relatives: if they did not make clear that they objected to dissection, it could be assumed that they did not object.

53 The Anatomy Act 1832 contained no definition of the term "anatomical examination" and there was therefore scope for some debate as to whether hospital (but not coronial) post mortem examinations might be brought within its provisions. The Anatomy Act 1984 does define the term, however, making it clear that it does not cover post mortem examinations:

> *"anatomical examination" means the examination by dissection of a body for purposes of teaching or studying, or researching into, morphology.*[27]

The 1984 Act does not purport to alter the definition of the term "anatomical examination" and the Inquiry concludes that the same definition has applied since 1832.

24 For the meaning of "lawful possession", see paragraph 87

25 Anatomy Act 1832, s7

26 Ibid, s8

27 Anatomy Act 1984, s1

54 The Anatomy Act 1984 was repealed by the Human Tissue Act 2004, which is discussed later in this chapter.

55 The Inquiry does not consider that the provisions of the Anatomy Acts are of any relevance to any of the issues which it has addressed. None of the stakeholders or individuals who gave evidence to the Inquiry submitted otherwise.

Hospital post mortem

56 The Human Tissue Act 1961 changed the law governing hospital post mortems.

Before 1961

57 It is not clear that any Act of Parliament applied to hospital post mortems before 1961. The most relevant Act is the Anatomy Act 1832 but, as discussed above, the intention of that Act was to regulate the teaching of anatomy (that is, dissection of bodies by medical students and doctors), not to govern pathology services.

From 1961

58 Under section 2 of the Human Tissue Act 1961, the person lawfully in possession[28] of the body could give authority for a hospital post mortem:

> *if, having made such reasonable enquiry as may be practicable, he has no reason to believe—*
>
> *(a) that the deceased had expressed an objection to his body being so dealt with after his death, and had not withdrawn it; or*
>
> *(b) that the surviving spouse or any surviving relative of the deceased objects to the body being so dealt with.*[29]

There was no requirement for the consent to be given in writing.

28 For the meaning of "lawful possession", see paragraph 87

29 Human Tissue Act 1961, ss1(2) and 2(2)

59 The purpose of a hospital post mortem is:[30]

- to establish or confirm the cause of death; *or*
- to investigate the existence or nature of abnormal conditions.

60 There is no express provision which allows body parts to be removed from the body in the course of a hospital post mortem, or for them to be retained or analysed. However, the distinction which exists at coronial post mortem between the post mortem itself and a special examination is not relevant at hospital post mortem. Organs can be removed and analysed if that analysis is necessary for the purpose of the hospital post mortem:

> *If the "purpose of establishing or confirming the cause of death or of investigating the existence or nature of abnormal conditions" properly requires organs to be removed and retained for examination, in my judgment, no further consent is required.*[31]

For example, if death were due to a brain tumour the brain could be removed and fixed before it was examined, or if death were due to a radiation-related cancer relevant organs could be removed and analysed for plutonium. Either could take some considerable time.

61 If a coronial post mortem is to be done on the body of the deceased person or an inquest is to be held into his death then the coroner's permission is required, in addition to that of the relatives, before a hospital post mortem can take place.[32]

Consent

62 Before 1961:

- the relatives' consent to dissection of the body for the study of anatomy could be assumed unless they made it known to the person lawfully in possession of the body that they objected;[33]
- there were no statutory provisions governing consent to (or any other aspect of) hospital post mortem, although relatives were sometimes asked to sign a form agreeing that it could be done.

30 Ibid, s2(1); repealed by the Anatomy Act 1984

31 *AB and ors v Leeds Teaching Hospital NHS Trust and anor* [2004] EWHC 644 (QB) *per* Mr Justice Gage at paragraph 126

32 Human Tissue Act 1961, ss1(5) and 2(2)

33 Anatomy Act 1832, s7

Since 1961, the person lawfully in possession of the body has been required to make *"reasonable enquiry"* to find out whether any relative objects.

63 It may be that non-objection *"implies a more passive approach than a requirement for consent"*.[34] However, the only real difference is that while any one of a number of relatives might *object* to a hospital post mortem (and by so doing prevent it from taking place), *consent* to the examination could be given by, and accepted from, one relative even if others object. Hence, if non-objection is the test, it is necessary to establish that *all* of the relevant family members do not object. Since this is usually done by accepting assurances given by a single close relative, it may be that any difference exists more in theory than in practice. The Department of Health issued guidance on the mechanics of obtaining authority for a post mortem, which is described later in this chapter.[35]

Extent of information

64 When giving consent to a hospital post mortem, the deceased person's relatives can restrict the extent of the examination. They can, for example, specify that the brain is not to be examined or that no body part is to be removed. They can stipulate that if body parts are removed for examination, they must be returned when that examination is completed.

65 The extent of the information to be given to relatives when obtaining their consent to a hospital post mortem is not defined by statute. In *AB and ors*, Mr Justice Gage said:[36]

> *Whether or not there is a difference between non-objection and consent I am quite satisfied that s2 of the 1961 Act requires no more than a consent to a post mortem being obtained without further explanation … that does not mean that if a relative asks questions or seeks further information those questions should not be answered nor the information supplied.*

66 From the evidence the Inquiry has heard, it does not occur to relatives that a post mortem could involve removal of whole organs which might not then be returned to them with the body (as opposed to slivers of tissue for microscopic inspection). Unless they are told of this possibility when they consent to the hospital post mortem, they are not in a position to ask for

34 *AB and ors* at paragraph 127

35 See paragraphs 90 et seq

36 *AB and ors* at paragraph 127

more information, to refuse permission for it to be done or to request that the organs be returned to them when no longer needed.

67 The Inquiry does not consider that there is any true distinction between establishing after *"reasonable enquiry"* that a relative *does not object* to a hospital post mortem and obtaining *consent* from relatives for a hospital post mortem. Just as consent is not real unless the relative is properly informed about that to which he consents, so non-objection is not real unless the relative is properly informed about that to which he does not object. If Mr Justice Gage, in the comments quoted above, intended to suggest that it was not necessary to mention when obtaining permission the possibility, if real, that whole organs might be removed, the Inquiry respectfully disagrees.

68 Both the nature of consent and the extent of the information required for consent to be valid were discussed in some detail in *The Royal Liverpool Children's Inquiry Report.*[37]

Research

69 Nothing in the Human Tissue Act 1961 suggested that consent by the family of the deceased person to a hospital post mortem implied consent to the removal or analysis of organs if that analysis was not related to the aims of the hospital post mortem. Consent to the hospital post mortem would not, therefore, imply consent to the use of parts of the body for medical education or research.

70 Section 1 of the Act permitted the removal of parts of the body after death, subject to appropriate consent, *"for therapeutic purposes or for purposes of medical education or research".*[38]

71 Some consent forms seen by the Inquiry included a reference to permission for tissue (the word "organs" is not used) to be taken for those purposes. A signature on such a consent form authorises not only a hospital post mortem (under section 2 of the Act) but also the removal of body parts for other purposes (under section 1), albeit that there is scope for misunderstanding over the amount of tissue for which removal has been authorised.

37 HC12-II (TSO, 2001), chapters 10 and 11

38 Human Tissue Act 1961, s1(1)

Attendance at hospital post mortem

72 No statutory provisions governed attendance at hospital post mortem.

Penalty

73 Breach of the provisions of the Human Tissue Act 1961 was not a criminal offence, nor did it give rise to any civil liability. Indeed, section 1(8) of the Act provided that:

> *Nothing in this section shall be construed as rendering unlawful any dealing with, or with any part of, the body of a deceased person which is lawful apart from this Act.*

The Nuclear Installations Act 1965

74 It is a criminal offence for anyone other than the United Kingdom Atomic Energy Authority to operate a nuclear reactor[39] or, in general, to deal with nuclear material in connection with the production of atomic energy without a nuclear site licence.

75 The holder of a nuclear site licence must ensure, among other things, that no injury or damage to property is caused by radiation emitted from material on the site or from waste discharged from the site.[40] Liability for any injury or damage so caused is strict: that is, it is not necessary to show that the holder of the licence was at fault.[41]

The Ionising Radiation Regulations 1985

76 These regulations provided that employers should reduce the exposure of their employees to ionising radiation so far as reasonably practicable and set dose limits which were not to be exceeded. The dose of radiation to which employees were subjected had to be assessed and monitored by an approved dosimetry service. Radiation workers were to be subject to adequate medical

39 Other than one in a means of transport: Nuclear Installations Act 1965, s1(1)

40 Nuclear Installations Act 1965, s7

41 Ibid, s12

surveillance by a doctor; their health records were to be maintained and copies kept for 50 years after the last entry in them had been made. The Ionising Radiation Regulations 1985 were superseded by the Ionising Radiation Regulations 1999.

Interaction between coronial and hospital post mortems

77 The aim of a coronial post mortem is limited to establishing the cause of death. It is narrower in scope than a hospital post mortem, which can involve investigation into other matters, such as the effects and side-effects of any treatment administered to the deceased person before he died, or other abnormal conditions unrelated to the death.

78 However, all the pathologists from whom the Inquiry heard evidence took the view that a properly conducted post mortem involves a full examination of the body and its organs, including routine histology. They made no distinction between coronial and hospital post mortems, except to acknowledge that if the consent form for a hospital post mortem specified that it was to be limited in some way, they would abide by that stipulation. They deprecated the idea that a coronial post mortem which stopped at merely establishing the cause of death could be described as an adequate post mortem examination.

79 Although a coroner cannot authorise the use of any part of the body taken at coronial post mortem for research purposes, there is no reason why agreement to such use could not be obtained from the deceased person's family and the organs then taken and analysed, provided the coroner consents.[42]

Removal, analysis and retention of organs

Removal

80 At a coronial post mortem, removal of organs was allowed only when the pathologist considered that further examination of those organs might be

42 Human Tissue Act 1961, ss1(2) and 1(5)

of assistance in establishing the cause of death. Removal of organs for any other purpose was permitted only subject to the provisions of the Human Tissue Act 1961.

81 Section 1 of that Act governed removal of parts of the body after death for non-coronial purposes. It provided that the person lawfully in possession of the body could authorise removal:

- if the deceased person had made a formal request that part of his body be used for therapeutic purposes, education or research; *or*
- if the deceased person had not objected and after making reasonable enquiry the person lawfully in possession of the body had no reason to believe that any surviving relative objected.

A formal request by the deceased person was a request made by him in writing at any time or made orally in the presence of two witnesses during his last illness.

82 At a hospital post mortem, therefore, removal of body parts was allowed:

- if it was necessary to serve the purpose of the post mortem, as discussed above;
- if the deceased person had requested it before his death; *or*
- if the agreement of the person lawfully in possession of the body and of the relatives had been obtained.

Analysis

83 It was legal to analyse organs removed at a coronial post mortem:

- if the analysis was regarded as part of a routine post mortem;
- at the coroner's request, if he had already decided to hold an inquest;[43]
- arguably, once the body had been disposed of by burial or cremation, for any purpose.[44]

84 It was legal to analyse organs removed at a hospital post mortem:

- to further the purpose of the hospital post mortem, set out above;
- if they had been removed because consent to their removal had been given under section 1 of the Human Tissue Act 1961, for any reason within the scope of the consent.

43 Coroners (Amendment) Act 1926, s22; Coroners Act 1988, s20

44 See paragraph 85

Retention and subsequent use

85 The law was unclear as to what should have been done with organs lawfully removed from a body at post mortem after the purpose for which they had been removed – whatever that purpose might have been – had been met. There were several possibilities, depending on the circumstances.

- The person who was or had been lawfully in possession of the body became lawfully in possession of the removed organs. They should have been returned to him, or disposed of in accordance with his instructions.
- An administrator of the deceased person's estate had been appointed and so had become lawfully in possession of the organs. They should have been returned to him, or disposed of in accordance with his instructions.
- The pathologist who had retained the organs became lawfully in possession of them. He could have kept them, disposed of them or subjected them to such analysis (which might have involved their destruction) as he wished.
- The pathologist who had removed the organs, at a coronial post mortem and in accordance with his duty under rule 6 of the Coroners Rules 1953 (later rule 9 of the Coroners Rules 1984), had passed the organs to someone else, anticipating that the coroner may have wished them to be analysed by that individual. However, the coroner did not request that analysis. The individual was therefore lawfully in possession of the organs and could have kept them, disposed of them or subjected them to such analysis (which might have involved their destruction) as he wished.
- The organs had been treated with skill and expertise in such a way that the rule that there is no property in a human body no longer applied to them.[45] They might then have been owned by someone, probably by the person whose skill and expertise had been applied or by his employers, and could have been dealt with as that person's property, in any way he wished.

86 Before the Human Tissue Act 2004 came into force,[46] the law provided no definitive answers. It is not clear whether the legal principles which applied to possession of a body could or should have been applied to organs which had been removed from it.

45 See *Doodeward v Spence* (1908) 6 CLR 406, HC (Aust); *R v Kelly* [1999] QB 621, CA

46 See paragraph 105

Lawful possession of the body

87 It is a long-established principle of English law that there is no property in a human body. No-one can actually *own* a body or any part of it. The right to decide what is done to a body is given to the persons *lawfully in possession* or *having lawful possession* of it. No Act defines the person lawfully in possession of a body. The Courts appear in the past to have held that the right to possession of a body belongs to those who have a duty to bury it. There may be competing claims to lawful possession.

- When the deceased person has died in hospital or similar institution, the hospital authorities[47] may have lawful possession of the body.
- While he is conducting a post mortem, the pathologist has lawful possession of the body.[48]
- An adult's executors, appointed by his will, have lawful possession of the body.[49]
- A child's parents have lawful possession of the body because they are under a duty, so far as their means allow it, to bury it.[50]
- If the coroner is investigating the death, it is arguable that he has lawful possession of the body until he decides to release it or for as long as his investigation continues. An alternative view would be that his authority, derived from and limited by statute, simply overrides the authority of anyone in lawful possession of the body.

88 Executors become lawfully in possession of the body immediately after death. In contrast, where there is no will, administrators acquire rights only after probate is granted. This does not usually happen until after the body has been buried or cremated so the administrators do not then acquire lawful possession.

89 Although there may be uncertainty in particular cases about who is actually lawfully in possession of the body, difficulties have seldom arisen in practice. It is perhaps for that reason that when conflicting arguments as to who has lawful possession of a body do fall to be resolved, the law provides no clear answer. The identity of those whom the law might regard as being in possession of organs lawfully removed from a body at post mortem examination and then physically separated from it is all the more obscure.

47 Human Tissue Act 1961, s1(7)

48 *AB and ors,* adopting a concession by the Claimants, at paragraphs 139 and 154

49 See, for example, *Williams v Williams* (1882) 20 Ch D 659, HC: "prima facie *the executors are entitled to the possession and are responsible for the burial of a dead body*"

50 *R v Vann* (1851) 2 Den 325; discussed in *AB and ors* at paragraphs 136 et seq

Guidance

Government guidance

90 A few days before the Human Tissue Act 1961 came into force in September of that year, the Ministry of Health produced a memorandum[51] which was circulated to regional hospital boards, hospital management committees and boards of governors.

91 As to consent for removal of organs for therapeutic, research or educational purposes, the guidance indicated that:

> *The nearest relative available should be asked if he objects or has reason to believe that any other relative would object, but hospital authorities are not expected to ask that relative for a statement that no other relatives object.*

92 The memorandum was an accurate and useful commentary on the Act and contained a summary of its provisions as an appendix. It is worthy of note that the discussion in the appendix of section 1(5) of the Act (which requires the consent of the coroner to be given before organs are removed from a body that is under or likely to be under his jurisdiction) includes the following:

> *The consents in subsections (1) and (2) will also be necessary in addition to the coroner's consent.*

Nobody who had read this guidance could be in any doubt that the consent provisions of the Human Tissue Act 1961 applied to the removal of organs or tissue from the body at a coronial post mortem for purposes, such as research, unconnected with determining the cause of death.

93 A separate summary of the provisions of the Human Tissue Act 1961 was sent to coroners by the Home Office[52] at about the same time.

94 The Department of Health and Social Security (DHSS) produced a further circular[53] in 1975, with distribution similar to that of the Ministry of Health's 1961 memorandum. It expanded on the discussion of who was lawfully in possession of a body. When discussing the question of consent (under section 1 of the 1961 Act) to organs being removed, it observed that *"Specific consent is not necessary, merely a lack of objection."* An appendix headed "Summary of Human Tissue Act" repeated, under discussion of

51 HM (61) 98

52 HO 182/1961

53 HSC (IS) 156

section 1(5), the sentence from the earlier (1961) guidance quoted in paragraph 92 above.

95 The main emphasis of the first two circulars was the legal basis for obtaining organs, particularly kidneys, for transplantation. In 1977 a third circular,[54] again from the DHSS, focused on the removal of tissue at post mortem, in particular pituitary glands (from which human growth hormone was being obtained). Paragraph 3 of this circular emphasised that:

> *if, during a post mortem examination, it is proposed to remove organs or tissue for the purposes specified in Section 1 of the Act, the provisions of the Act must be observed*

and continued:

> *Save in a case where the deceased has made an express wish to this effect, the removal of tissue may be authorised only if, having made such reasonable enquiry as may be practicable, the person lawfully in possession of the body has no reason to believe that the deceased had expressed objection or that a surviving spouse or other relative objects. Specific consent is not required by the Act.*

96 It was suggested that a post mortem declaration form be signed and a model form was attached which read:

> *I do not object to a post mortem examination being carried out on the body of ..... and I am not aware that he/she had expressed objection or that another relative objects. I understand that this examination is carried out (a) to verify the cause of death and to study the effects of treatment, which may involve the retention of tissue for laboratory study. (b) to remove amounts of tissue for the treatment of other patients and for medical education and research.*

97 Paragraph 7 of this circular read:

> *The provisions relating to the removal of tissue for therapeutic use and for medical education and research apply when a post mortem examination is ordered by the coroner as they apply to any other post mortem examination, save that their removal requires also the consent or approval of the coroner.*

54 HC (77) 28

98 The advice given in this last circular was correct. As with the earlier circular, no-one who had read it could be in any doubt that while the coroner could **refuse** to allow the removal of organs for research purposes unconnected with his own investigation into the cause of death, neither he nor anyone else could **permit** such removal without first having taken reasonable steps to ensure that the deceased person's relatives did not object.

Professional guidance

99 The Inquiry has seen four relevant articles published in the *British Medical Journal*. None directly addressed the issue of the legal basis for removal of organs at post mortem. None would have been of great assistance to a pathologist hoping to understand the legislation under which he practised.

100 A column[55] entitled "Any Questions?", published in 1954, includes the observation:

> *pathologists without any legal sanction have usually considered that the consent to perform a post mortem examination extends to the removal of any specimen of pathological interest.*

101 An article[56] in 1961 described the provisions of the newly-introduced Human Tissue Act 1961. The focus was on the implications of the Act for organ donation. The only reference to post mortem examinations is the comment:

> *For the purpose of dispelling doubt Section 2 of the Act makes it clear that post mortem examinations … if carried out in accordance with that section … will not contravene the provisions of the Anatomy Act 1832.*

102 A full-page article[57] was printed in 1966 entitled "Law and the Corpse" and attributed to "our Legal Correspondent". The article gives an overview of the Anatomy Act 1832 and of the Human Tissue Act 1961. It is observed that under the latter Act the deceased person's relatives have a power of veto over the removal of tissue from the body *"when the person lawfully in possession acts of his own volition. There is no duty to make inquiry of the relatives unless there is some reason to believe that they object"*. The latter sentence is plainly wrong: the Act expressly provided[58] for authority to be

55 Any Questions? Ownership of Operation and Necropsy Specimens, *BMJ*, 1954: 1369

56 Annotation: Human Tissue Act, 1961, *BMJ*, 1961: 879

57 Our Legal Correspondent, Law and the Corpse, *BMJ*, 1966: 595

58 Human Tissue Act 1961, ss1(2) and 2(2)

given by the person lawfully in possession of the body only after he had made *"such reasonable enquiry as might be practicable"* and this is obviously incompatible with transferring the burden to the relatives actively to make an objection known.

103 In 1978 an article[59] observed:

> *Major techniques such as kidney transplants are well regulated … but for many years the removal and the use of other tissues have been controlled by custom and tacit approval by the authorities rather than the Human Tissues* [sic] *Act.*

The article referred as an example to the taking of pituitary glands for the preparation of growth hormone and warned starkly of the need to comply with legislation by obtaining the consent of the relatives:

> *All these innocent activities are illegal unless brought strictly within the terms of the Human Tissues Act.*

104 The *Bulletin of the Royal College of Pathologists* is *"a professional in-house magazine … distributed free of charge to all active College members, Registered Trainees and retired members who have chosen to receive mailings"*.[60] In September 1985 it published an article by Professor Bernard Knight[61] entitled "Legal Considerations in the Retention of Post-mortem Material". The article accurately and lucidly summarised the legal position in relation to both coronial and hospital post mortems. In relation to coronial post mortem examinations, Professor Knight wrote:

> *the retention of tissues for teaching and research is not covered by the coroner's permission and the coroner cannot grant such permission, as it is not within his remit to do so. He can forbid the use of any tissues for such purposes, but positive permission must be obtained under the terms of the Human Tissue Act, 1961*

59 Editorial: Postmortem tissue problems, *BMJ*, 1978: 382

60 Description on the College's website: www.rcpath.org/index.asp?PageID=36

61 Professor of Pathology, Cardiff Royal Infirmary

and in relation to hospital post mortems:

> *In respect of tissue retention, the usual hospital consent form has a sub-clause (which can be deleted by the relatives if they so wish) which allows tissues to be retained for therapeutic, teaching or research purposes … Although not yet put to the legal test, it is likely that the same concept of "informed" consent applies as with live patients, in that it would be both unethical and certainly a matter of bad public relations for the hospital, if some major mutilation was inflicted without any information or express request being made to the relative at the time of signing of the consent form.*

The Human Tissue Act 2004

105 This lengthy Act repealed several others, including the Human Tissue Act 1961 and the Anatomy Act 1984. It clarifies the existing, rather incomplete, law at the expense of considerable complexity. In particular, it removes any doubt, provided appropriate consent is obtained, about the legality of:

- storage of a human body for purposes which are set out in Schedule 1 to the Act;[62]
- use of the body for those purposes;
- removal of *"relevant material"* from a deceased person for those purposes;
- storage of relevant material for those purposes;
- use of relevant material for those purposes.

There are detailed definitions of *"appropriate consent"* in respect of adults and children.

106 Relevant material is defined[63] as *"material, other than gametes, which consists of or includes human cells"* but excludes hair and nails. There is no lower limit on the size of tissue sample which constitutes relevant material or even on the number of human cells which must be present.

107 Activities conducted without consent are made criminal offences, carrying sentences of up to three years' imprisonment, an unlimited fine or both.

108 The Act created the Human Tissue Authority (HTA), an organisation whose duties include the issuing of licences to carry on the various specified

62 These are wide-ranging and include anatomical examination, determining the cause of death, research, transplantation and education or training

63 Human Tissue Act 2004, s53

activities, superintending compliance with the various provisions of the Act and drafting of codes of practice in relation to those activities. The HTA has published several such codes, which were revised in 2009.

109 The Act has no effect on anything done by or on the authority of coroners, the scope of whose role remains unchanged. If a body or material from a body may be required for a coroner's purposes, it may not be used for any other purpose without the coroner's permission.[64] Once the coroner's investigation into a death is complete, however, the provisions of the Act would appear to begin to apply in respect of any material, such as organs, which had been lawfully retained under his authority.

The Coroners (Amendment) Rules 2005

110 The Coroners (Amendment) Rules 2005 amended rules 9 and 12 of the Coroners Rules 1984 to introduce significant changes to the way in which tissues and organs retained by a pathologist in the course of a coronial post mortem were to be dealt with. The pathologist's duty to retain material which he considers might help in establishing the cause of death remains unchanged, but in addition those amended rules:

- require the pathologist to notify the coroner forthwith in writing that he has preserved material, identify it, give his reasons for preserving it and, optionally, indicate for how long he considers it should be preserved;
- require the coroner to specify the period for which he requires the material to be preserved, which, if it has not expired by the time his functions under the Coroners Act 1988 cease, expires at that time;
- require the coroner to notify the deceased person's relatives that material has been retained and to set out for them the options for dealing with it after the end of that period, those options being:
  - burial, cremation or other lawful disposal by the pathologist;
  - return to the relatives;
  - retention for research or other purposes;
- amend the standard form of post mortem report to require the pathologist to indicate whether any organs or tissue have been retained (but only by a simple yes or no; it is not necessary for him to specify what has been kept) and, if so, who retains them and for how long.

64 Ibid, s11

111 What constitutes "material" is not defined in the amended rules (nor elsewhere in the Coroners Acts or Rules).

112 Curiously, although the coroner must inform the deceased person's relatives of the options for disposal of retained tissue or organs, the amended rules do not require him to abide by, or even to solicit, their views.

The Coroners and Justice Act 2009

113 This Act, which received Royal Assent in November 2009, introduces many changes to the coronial system described above. Among the changes relevant to the matters with which the Inquiry has been concerned are:

- transfer of focus of the coroner's activities from the inquest to the investigation as a whole into the deceased person's death;
- removal of the requirement for the unexpected death to have been "sudden" (see paragraph 12);
- widening of the requirement to investigate when a death has occurred in prison to any form of state detention (for example, in police cells or psychiatric hospitals);
- abolition of the distinction between post mortem and special examination.

114 None of the provisions of this Act relating to matters discussed in this Report is yet in force.

Post Mortem Analysis in the Nuclear Age

Chapter 4

Post Mortem Analysis in the Nuclear Age

Chapter 4

Contents

Introduction

1 The advent of nuclear weapons and nuclear reactors increased interest in the possible effects of radiation on human health. There was concern, both scientific and public, that little was known of the possibility that radioactive elements could be taken up and stored in the body or of the potential adverse effects of radiation in the long term. This chapter provides an overview of the attempts to address that lack of knowledge and the context in which those attempts were made. These matters are also discussed, in more detail, later in this Report.

Uses of nuclear fission

2 The term "nuclear fission"[1] was first used in 1939. From 1942, the Manhattan Project, led by the US with assistance from the UK and Canada, used the first nuclear reactors to manufacture enriched uranium (at Oak Ridge, Tennessee) and plutonium (at Hanford, Washington) for use in nuclear weapons. This work led to the first atomic bomb being exploded on 16 July 1945 at Alamogordo, New Mexico.

3 Within a month the US Air Force had dropped atomic bombs on Hiroshima on 6 August 1945 and Nagasaki on 9 August 1945, to devastating effect. The novelty of the technology and the absence, given the extreme urgency of the project, of a full testing programme meant that little was known about the long-term effects on health of the processes involved in producing fissile material or the radioactive fallout produced by nuclear weapons.

4 Nevertheless, the major powers strove to develop nuclear weapons. The British programme began in 1947. In 1949, the Soviet Union exploded its first nuclear weapon and testing increased in the 1950s, during the Cold War. The majority of early tests took place in the atmosphere or underwater.

5 In the UK, fissile material was initially produced at two plants: uranium at Springfields, Lancashire, from 1948 and plutonium at Sellafield,[2] Cumbria, from 1952. The first British nuclear weapon test was of a plutonium-based

1 See chapter 2, "Science"

2 Then known as Windscale and Calder works

bomb and took place at the Monte Bello Islands off the coast of Western Australia in October 1952.

6 Simultaneously, research was conducted into the use of controlled nuclear fission in a reactor for electricity generation. Nuclear-generated electricity was first produced in the US in 1951. The first commercial nuclear power station in the world was opened at Calder Hall, Cumbria, in October 1956.

Research into health effects

7 The use of nuclear fission in weapons and reactors increased the potential for radiation-induced injury. As a result, the field of health physics developed to study and devise protection against the hazards of radiation. Early work included investigation into the presence of both stable and radioactive elements in the human body. To quote a contemporary paper:[3]

> *With the advent of large-scale atomic-energy programmes in many countries and the use of radioactive substances in reactors, in research and as weapons, a new significance has been given to trace elements in living materials. It is inevitable that there will be a small escape of fission products and of materials with neutron-induced radioactivity into air and water supplies as a result of these programmes. In order to evaluate the hazard due to the metabolism of these substances it is necessary to obtain an estimate of the levels of the various stable elements which occur in the human body.*

In the UK, work in this field was carried out principally by the United Kingdom Atomic Energy Authority (UKAEA) and the Medical Research Council (MRC).

8 American scientists began to study the effects of radiation arising from the materials used in nuclear fission on the human body and on the food chain, soil and water in the 1940s. The potential importance of data gathered from analysis of organs obtained after death was recognised early and the work included analysis of organs obtained at over 200 post mortem examinations performed in Japan in the four months following the Hiroshima and Nagasaki explosions. American research into levels of strontium-90 (a radioactive element contained in fallout from nuclear weapons tests) in

3 Stitch SR, Trace elements in human tissue. 1: A semi-quantitative spectrographic survey, *Biochemical Journal*, 1957, 67(1): 97–103

human bone started in 1953[4] and from 1955 included bone sent from the UK.

9 British research on the presence of strontium-90 in human bones started in 1955.[5] It was initially carried out by the UKAEA; the MRC was involved in its co-ordination and in reviewing the results. Both British and American research into strontium-90 used bones – usually femur, ribs or vertebrae – obtained at post mortem. It was intended to monitor radioactivity arising from nuclear fallout and therefore used bones gathered from the general population rather than from individuals thought to have been at particular risk of exposure. The strontium research is considered in detail in chapter 11, "Strontium and the Medical Research Council".

10 Further research on organs obtained at post mortem from the general population was carried out on behalf of the MRC's Committee on Protection against Ionising Radiations at the Atomic Energy Research Establishment, Harwell, which was run by the UKAEA. The resulting paper[6] indicates that organs were obtained through contact between Dr S R Stitch, a researcher employed in the MRC's Radiobiological Research Unit, and pathologists:

> *Arrangements were made in the first place to receive tissue specimens from the Radcliffe Infirmary, Oxford … contact was made with the pathologists at the Royal Berkshire Hospital, Reading and the Horton General Hospital, Banbury, and arrangements made to obtain material from suitable accident cases which may become available. This arrangement has worked smoothly if somewhat slowly since only three accident cases have been obtained to date. Contact will have to be made with many other sources if an adequate supply of normal material is to be obtained.*

11 This work involved exchange of both ashed and dried tissue with researchers in the US, led by Professor Isobel Tipton at the Physics Department of the University of Tennessee:

4 Kulp JL, Eckelmann WR and Schulert AR, Strontium-90 in Man, *Science*, 1957, 125: 219–25

5 Bryant FJ, Chamberlain AC, Morgan A and Spicer GS, *Radiostrontium fallout in biological materials in Britain*, HP/R 2056 (AERE, 1956)

6 Stitch SR, The spectrographic determination of trace elements in human tissues. Medical Research Council, Committee on Protection against Ionising Radiations, subcommittee on Internal Radiations, PIRC IR/70, October 1954

> *The American team has asked for a collaborative effort on the determination of trace elements, by exchange of material, for comparison purposes. Seventeen tissue ash specimens have been forwarded to Professor Tipton as well as seventeen oven dried tissue specimens from an accident case. It is intended by these exchanges to cross check on methods and provide each investigation with material from different geological areas.*

The desirability of exchanging human material is a recurring feature in studies of trace element and radionuclide levels in human organs, reflecting the scientific requirement for consistency of results and methodology.

12 The value of using material obtained at post mortem examination in identifying the effects of occupational exposure to radiation was also recognised. In 1954, Dr Thomas Graham, Senior Medical Officer at Sellafield, wrote:

> *direct evidence by analysis of bone from plutonium workers who eventually reach the post-mortem table, from natural causes or otherwise, would be very valuable.*[7]

The earliest work identified by the Inquiry involving analysis of organs obtained from nuclear workers was performed by the UKAEA at Springfields in 1954.[8] It demonstrated another recurring feature in this field, the results from the nuclear worker being compared to those from a non-exposed human control. From a scientific perspective the value of control samples, which allow a baseline to be determined, is obvious. Organs for this research were supplied by pathologists from Blackpool Victoria Hospital and Preston Royal Infirmary.

13 In late 1954 and early 1955, similar work was undertaken on lung tissue at Sellafield. The Inquiry has seen no evidence which would allow conclusions to be drawn as to the source of the tissue or how it was obtained.

The need for further research

14 The potential for beneficial uses of nuclear energy as well as the harmful effects of radiation on health became more widely appreciated by politicians

7 UKAEA internal memorandum

8 Butterworth A and McLean AS, Observations on the metabolism of soluble uranium in humans, UKAEA internal paper, 9 December 1955

and the media in the 1950s. It was apparent that further research was necessary and on 29 March 1955 the Prime Minister, the Rt Hon Winston Churchill MP, asked the MRC to *"appoint an independent committee to report on the medical aspects of nuclear radiation"*.

15 The report[9] was presented to the Marquess of Salisbury, Lord President of the Council, in June 1956 and debated in the House of Commons on 16 July 1956. The Rt Hon Dr Edith Summerskill MP said:

> *I believe that the importance of this debate transcends that of any other because only if we apply ourselves to the question of controlling nuclear radiation can our plans for the future have any significance at all … we must become, if we are to take our duty to humanity and posterity seriously, more alert to the appalling potential dangers of this new form of energy.*[10]

The need for further research was clear. The introduction to the report concluded:

> *It will be evident to any reader of this report that, at the present time, there are many large and serious gaps in our knowledge of the medical and biological effects of ionizing radiation. If the potentialities for good are to be exploited with confidence and safety, it is necessary that these gaps should be filled. Much research on many broad fronts will be required.*

16 Some of those gaps were filled by research which included analysis of organs obtained from nuclear workers from the 1960s to the 1990s by the UKAEA and subsequently British Nuclear Fuels Limited (BNFL) and from the general public in the 1980s by the National Radiological Protection Board (NRPB). These and other studies will be examined in detail elsewhere in this Report. Many other gaps in knowledge were filled by research which did not involve the use of such material. Research on the medical and biological effects of radiation continues to this day.

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9 *The Hazards to Man of Nuclear and Allied Radiations*, Cmd 9780 (HMSO, 1956)

10 Hansard, HC Deb, 16 July 1956, vol 556, cols 928–75; see also chapter 11, "Strontium and the Medical Research Council", paragraphs 19 et seq

Analysis for coronial purposes

17 Coroners also used the results of analysis of organs obtained at post mortem examination to assist them in determining the cause of death when the deceased had potentially been exposed to radiation in the course of his employment. The first instance of such analysis for which the Inquiry has definite evidence was in 1957, in relation to a Springfields worker whose death from cancer was alleged to have been caused by occupational radiation exposure. The note of evidence from the inquest indicates that Dr Alan Butterworth[11] had attended the post mortem and collected large samples of lung and kidney which were then analysed at Springfields. Dr Butterworth presented the results in support of his view that the death had not been caused by occupational exposure to radiation. The inquest concluded that the death was due to natural causes.

18 Analyses were also sometimes performed in the course of coronial investigations into the deaths of men who had been involved in the British nuclear weapons testing programme. In 1958, the strontium-90 content of femora obtained at post mortem examination from two servicemen who had been in the vicinity of the Christmas Island weapons tests was estimated on behalf of the respective coroners. The analyses were performed at the UKAEA laboratory in Woolwich. The results indicated that in neither case was the level of strontium-90 above that which was being found in the bones of adults who had not been present at nuclear weapons tests. In one case there was an open verdict; in the other death was due to natural causes.

19 These cases also illustrate the way in which data obtained for coroners were used also for other purposes. The results from both the cases were included anonymously in the published research on strontium levels in the UK population. It was also anticipated that the analytical results would assist in the determination of claims made by the families of the deceased. In these two cases those claims were for service pensions, which would have been payable if the deaths had been caused by injury or illness sustained as a result of military service; in others, analysis took place in the context of a potential civil claim for damages. Such further use of data derived from analyses performed under the coroner's jurisdiction, and the questions raised in some cases about the primary motive for the analysis, will be discussed later in this Report.

11 UKAEA Senior Medical Officer

Whose organs and why?

20 Since the 1950s, human organs have been removed at post mortem and analysed at nuclear facilities to determine the levels of radionuclides they contained. Various rationales are apparent in the early work, which remained of relevance into the 1990s:

- research for scientific purposes on the amount of radiation present and the effect of radiation exposure;
- evidence on the cause of death for coronial purposes;
- evidence in possible claims for compensation arising from deaths of individuals potentially exposed to radiation.

In many cases, more than one reason pertained.

21 Individuals from whom organs were removed at post mortem for these reasons included:

- employees of the nuclear industry;[12]
- service veterans who had attended nuclear weapons tests;[13]
- individuals who had lived close to nuclear facilities;[14]
- the general population with no occupational or geographical link to the nuclear industry.[15]

While these are the broad categories of individuals from whom organs were taken for analysis, it is important to note that only very few individuals from each group were involved.

22 There was no one single concerted research effort covering all the groups referred to in paragraph 21. Instead, analysis was carried out on a piecemeal basis by employers and government-sponsored researchers such as the MRC and the NRPB at various sites and for the various different purposes identified in paragraph 20.

12 For example, BNFL, the UKAEA and the AWE: see chapters 5, 6 and 9 discussing those organisations

13 See chapter 9, "The Atomic Weapons Establishment"

14 For example, the population studies: see chapter 8, "The National Radiological Protection Board"

15 For example, the strontium surveys and the population studies: see chapter 11, "Strontium and the Medical Research Council" and chapter 8, "The National Radiological Protection Board"

Analysis outside the nuclear industry

23 It was not only the nuclear industry which was interested in the analysis of organs removed from former employees at post mortem. Examples from other industries include studies undertaken on coal miners, barium miners, shale miners and asbestos workers. Tissue analysed was usually either small histological sections routinely removed by the pathologist to determine the cause of death or whole lungs supplied to the Pneumoconiosis Medical Panels. The motives for the work appear to have been similar to those set out above in relation to the nuclear industry, namely scientific research and potential claims for damages.

24 Research into the presence of radioactive material in organs from the general population was typically undertaken by hospital or university researchers or by the Radiological Protection Service (RPS). The RPS was initially part of the MRC and was transferred to the newly-formed NRPB in 1970.

British Nuclear Fuels Limited

Chapter 5

British Nuclear Fuels Limited

Chapter 5

Contents

The genesis of the nuclear industry

1 In 1945, the UK Government embarked upon a programme to develop nuclear weapons and nuclear energy. The following year, construction work began on the Atomic Energy Research Establishment (AERE) at Harwell and the Atomic Energy Production Division was set up at Risley, near Warrington. Work also started on a uranium processing and nuclear fuel production plant at Springfields in Lancashire and a radiochemical centre at Amersham in Buckinghamshire.

2 In 1947 work started on a factory at Windscale (Sellafield), to produce plutonium for UK nuclear weapons. The first industrial-scale reactor became operational in 1950; the first plutonium was produced in 1952; and production of the UK's first nuclear weapon began later that year.

3 This work was managed initially by the Ministry of Supply (MoS) and from 1954 by the United Kingdom Atomic Energy Authority (UKAEA). It required extensive industrial, research, engineering and administrative support. The sites included the following.

- Aldermaston, near Reading, where the Atomic Weapons Research Establishment (AWRE) was based. In 1987, the AWRE merged with Royal Ordnance Factories at Burghfield and Cardiff, becoming the Atomic Weapons Establishment (AWE).
- Amersham, the location of the radiochemical centre for the production of radionuclides for use in industry and in medicine.
- Culham, near Oxford, which opened in 1960 and specialised in the development of fusion reactors.
- Dounreay, near Thurso in Scotland, the key site for development of naval and fast breeder reactors. It opened in 1955 and the first fast reactor became operational in 1959.
- Harwell, in Oxfordshire, where the AERE provided research and development services. Importantly, it was also the centre for the Radiological Protection Division (RPD).
- Risley, near Warrington, which provided management and administration, health and safety and central engineering services.
- Winfrith, in Dorset, used for the development and operation of a range of reactor types from 1958.

4 A further four sites later became part of British Nuclear Fuels Limited (BNFL).

Sellafield

5 During the Second World War, trinitrotoluene (TNT) had been manufactured at Windscale. In 1947, Windscale was commissioned to produce plutonium and other nuclear weapons materials. Sellafield included the Windscale and Calder Hall works. It specialised in building and operating reactors, chemical processing of spent nuclear fuel and extraction of plutonium and other materials for military and civilian purposes.

6 The first plutonium was produced in 1952. Electricity generation began with the construction of the Calder Hall reactors in 1956. A plant to reprocess spent fuel from Calder Hall, Chapelcross and other reactors became operational in 1964.

7 In 1962, an advanced gas-cooled reactor (AGR) was opened. Its fuel, enriched uranium oxide, presented challenges for the existing reprocessing facilities. In 1971, Sellafield was transferred from the UKAEA to BNFL.

8 A number of radioactive effluent and waste treatment plants have been constructed and brought into operation at Sellafield over the years. The materials produced by these plants have been stored in purpose-built facilities on the site.

9 In the late 1990s, the focus of work at Sellafield changed from reprocessing to decommissioning and clean-up of redundant facilities and stored nuclear waste. Since 2005, the site has been operated by Sellafield Limited (SL). It is owned by the Nuclear Decommissioning Authority (NDA).[1]

Springfields

10 Springfields had also been a wartime factory, producing poison gas. Uranium was produced there from 1948 under MoS management. The site was incorporated into the UKAEA in 1954 and later manufactured a variety of nuclear fuels.

11 Springfields was transferred to BNFL in 1971. In 2006, BNFL sold Springfields Fuels Limited to Toshiba. The site has been owned by the NDA since 2005 but continues to be operated by Springfields Fuels.

1 The Energy Act 2004 created the Nuclear Decommissioning Authority and provided for the transfer to it of all BNFL's licensed nuclear sites

Capenhurst

12 Enrichment of uranium for reactor fuels and nuclear weapons began at Capenhurst in 1953. Production of weapons-grade uranium ceased in 1963 and the diffusion plant closed in 1982. Capenhurst was transferred to the UKAEA in 1954 and to BNFL in 1971.

13 Following the transfer to BNFL in 1971, gas enrichment plants were constructed and operated. These were transferred to URENCO (a partnership between the UK, the Netherlands and Germany) in 1993.

14 Since 1995, that part of the site still under BNFL control has been used as a storage facility for nuclear materials. It is now managed by SL under contract from the NDA.

Chapelcross

15 Chapelcross was developed for plutonium production and power generation and became operational from 1959. It was owned by the UKAEA until 1971 when it was transferred to BNFL. It ceased electricity generation in 2004 and in 2005 passed to the NDA for decommissioning.

The UKAEA, 1954–71

16 The UKAEA was established in 1954.[2] It was a non-departmental public body, managed independently of the civil service and central government. It acquired responsibility for the entire nuclear programme except for civil nuclear power stations.

17 One part of the UKAEA was known as the Industrial Group: it included the sites at Risley, Sellafield, Springfields, Capenhurst, Dounreay and Chapelcross. In 1959, it was split into a Production Group[3] and a Development and Engineering Group.

18 The UKAEA Health and Safety Branch was created in 1959, with three divisions: the Safety and the Administrative Divisions at Risley and the RPD at Harwell. In 1971, the National Radiological Protection Board

2 Atomic Energy Authority Act 1954

3 Consisting of the Risley, Capenhurst, Sellafield, Chapelcross and Springfields sites

(NRPB) was established:[4] it assumed the responsibilities of the RPD and the Radiological Protection Service, provided by the Medical Research Council (MRC).

BNFL, from 1971

19 BNFL was formed in 1971[5] from the UKAEA Production Group. Its head-quarters were at Risley until 2003, when they moved to Daresbury. In 1984, BNFL became a public limited company wholly owned by the British Government. In 1998, it acquired Magnox Electric plc, which owned and operated the UK's magnox nuclear reactors.

20 In 2005, all BNFL's licensed nuclear sites were transferred to the NDA for decommissioning. British Nuclear Group Limited (BNG) was created to own a number of new and existing companies, including SL, which had been part of BNFL. On 24 November 2008, SL was sold to Nuclear Management Partners (NMP), comprising Washington International Holdings Limited, AMEC and AREVA NC.

21 Although until 1981 the site now called Sellafield was known as Windscale (strictly Windscale and Calder works), it is referred to as Sellafield throughout this chapter.

Occupational health and analytical services at Sellafield

22 The occupational health of the workforce at Sellafield and other sites was the responsibility of medical officers and staff of the Occupational Health Department (also known as the Medical Department) at the site medical centres. The medical officers' responsibilities included advising management on any medical matters relating to employment. The Sellafield Medical Department was headed by a Senior Medical Officer (SMO).

4 Radiological Protection Act 1970: see chapter 8, "The National Radiological Protection Board"

5 The Atomic Energy Act 1971 provided for the transfer from the appropriate date, accomplished by secondary legislation: SI 1971/478

Monitoring of workers

23 Before the commissioning of Sellafield in the early 1950s, radioactive materials had not been processed in large quantities by an industrial workforce in the UK. Novel radiological hazards were posed by exposure to plutonium and nuclear fission products. Those hazards were addressed by containing and minimising manual handling of radioactive materials and shielding and protecting the workforce from radiation. Various techniques were used to monitor workers' exposure to radiation.[6]

24 The Analytical Services Department, part of the Research and Development Department, undertook routine monitoring of the workforce. It had two main monitoring functions:

- environmental monitoring involved analyses of samples from on and around the Sellafield site, including vegetation, soil and sea-life;
- personnel monitoring, undertaken in order to comply with BNFL's statutory obligations, involved routine analysis of urine and other excreta and non-routine analyses (for example noseblow) as requested by the Medical Department.

Environmental samples generally contained much higher levels of radioactivity than personal samples and the two laboratories were separated to avoid contamination.

25 The analytical services laboratories were housed in a building constructed in the late 1950s, adjacent to the Medical Department, in an area of the site sufficiently remote for the sensitive measuring equipment used to be unaffected by radioactive contamination or radiation fields elsewhere. In 1992, they were moved a few miles to the Geoffrey Schofield Laboratories at Westlakes Science and Technology Park.

26 Radiation, such as alpha particles emitted by uranium and plutonium, may be harmful to health. Radiological protection therefore involves the determination, with reasonable accuracy, of the amounts of radionuclides in various tissues of the body. However, alpha particles travel only very short distances and cannot be detected from outside the body. While the worker is alive, it is necessary to resort to indirect methods of quantifying internal radionuclides, such as radiochemical analysis of urine samples (urinalysis). These indirect methods of measurement are subject to much uncertainty.[7]

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6 See chapter 2, "Science"

7 Ibid

27 An alternative, direct method of measuring radionuclide content is to analyse organs taken at post mortem. Such direct measurements can then be compared with those derived from indirect monitoring methods during life. This comparison enables indirect measurements such as urinalysis to be interpreted with greater confidence and hence for better radiological protection to be provided. It was this desire for greater understanding which led to the early analyses of organs obtained at post mortem from nuclear workers.

28 The inaccuracy of urinalysis for measuring plutonium intake in radiation workers was recognised at an early stage. In October 1954, Dr Thomas Graham, the UKAEA SMO,[8] noted in a memorandum to the Project Health Discussion Group[9] that *"direct evidence by analysis of bone from plutonium workers who eventually reach the post-mortem table, from natural causes or otherwise, would be very valuable"*. Bone is one of the main areas in the body where plutonium is deposited.

Analysis of lung tissue at Sellafield, 1954–55

29 The lung was also of interest, as insoluble plutonium dust remains in the lungs after inhalation, and some of the first analyses undertaken at Sellafield were of lung tissue taken at post mortem.

30 Laboratory records show that eight samples of lung tissue were received at Sellafield on 23 December 1954 and in January 1955 Dr Graham reported the results of the analysis to the County Pathologist. Such documentation as remains after more than 50 years is inadequate for the Inquiry to determine the circumstances in which the tissue was taken.[10] In particular, it is unclear whether the tissue was obtained at hospital or coronial post mortem examinations, whether the deceased had ever been nuclear workers or even from how many individuals tissue was taken.

8 Based first at Sellafield then at Springfields

9 A group consisting of medical officers and some managers from all UKAEA sites, which met regularly until the creation of BNFL in 1971 and whose remit included discussion of occupational health issues and policies

10 A record of post mortems ordered by the Coroner for West Cumbria is held at the Cumbria Record Office in Whitehaven but does not start until 1956; the period July 1943 to December 1955 is presumed to have been lost or destroyed over the years

Post mortem work at Springfields, 1954–62

31 The recognition within the UKAEA that such analytical work could be of benefit resulted in the first concerted effort, at Springfields, to undertake analysis of organs obtained at post mortem from nuclear workers. The main radiological hazard on the Springfields site was exposure to uranium. Uranium in the body is concentrated in the lungs, kidneys and bones.

32 Analysis of organs taken at post mortem started at Springfields in 1954. A UKAEA report[11] in 1958 provided a useful summary:

> *In 1953 we decided to obtain post-mortem material from employees autopsied after death. We arranged with our two main local hospitals to be informed if a death occurred among our employees, so that we could be present at any appropriate post-mortem. By 1954 the system was working fairly well. In 1954 we had the first case … in which we were confident that the analytical data were sufficiently accurate to be used as a reasonable basis for calculations ... The kidney and lung were analysed for uranium … To date we have had 7 post-mortems … Obviously much more work must be done, and we will have to cooperate more closely with our local hospitals in order to continue to obtain this type of information.*

33 The report indicated that analysis had also taken place of organs obtained from non-nuclear workers:

> *We have also done analyses on a number of post-mortem samples obtained from individuals who had never worked with uranium or been exposed to it. These are our control figures … it is important for all production establishments to obtain as much information as possible on human as well as on animal material, and in order to do this it is of vital importance to plan in advance. Had we planned better in 1953 and 1954, we might have more information available now.*

By the time the paper was prepared, organs from 19 individuals (seven employees and 12 others as controls) had been analysed.

34 Knowledge of the Springfields work, which continued until the early 1960s, was widely shared by those working in the occupational health departments at other UKAEA sites: for example, in 1955, a report[12] of the analysis of

11 Butterworth A, *Human data on uranium exposure*, US AEC report HASL-58 (US AEC, 1959)

12 Butterworth A and McLean AS, Observations on the metabolism of soluble uranium in humans, UKAEA internal paper, 9 December 1955

organs from a Springfields employee was circulated[13] at Harwell, Risley, Aldermaston, Sellafield, Capenhurst and Springfields. In 1959, the need for consistency of technique was emphasised:[14]

> *For obvious reasons the amount of information available on the uranium content of post-mortem material from ex-uranium workers is small … The need to standardise not only our analytical technique but our methods of sampling and storage of post-mortem specimens was emphasised.*

35 Another paper,[15] published in 1962, also described the work:

> *Detailed personal records of uranium workers throughout life are kept, together with records of urinary excretion, and these are carefully compared with the results of subsequent post mortem examinations.*

A table in the paper referred to *"representative findings in 10 cases"*. All ten cases were employees but it is unclear whether they included, or were in addition to, the seven employees discussed in the 1958 report. The organs analysed were heart, lung, kidney, liver, lymph nodes and spleen.

36 With one exception[16] it has not proved possible for the Inquiry to identify the individuals referred to in the 1958 Butterworth and 1962 Meichen papers. Very little relevant documentation can be traced and it is not clear whether the organs were removed at hospital or coronial post mortem and how the control organs were obtained.

A Sellafield case, 1960

37 The first record which the Inquiry has seen of analysis of organs from a Sellafield worker relates to a man who died towards the end of 1960. According to the post mortem report prepared for the coroner, the organs taken were *"both femora, portion of vertebral bodies, both eyes, both kidneys, the liver, the spleen, and both lungs"*. The deceased had intimated a civil claim against the UKAEA before his death. His family's solicitors requested that organs be taken. The organs were divided between

13 Primarily within occupational health and/or health and safety departments

14 Butterworth A and Mason H, Notes on a Symposium on Health Protection Criteria for Uranium Processing, 1959

15 Meichen FW, Medical supervision of employees in the Atomic Energy industry, *Atompraxis*, 1962, 8: 24–6

16 A coronial case in 1957

Dr Kenneth Duncan[17] and the family's own expert and analysed at Woolwich.[18] There is therefore evidence that the deceased's widow agreed to the organs being removed.[19] There is no evidence that the results of any analysis were ever presented to the coroner. In due course, the court proceedings resulted in a payment being made to the widow.

Dr Geoffrey Schofield

38 That post mortem examination was attended by Dr Geoffrey Schofield, who had become a medical officer at Sellafield on 10 November 1958, reporting to Dr Graham. He was, by all accounts, a competent, well-liked and loyal occupational health practitioner. He remained at Sellafield until his death on 31 May 1985. He secured a number of promotions: the first, when Dr Graham moved to Springfields as Company SMO, was on 25 September 1961, to SMO at Sellafield.

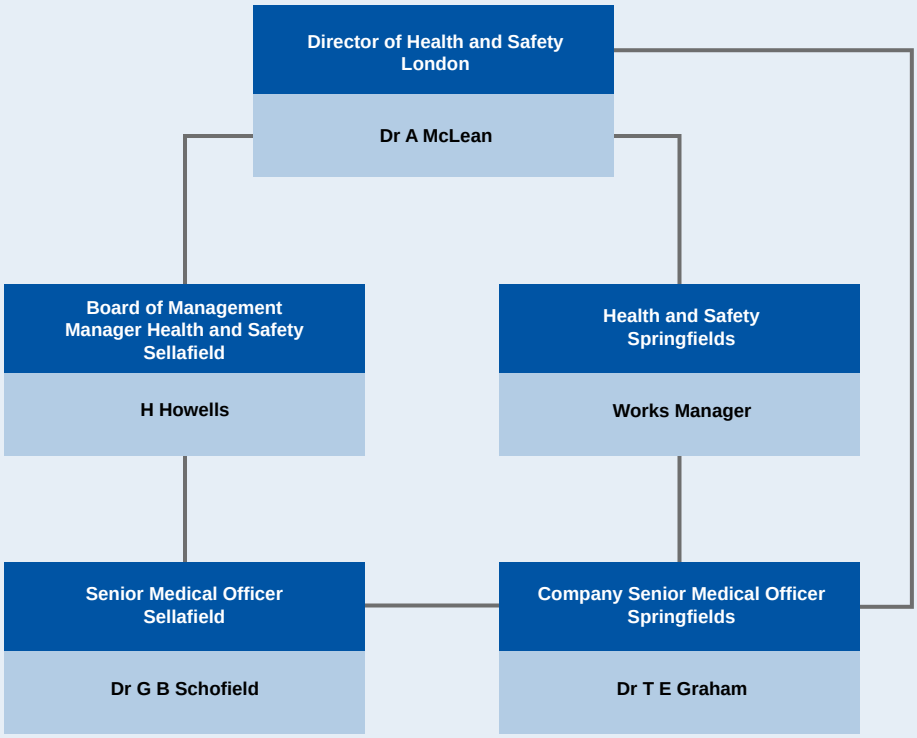
39 As SMO, Dr Schofield was accountable to the Sellafield Works Board of Management through the Manager of Health and Safety, Mr Huw Howells, and to the Company SMO, Dr Graham. Mr Howells was in turn accountable to Dr Andrew McLean, UKAEA Director of Health and Safety based in London.

17 Medical Adviser and later Chief Medical Officer, UKAEA

18 The UKAEA's Chemistry Division had an outstation at Woolwich; it closed in 1964

19 The evidence seen by the Inquiry indicates that she had not asked for the removal of the kidneys

Figure 5.1: Occupational Health Department, September 1961



Appreciation of the importance of post mortem analysis

40 The importance of post mortem work was emphasised on numerous occasions at meetings of the UKAEA's Medical Officers' Co-ordinating Committee (MOCC), the successor to the Project Health Discussion Group mentioned above. Both Dr Schofield and Dr Graham attended regularly and were present at a meeting in May 1962 when the topic was discussed:

> *There was a long discussion on the importance of obtaining material from post mortem examinations … This was particularly important in the case of plutonium and uranium workers at present. It was agreed that in the interests of science generally and future production in particular, it was absolutely essential that this work be done … there were circumstances, and these had already arisen, where there was strong emotional resistance to carrying out these analyses in the employee's own establishment or in any way where the samples could be identified … the information from the analyses would be medically confidential but additional safeguards against possible misunderstanding could probably be obtained by having central arrangements for the work … The Committee stressed the importance of this project … They invited Dr. Duncan and Dr. Eve*[20] *to look into the possible methods of implementing this and if possible to evolve a system suitable for general application throughout the Authority.*

The Committee minutes were widely distributed to management in the UKAEA, including Dr McLean (who reported to the UKAEA Board), and to all site medical officers.

41 During the 1960s, organs continued to be taken at post mortem in separate studies on workers from Springfields and Sellafield. Minutes of the UKAEA Health Committee for April 1963 record Dr Duncan indicating that *"arrangements had been made to obtain as many post-mortem specimens as possible from workers known to have worked with radioactive materials"* and the Committee discussed the work on several occasions. In a UKAEA[21] report in 1964, Dr Geoffrey Dolphin wrote:

> *Some valuable information may be obtained by comparing the amounts of plutonium found in the body organs at autopsy with measurements of the excretion rate made during life and every effort should be made to collect this type of data.*[22]

20 UKAEA Medical Officer

21 Authority Health and Safety Branch (AHSB), RPD, Harwell

22 Dolphin GW, *A Review of Some Problems in Estimating the Body Content of Plutonium from Measurements of Excretion Rate*, UKAEA Report, 1964

Dr Dolphin reiterated this view in a paper presented in Heidelberg the same year:

> *Evidence from autopsy data is the only satisfactory way of showing that body content after inhalation of plutonium can be related to the urinary excretion rate in the manner suggested in this paper. Every effort should be made to obtain measurements of the organ content at autopsy on the body of any worker who was exposed to a plutonium inhalation hazard and who had given fairly frequent urine samples for plutonium measurement.*[23]

Problems at Springfields

42 The sensitive nature of the analytical work at Springfields was obvious. In one case in 1962, solicitors instructed to represent the UKAEA at the inquest were briefed that the analytical report would follow:

> *The General Manager is, however, anxious that it should not be unnecessarily disclosed at the Inquest that the analysis was done at Springfields, still less that there is a standing arrangement whereby specimens are handed to our doctors in circumstances like this, as he feels that it might have an unsettling effect on the workmen at Springfields if they should get to hear that parts of the bodies of their fellow-workmen are analysed within the Works, that this arrangement was started at the initiative of our doctors, and that the analyses are really done for the Authority's purposes as appears to be the case.*

43 The final three lines suggest that organs were removed at coronial post mortem and analysed for the UKAEA's purposes rather than for the coroner's. Without the consent of both the coroner and the family of the deceased, this would not have been lawful.[24] There is no extant documentation which would enable the Inquiry to establish in how many such cases organs were removed, which organs were taken or the identities of the individuals mentioned in the published papers.[25]

23 Dolphin GW, Estimation of body content following inhalation of insoluble plutonium, *Assessment of Radioactivity in Man*, vol II, Proceedings of the IAEA Symposium, Heidelberg, 1964: 589–602

24 See chapter 3, "Law and Guidance"

25 See notes 11 and 15, above

44 However, the documents seen by the Inquiry which relate to the case mentioned above do refer to consent. Mr R N Bankes-Jones[26] wrote to Mr Donald Sim:[27]

> *Our objects … were first to avoid the unsettling effect on local staff of it becoming known that such work is undertaken with the consent of the next of kin "in the next room" (as you put it) and second to achieve a more obviously impartial and authoritative source of analytical services … you may also wish to take up ... the question whether ... the Unsealed Source Regulations should expressly require that employers of classified workers on whom a post-mortem is held should arrange for analysis of appropriate organs.*

Mr Sim replied a few days later:

> *Regarding your last sentence … I do not think that this suggestion would be accepted in any quarter … although … some of the Coroner's pathologists are prepared to let the Authority have parts of bodies for analysis, very different considerations would come into play when, for example, the employer is some tin pot little firm who would not know what to do with bits of bodies even if they were able to persuade the pathologist and/or the coroner, as well as the next of kin, to hand bits over.*

45 The Inquiry cannot conclude from the mention of consent in two documents that consent was obtained in that case or in any other case in which analysis was undertaken of organs from a Springfields worker, or even that the requirement that it be obtained[28] was recognised. Nevertheless, the reference suggests an assumption on the part of a senior administrator at the UKAEA and the UKAEA's legal adviser that issues involving consent would have been addressed, almost as a matter of course. The Inquiry has seen no evidence to suggest that that assumption was verified or valid.

46 The problems associated with the case above led to the end of analysis of human organs at Springfields. Minutes of a UKAEA Health Committee meeting in March 1964 record *"a disinclination on the part of the Springfields management to support the obtaining of post mortem material"*. On 6 May 1964, shortly after that meeting, the General Manager at Springfields, Dr Harold Rogan, wrote to Dr McLean indicating that while he had no objection to the obtaining of post mortem material:

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26 Manager, Group Secretariat, UKAEA

27 Legal adviser to the UKAEA

28 Human Tissue Act 1961; see chapter 3, "Law and Guidance"

> *I have objected to … the method and procedure for obtaining post mortem material and the procedures adopted in this Works for having the samples analysed … between two and three years ago there were two very unfortunate incidents in this Works concerning the obtaining of post mortem material. The way the matter was handled on each of those occasions caused some very deep concern amongst some of the staff in this Works and, as a result, I expressed my dissatisfaction at the way the whole thing was handled ... I made it clear at the time of the difficulties that in future … the examination should be done at some other Establishment other than this Works.*

Dr Rogan's concerns appear to have been heeded: there is no evidence that organs were again taken from a Springfields worker and analysed at the site.[29]

Analysis at Sellafield, 1960–71

Lymph nodes, 1964–65

47 The work at Springfields involved analysis of organs taken from nuclear workers and from members of the public. In the mid-1960s, a study was undertaken at Sellafield in which the tissue was taken solely from individuals unconnected to the nuclear industry. Minutes of the UKAEA's MOCC for October 1964 refer to analysis at Sellafield of:

> *post mortem material obtained from outside the Authority, with particular reference to the examination of pulmonary lymph nodes for the presence of plutonium … Further post mortem samples were required from other areas, and Dr* [Alexander] *Laylee*[30] *undertook to obtain about twenty from a medical contact at Rhyl. These would provide representative data for a high rainfall area and it was felt to be valuable to have this type of information available lest at some future date plutonium in the lung was considered to be inevitably of occupational origin and any malignancies attributed accordingly.*

29 Organs were taken from workers at Springfields on other occasions but analysed elsewhere: see paragraphs 337 and 343

30 UKAEA Medical Officer, Winfrith

48 On 22 February 1965, Dr Dolphin wrote to Dr Schofield referring to data obtained from analysis of respiratory lymph nodes: material had been obtained from 18 people in West Cumberland and, for comparison, 100 in the Newcastle area. Dr Dolphin anticipated further work:

> *One point which might be worth pursuing is to get two or three groups of lymph nodes from the same body and to measure them separately for plutonium … Another point might be to get a few large samples of lymph nodes from Newcastle.*

49 The nature of the work actually undertaken is far from clear. The Inquiry has seen nothing to indicate that Dr Laylee in fact obtained the lymph nodes, as he had suggested he could, nor any documentation of relevance to the lymph nodes mentioned by Dr Dolphin, save for some laboratory records containing insufficient detail to identify the source of the tissue or who assisted in its supply.

50 The Inquiry is not the first attempt to understand what took place in the mid-1960s. In the early 1990s, litigation was pursued (unsuccessfully) against BNFL in which it was alleged that the leukaemia which had caused the death of a Sellafield worker's daughter had been caused by his exposure to radiation before her conception.[31] In the course of that litigation, BNFL discovered Dr Dolphin's correspondence from February 1965 and searched all its laboratory records in an attempt to locate further relevant documentation. Unfortunately, the document on which the results of the lymph node analysis were probably recorded, described as "card 34", could not be found.

51 Further investigation at the time proved fruitless and the Inquiry was also unable to resolve the issue. Concerns over ethical and legal aspects of the respiratory lymph node work were identified in an internal "historic review" prepared for a BNFL executive meeting in July 1994 by Mr David Coulston[32] and Mr Alvin Shuttleworth.[33] The review was intended to establish a database of potential historical health, safety and environmental problems. The authors identified one area of interest:

> *Large number of autopsy samples from West Cumbria and Newcastle analysed at Sellafield in 1965. Compliance with medical ethics/ requirements of relevant legislation appears doubtful.*

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31 *Reay v British Nuclear Fuels PLC* [1994] Env LR 320, HC

32 Director of Health and Safety

33 Company Secretary and Group Legal Director

They assessed the potential impact as *"high, legitimacy of autopsy programme could be challenged; adverse PR"* and noted the unsuccessful attempts to explore these events during the litigation. They recommended no further follow-up action, except to check whether the documents would be sent to the Public Record Office.[34]

Other organs, 1960–71

52 Curiously, despite its thorough and comprehensive nature, the 1994 review made no reference to any post mortem work undertaken at Sellafield other than the lymph node study. As will be seen, a series of analyses of organs taken at post mortem from the bodies of former Sellafield employees had in fact been undertaken between 1960 and 1991 and extensive documentation was retained at the plant.

53 Between 1962 and 1 April 1971, when the UKAEA Production Group was transferred to BNFL, organs from six former Sellafield employees were provided to Dr Schofield and analysed at his request. Organs in the first two cases were analysed at both Woolwich and Harwell; in the remainder, the analysis was performed at Sellafield. All six deaths were reported to the Coroner for West Cumbria, Mr Hubert Gough; one was investigated by his Deputy, Mr Adrian Walker. In five there was no possible connection between the cause of death and the deceased's employment at Sellafield; no inquest was held but many organs were removed for analysis. For example, one man had died of a heart attack, yet organs removed from his body included lung, liver, spleen, kidney, testis, vertebral bodies and femur.

54 SL[35] now accepts that in those five cases *"BNFL's interest appears to have been for the purposes of scientific research"* and that the justification for the removal of the organs is unclear.

55 In the sixth case an inquest was held. After the pathologist declined to link the cause of death to the deceased's employment, the coroner instructed the jury to return an open verdict. It was submitted to the Inquiry that in that case coronial interest in the analysis, to ascertain the cause of death, could be inferred against a background of possible litigation. The Inquiry does not agree. It has seen no evidence that the coroner consented to, or was even aware of, the removal of organs or that the analytical results were either given in evidence at the inquest or otherwise reported to him. In addition,

34 The 1965 correspondence was indeed filed at The National Archives

35 SL liaised with the Inquiry regarding BNFL's activities

no claim for damages was intimated until over a month after the inquest was concluded.

56 There is no evidence in any of the six cases that the deceased's families knew of or consented to the taking of organs; indeed, in only one case did the post mortem report record that organs had been removed.

"Entirely scientific"

57 The importance of the post mortem work extended far beyond any individual case and had implications for all nuclear workers. Dr Schofield acknowledged the nature of his interest in an internal paper:[36] *"The initial purpose in carrying out the radiochemical analysis of post mortem tissue was entirely scientific."*

58 While the need for scientific research may be readily understood, there was, without consent from the relatives, no authority for organs to be removed to allow it to be undertaken. The organs Dr Schofield acquired for his research had been taken at coronial post mortem. A coronial post mortem could be done, and organs removed which were relevant to the cause of death, without the relative's consent; but both their consent and that of the coroner was necessary before organs could be removed for research.[37]

59 The Inquiry concludes, therefore, that there was no legal justification for the removal of organs from any of these six individuals.

Provision of thyroid glands, 1968

60 Dr Schofield evidently had a good relationship with the local pathologists at West Cumberland Hospital. In 1968, he helped Dr Malcolm Dean and Dr I Trevena, from the AWE, to obtain thyroid glands from those pathologists for research.[38] Minutes from the AHSB Management Committee in late 1968 record:

36 "Collection and analysis of autopsy specimens", apparently prepared in 1982 by Dr Schofield as the precursor to his paper published later that year (Schofield GB, Comparisons between in-vivo estimates of systemic Pu deposition and autopsy data, in *Radiological Protection – Advances in Theory and Practice. Proceedings of the 3rd International Symposium of the Society for Radiological Protection*, vol 2 (1982), pp 525–9)

37 See chapter 3, "Law and Guidance"

38 See chapter 9, "The Atomic Weapons Establishment"

> *Human thyroids from the West Cumberland Hospital at Whitehaven have been obtained with the help of Dr. G.B. Schofield from Windscale. After inspection and weighing, Dyson*[39] *has despatched these to Aldermaston for chemical analysis.*

61 The resulting internal AWE paper[40] reported that the work was done using:

> *human thyroids obtained post mortem at a hospital near the Windscale Works of the UKAEA … The samples were obtained in 1968 via AHSB, Harwell, who have an interest in the natural iodine content of the thyroid. Eighteen samples were obtained in all covering a wide range of ages. Most subjects lived locally but a few were from farther afield.*

Thanks were given to Dr Dyson, *"who arranged the provision of samples"*.

62 A table in the report shows that eight of the 18 were neonates and gives the locations, where known, of the deceased. The majority came from Cumbria and Yorkshire. By reviewing coroners' records, the Inquiry has identified ten[41] of the 18 cases, none of whom was a nuclear worker at Sellafield. In all but one of the ten identified cases the post mortem was performed by Dr David Smith, consultant pathologist at West Cumberland Hospital.

Did the UKAEA know?

63 There is much evidence that the importance of post mortem work was recognised at high level within the UKAEA and that the work was officially encouraged. On 20 March 1967, Dr Dolphin told an MRC radiobiology forum:[42]

> *Every effort is made to collect samples at post mortem from those who have been plutonium workers. Naturally the opportunities are few and information will only come forward very slowly from this source. Some measurements have been made, post mortem, of plutonium in respiratory lymph nodes from non-radiation workers.*

39 Dr E D Dyson, AHSB, UKAEA Harwell

40 Dean MH and Trevena I, *I-129/I-127 in Human Thyroids near Windscale: a Preliminary Investigation*, AWRE Report O92/70 (AWRE, 1970)

41 Nine adults and one child

42 The 9th Radiobiology Forum, held in London by the MRC's Committee on Protection against Ionising Radiations

64 In the same year, Dr N L Spoor[43] presented a paper to the MOCC:

> *to consider the desirability of improving the arrangements that now exist for removing at certain post mortem examinations sizeable specimens of tissue for subsequent analysis … It is probable that if an Authority employee died in circumstances … which suggest that death has resulted wholly or in part from occupational exposure to uranium, appropriate steps will be taken at the post mortem to remove parts of various organs (lung, bone and kidney) for uranium analysis … Another kind of situation does arise in which a post mortem is conducted on an employee who has been occupationally exposed to uranium, in circumstances which admit no probability of a causal connection between exposure history and death. Traffic accidents present the classic case. In such a situation any part of the body (lung, bone or kidney) excised for uranium analysis would provide information relevant to our investigation into the human metabolism of uranium.*

Dr Spoor recommended that the medical officer should be informed of those post mortems which were likely to be of interest, so that a list of employees of interest might be kept. While the paper was primarily concerned with uranium exposure (and therefore of particular relevance to Springfields) it included a description of the work undertaken at Sellafield which indicates a good understanding of Dr Schofield's methodology:

> *At Windscale this kind of tissue* [kidney] *is kept for a short period simply by wrapping in a plastic bag … At UKAEA, Windscale it is usual at post mortems, when bone is removed, to remove vertebral bodies.*

65 Reference to ongoing post mortem work was made in published papers[44] and it was often discussed at meetings of the MOCC, which were chaired by the Chief Medical Officer (CMO). At one meeting, on 9 December 1970, the need for more such work was emphasised:

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43 From the UKAEA RPD

44 See, for example, the reference to Dr Schofield's work by Dr Dolphin in a published paper in May 1970: *"More data are required on the distribution of Pu among organs in the human body. These data are being collected slowly by analysis of tissues obtained at post mortem."* (Dolphin GW, The biological problems in the radiological protection of workers exposed to ^{239}Pu, *Health Physics*, 1971, 20: 549–57)

> *Dr Stott*[45] *enquired whether efforts should be made by the Authority to obtain more post-mortem information concerning plutonium levels in the lungs of radiation workers. Dr Hill*[46] *informed the Committee that this possibility had been considered before but it was considered undesirable to approach employees before death regarding the donation of their bodies. Every opportunity should however be taken to obtain post-mortem material if this became available.*

66 It is evident that the UKAEA knew of Dr Schofield's post mortem work. Indeed, SL submitted to the Inquiry that Dr Schofield was acting at the behest of the UKAEA:

> *It seems reasonable to conclude that the autopsy analytical work initiated at Sellafield in the early 1960s was not initiated by Dr. Schofield acting in isolation and/or pursuing a particular personal interest of his own – it was an important UKAEA project discussed within the UKAEA at a senior level and implemented by the UKAEA as an organisational objective. No doubt Dr. Schofield played an important part in carrying this forward – but it would be wrong, in SL's view, to regard him as the architect of the project.*

67 In its supplemental response to the Inquiry, the UKAEA conceded that it was likely that its management *"at some level in the 1960s"* knew both of the need for the post mortem analysis of tissue and of the fact that *"occasional analysis of post mortem tissue was carried out"*. It disagreed with SL's contention as to the significance of the programme to the UKAEA:

> *During the 13 years of Dr Schofield's employment by UKAEA (1958–1971) the evidence indicates that he was involved in the analysis of 7 samples … A distribution averaging one analysis every 24 months does not suggest an "important … organisational objective" during the period up to 1971. It may have become so subsequently* [after the transfer of Sellafield to BNFL] *when the programme appears to have accelerated.*

It continued:

> *UKAEA has not seen any evidence indicating that they were closely involved in the detail of the work, particularly arrangements for obtaining samples, nor that these aspects explicitly or implicitly received senior management sanction.*

45 Dr Alexander Stott, CMO at UKAEA Harwell

46 CMO at the UKAEA

68 The reality is that the UKAEA well understood the importance of the analysis of organs taken at post mortem from its employees. Dr Schofield's work was explicitly encouraged and Dr McLean was aware of it. It was, therefore, *"an important UKAEA project … implemented … as an organisational objective"*. However, it was opportunistic; it was not published until 1974,[47] three years after Sellafield had been transferred to BNFL; and the Inquiry has seen no evidence of any formal communication between Dr Schofield and the UKAEA as to the progress of his work or the parameters within which he intended or was expected to operate, despite the existence of a management structure. Dr Schofield appears to have acted with a good deal of autonomy: given the laxity of corporate governance in the 1960s, this is perhaps unsurprising.

The creation of BNFL, 1971

69 In 1971, BNFL was formed from the UKAEA's Production Group. At Sellafield, there was no change in Dr Schofield's job title, duties or responsibilities. Dr Graham became BNFL Company SMO, based at Springfields.

70 The minutes of the MOCC meeting held in December 1970, quoted in paragraph 65, show that the new management at BNFL was aware of the post mortem work being undertaken at the UKAEA: the distribution list included Mr Huw Howells, who was about to become BNFL Company Health and Safety Officer.

Dr Schofield's career at BNFL, 1971–85

Company SMO, 1973

71 Dr Graham died in early 1973 and Dr Schofield became Company SMO on 1 April 1973. On 30 March 1973, he wrote to Mr Arthur Riddle, Company Staff Manager, suggesting that as a result of the 1971 reorganisation, the SMO's duties included tasks which had previously fallen to the UKAEA's CMO:

47 Schofield GB and Dolphin GW, U.K. experience on the medical aspects of radiological protection of workers handling plutonium, *Annals of Occupational Hygiene*, 1974, 17(2): 73–83

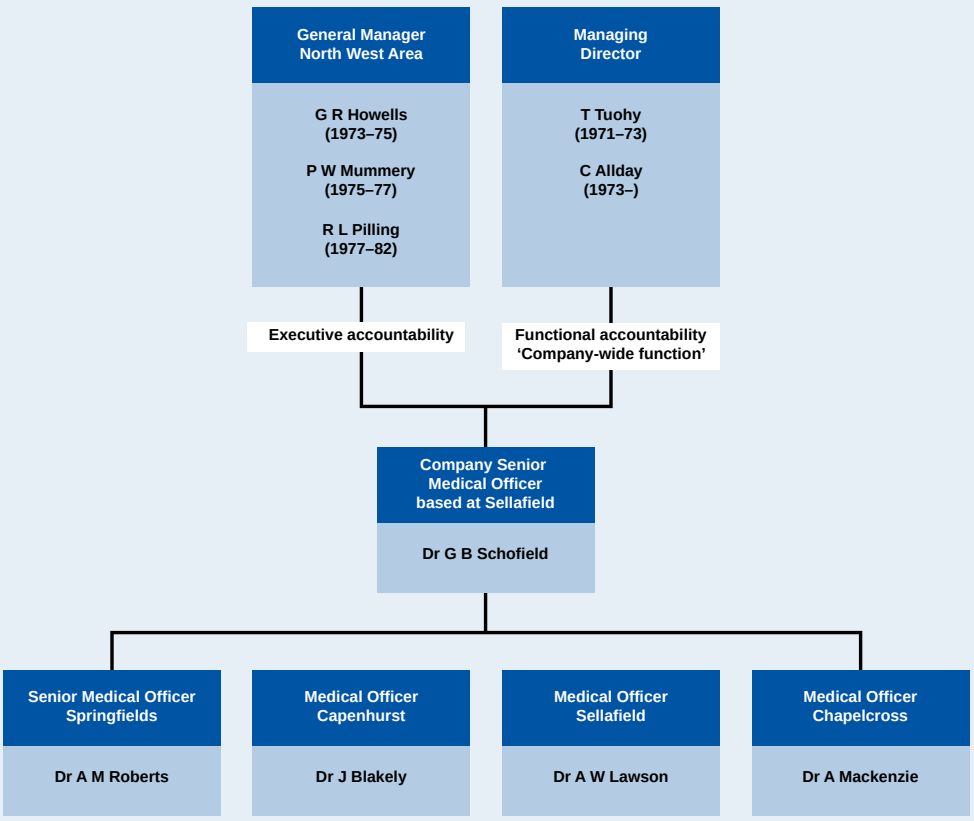
> *I have been giving the responsibilities of this job close consideration, and there is no doubt that they are not the same as they were when the Company was part of the Atomic Energy Authority. At that time the Senior Medical Officer was functionally responsible to the Chief Medical Officer of the Authority. Any important medical or legal problems were referred to the Chief Medical Officer and it was also his responsibility to take part in negotiations and discussions with outside organisations like the CEGB* [Central Electricity Generating Board] *and the various Ministries. Further, the Chief Medical Officer represented the Production Group in any occupational health discussion with parallel organisations overseas. The British Nuclear Fuels Ltd. is now a separate organisation and the duties outlined above will now fall to the Senior Medical Officer of the Company.*

72 Dr Schofield proposed changes to the SMO's job description, which were duly implemented:

> *The Senior Medical Officer of the Company will be responsible –*
>
> *a. primarily to the General Manager, N W Area, for occupational health services for the Windscale and Calder site;*
> *b. for advising the Company Administration on specific questions pertaining to the health of employees, eg morbidity and mortality experience;*
> *c. for keeping under review the arrangements for occupational health services throughout the Company and representing the Company, at home and overseas, on those occasions which are appropriate to the function.*

In 1973, the General Manager for the North West Area was Mr G R Howells. He was replaced in early 1975 by Mr Peter Mummery. In respect of Dr Schofield's company-wide responsibilities, however, in which he was senior to the SMOs on the other BNFL sites, he was accountable directly to the Managing Director, Mr Coningsby Allday. Figure 5.2 shows the structure of the Medical Department in 1973.

Figure 5.2: BNFL Occupational Health from May 1973



Freedom to undertake research

73 Dr Schofield's promotion to Company SMO, with its duty to advise *"on specific questions pertaining to the health of employees"*, gave him a wide discretion to devise and pursue scientific research projects and programmes. While he was generally accountable to the Board, and needed to produce annual reports, he had a considerable degree of autonomy and was not required to obtain specific approval from the Board for any particular project.

74 The extent and nature of any research was therefore very much within Dr Schofield's control. An insight into those times was provided by Dr Adam Lawson.[48] In 1988, Dr Lawson conducted a formal review of BNFL occupational health services. He observed that:

> *The recognised responsibilities of an Occupational Health Service* [include] … *RESEARCH Largely determined by the opportunities available and the special interests of the Medical Officers* …

and continued:

> *I returned to Windscale in 1973 … My recollection of that time was that there was no attempt to co-ordinate the activities of the medical services, especially in relation to the format adopted for routine medical examinations. Nevertheless the next few years proved to be a busy period, particularly at Windscale. Dr Schofield continued his studies on plutonium metabolism; the indications for chelating agents and the collection of post-mortem tissues for radiobiological analysis.*

75 Dr Schofield continued the post mortem work he had begun at the UKAEA and in 1973 summarised it in his annual report, distributed to, among others, Mr G R Howells and Mr Huw Howells:[49]

> *During the last 10 years there has been ongoing work in connection with the estimation of body content of plutonium in tissue obtained from plutonium workers who have come to post mortem for various reasons. This work has run parallel with similar investigations being carried out in the U.S.A. and is of particular importance … At Windscale 13 cases have been examined.*

He observed that the body burdens estimated from the post mortem data were significantly below those derived from urinalysis and concluded that the findings suggested that the safety measures in use were satisfactory.

48 Medical Officer at UKAEA Sellafield, under Dr Schofield, from May 1962 to June 1965 and from October 1973 to April 1976 and SMO until Dr Schofield's death in 1985

49 The report was also circulated to the Company Secretary, the SMOs and General Managers at Springfields and Capenhurst, and to the UKAEA CMO

First publication, 1974

76 In 1974, Dr Schofield published his first paper[50] on the post mortem work, written with Dr Dolphin:

> *The most important information on body content has been obtained from ten workers at Windscale who were exposed to plutonium and who have come to post mortem … The investigations were carried out on whole lung, half the liver, about 0.5 kg of bone (vertebral bodies, sternum, ribs and long bone) the whole mediastinum, the spleen and one kidney … Since the lung is such an important organ of deposition, the regional lymph nodes in the mediastinum have also been analysed for plutonium content. In five cases as many as possible of the tracheo-bronchial lymph nodes (TBLN) were dissected out.*

The work continued. By the time the paper appeared rather more than ten cases had been analysed and by the end of 1974 there had been analysis of organs taken from 17 Sellafield workers.

Tissue taken during surgery

77 On occasion, tissue was taken *in vivo*. In 1974, a Sellafield employee underwent a cholecystectomy.[51] He was pursuing a compensation claim as a result of an accident some years before, in which he had sustained a wound contaminated with plutonium. Dr Schofield attended the operation, with the employee's consent, as did a pathologist instructed by the man's own solicitors. In the course of the operation, Dr Schofield asked the surgeon to remove some liver for radiochemical analysis. The employee had agreed that his gall bladder be given to Dr Schofield, but the liver biopsy appears to have been opportunistic. Dr Schofield sent the liver sample for analysis to Dr John Loutit[52] and in a letter to him wrote:

> *In view of the nature of his operation I thought that here was a good chance to get a bit of liver, and I therefore asked the surgeon to take a biopsy for me at the operation and he took a small wedge from the lower edge of the liver.*

50 See note 47, above

51 Removal of the gall bladder

52 At the Medical Research Council

There is evidence that the pathologist instructed by the employee's solicitors took part of the liver biopsy. There is no evidence that either doctor obtained the necessary consent for the liver biopsy.

78 In two further cases, nuclear workers underwent removal of all or part of a lung for medical reasons. In the first, the removed lung underwent routine histological examination at the hospital and was then sent to Dr Schofield. Whether the worker understood that there would be further examination at Sellafield (and what view, if any, he would have taken if he had been made aware) is not known. No relevant information is available to the Inquiry to assist in a proper determination of the circumstances of the second case save that the employee worked at Springfields and that it related to a lung biopsy.

Chief Medical Officer, 1975

79 In January 1975, Dr Schofield was appointed CMO at Sellafield. There was no obvious change in his duties or accountabilities, but he assumed responsibility for the principal site medical databases and the Company Medical Office was established to collect morbidity and mortality data on BNFL and UKAEA employees.

80 In March 1977, Mr Roy Pilling was appointed General Manager, North West Area, on Mr Mummery's promotion to Director of the Health and Safety Directorate. Mr Mummery reported initially to BNFL's Company Secretary, Mr Arthur Scott, and after Mr Scott retired in March 1979, to the Deputy Managing Director, Dr Donald Avery. Dr Schofield's reporting lines remained unchanged.

81 In October 1978, Mr Scott noted Dr Schofield's duty to report to Mr Pilling for occupational health services at Sellafield. He observed of Dr Schofield:

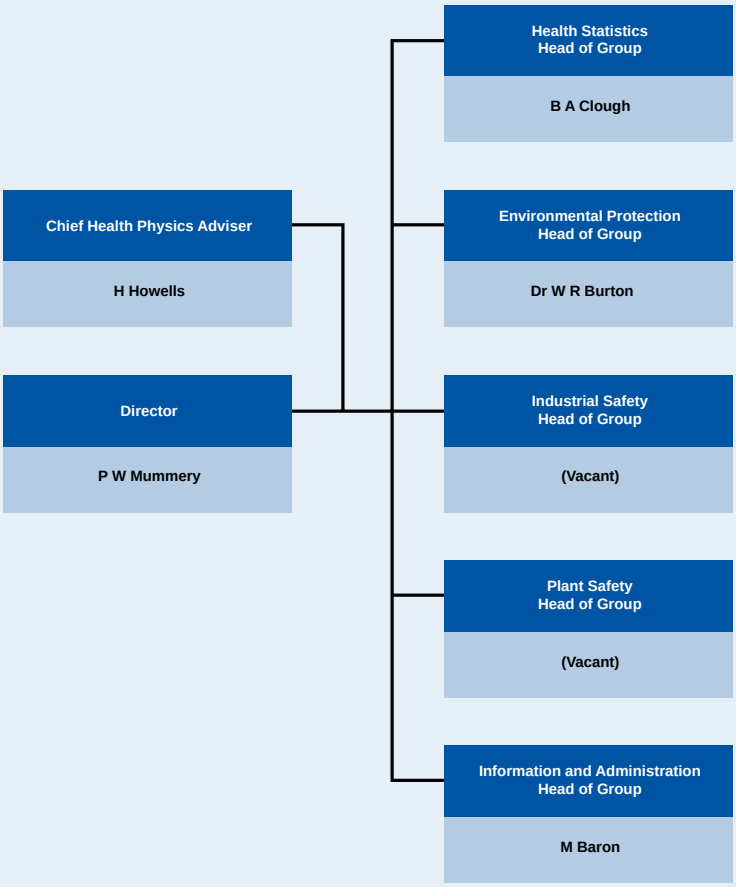
> *his primary responsibility now is for medical and related matters for the Company as a whole. The organisation charts ... nowhere show him reporting to anybody in respect of his Company wide function … Mr Allday has made clear his view that in his Company wide function, Dr. Schofield reports to the M.D. and that the arrangement under which he reports to me in practice is an administrative device which works quite satisfactorily but can be changed as necessary given that Dr. Schofield's formal reporting arrangement (though the charts do not show it) is to the Managing Director.*

82 Mr Harold Bolter became Company Secretary on Mr Scott's retirement. His duties were the same as Mr Scott's.

83 A notice dated 19 January 1979 set out details of the functions of the Health and Safety Directorate, its organisation and staff accountabilities:

> *2. The Director Health and Safety is responsible, in conjunction with the Chief Medical Officer as appropriate, for keeping Company policy and its implementation in the fields of health protection, environmental protection and safety (covering both radiological and non-radiological factors) under review, for being satisfied as to the extent and content of audit in these fields and for maintaining appropriate contact with external agencies. This responsibility includes consideration, where relevant, of laws, regulations, codes of practice and consultative documents, of internal documents, of longer term R & D requirements and of the need to publish reports on aspects of the Company's activities.*
>
> *3. The Director Health and Safety is the Chairman of the Company Joint Health and Safety Committee on which the management side representation includes the Chief Medical Officer and the Chief Health Physics Adviser, as well as appropriate site representative …*
>
> *4. Health and safety and medical activities at the Works remain the responsibility of the respective Heads of Departments reporting to their management. There will be close liaison and consultation between the Director Health and Safety and the Chief Medical Officer as appropriate and the Heads of those Departments to ensure that a high and co-ordinated standard on health and safety matters is maintained throughout the Company.*
>
> *5. The chart attached* [figure 5.3] *shows the structural design of the Directorate together with the names of those Head of Groups already in post.*

Figure 5.3: BNFL Health and Safety Directorate, January 1979



84 The notice established Mr Mummery's responsibility for audit of the Directorate's work and for consideration of relevant laws, regulations and codes of practice. It also confirmed Dr Schofield's place on the Joint Health and Safety Committee, which would have provided a possible forum for discussion of his post mortem work with the unions.

Company Chief Medical Officer, 1979

85 On 16 March 1979, following the redefinition of his previous position, Dr Schofield was appointed Company CMO (CCMO), a position he held until his death in 1985. His role was clarified in a Company Notice:

> 1. *With the growth of the Company and of public interest in its activities, the Company-wide responsibilities of the Company Chief Medical Officer (CCMO) have grown to the point where it has become necessary to separate this function from the executive responsibility for medical services for the Windscale and Calder works ...*
> 2. *DR. G. B. SCHOFIELD, as CCMO, will be responsible for recommending Company policy on medical matters; for ensuring that medical services throughout the Company are maintained at an appropriately high standard; for co-ordination and action in the case of all Company-wide medical matters; for directing any medical R & D which it may be appropriate for the Company to undertake; and normally for external representation of the Company in the medical field. Where appropriate, he will work closely in conjunction with the Director of Health and Safety.*
> 3. *DR. SCHOFIELD will continue to be based at Windscale but will in future report to the Deputy Managing Director, DR. D.G. AVERY. He will attend the Company Executive when medical matters are to be discussed and will continue to have responsibility for drawing to the personal attention of the Managing Director and other Company Executive Members such medical matters, relating to the health of employees collectively or individually, as he judges necessary.*
> 4. *Executive responsibility for medical services on the Windscale and Calder site will rest with the SMO, Windscale & Calder Works. As SMO, DR. A. W. B. LAWSON will report to the General Manager, MR. R. L. PILLING. He will continue to be assisted by DR. E. BARKER (who also has responsibility for medical matters at Chapelcross Works on a part-time basis) and DR. A. L. N. CREED.*
> 5. *The post of SMO, Windscale and Calder Works, has been regraded as a senior appointment because of the increased personal responsibility which it now carries.*

86 As SMO, Dr Lawson was responsible for the provision of a comprehensive medical service at Sellafield. His job description, prepared in 1979, indicated in respect of the *"discretionary powers"* attaching to the post:

> *In the purely medical field the Senior Medical Officer's freedom of action is limited only by his ethical responsibilities.*

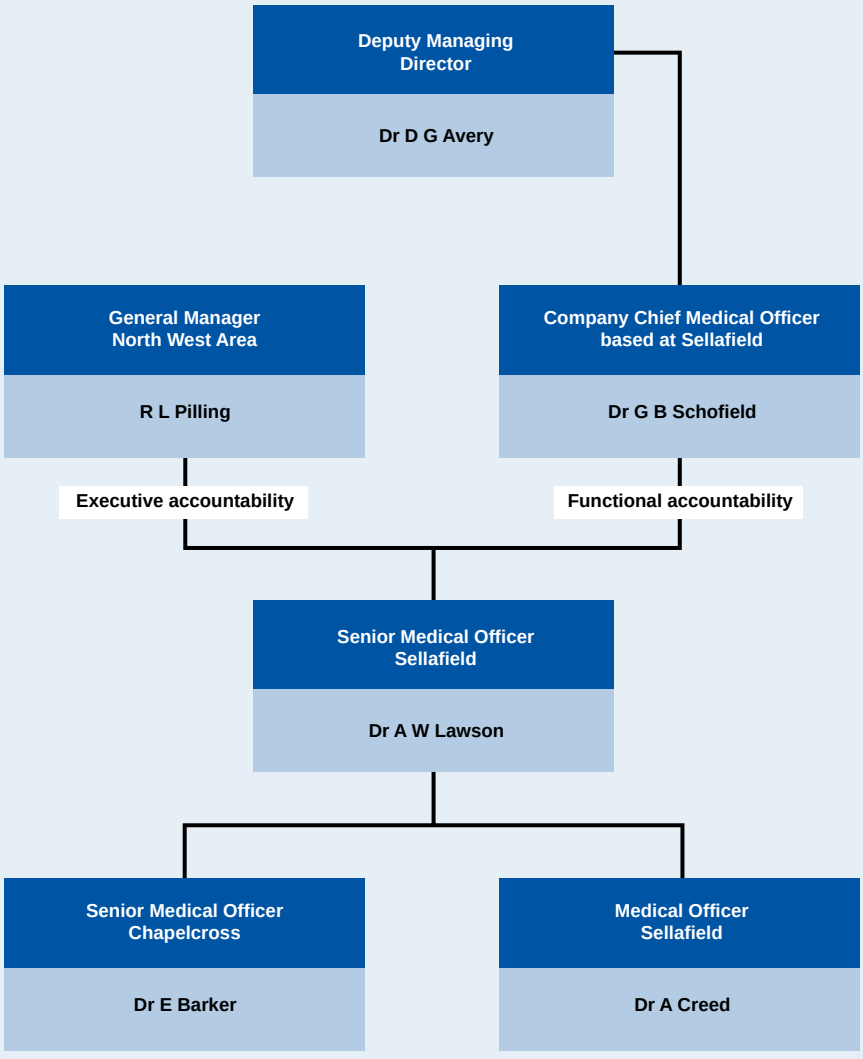
87 A memorandum dated 19 April 1979 set out Dr Schofield's duties:

Company Chief Medical Officer – Terms of Reference

1. *To be responsible to the Deputy Managing Director for the co-ordination and functional control of BNFL Occupational Health Units and for advising on their staffing.*
2. *To be responsible, in conjunction with the Director of Health and Safety, for recommending Company policy on health matters associated with both radiobiological and non-radiobiological hazards and to advise the Company Management in this area.*
3. *To represent the Company's interests in medico-legal matters as necessary.*
4. *To be responsible for representation of the BNFL medical interest on committees, either internal or external, which are concerned with health in the nuclear industry.*
5. *To be responsible for the co-ordination of the medical records systems in the Company and for the collection of morbidity and mortality data to produce an annual report.*
6. *To have particular responsibility for matters concerning human radiobiology and cytogenetics and to direct research or development work in these fields and in any other areas where the Company may agree to undertake or support R&D.*
7. *To represent the Company as necessary at home and overseas in the fields of occupational health and radiobiology.*

88 Figure 5.4 represents the structural position in 1979.

Figure 5.4: BNFL Occupational Health, March 1979



Annual medical report, 1979

89 One of Dr Schofield's duties as CCMO was the production of an annual report to the Company Executive. He had referred to his post mortem work in his 1973 report and in 1979 provided further detail:

> *As an appendix … a resume is provided of analytical work carried out on autopsy specimens obtained from employees who at some time during the course of their employment came into contact with plutonium. The paper giving the results of these analyses appeared in the British Journal of Radiology in May 1980*[53] *and attention is particularly drawn to this matter since a meeting is to be convened shortly by the Medical Research Council with the intention of exploring the possibilities of setting up a central analytical facility and initiating a national register of workers who are or have been exposed to transuranic elements. The setting up of such a register, similar to that already in use in the USA, would have administrative, legal and industrial implications for the Company and the Executive is therefore invited to comment on the matter.*

The appendix stated that *"autopsy specimens"*:

> *have been collected from 29 cases since 1964; 26 of these being from plutonium workers and the remaining 3 being personnel who were employed on a nuclear site but not specifically exposed to plutonium. The organs in which plutonium and the other actinides principally deposit are the bones, liver and lungs. These organs were obtained at each autopsy and subjected to radiochemical analysis ... It is important … that there should be a continuing accumulation of autopsy data to allow more comparisons to be made with in vivo estimations.*

90 Dr Schofield's report was presented to the Company Executive by Dr Avery, who stated in a covering report of his own:

> *it is timely for consideration to be given within the Company of its interests in and the arrangements for analysis of autopsy specimens. There are no clear formal or informal arrangements within the UK although NRPB appeared to be making proposals some time ago. More recently however MRC have indicated that they are interested in obtaining opinions from different organisations and individuals as to what is needed. It is important to the Company that the maximum amount of information is obtained so as to assist in the clarification of the basis of standards but that this should be done with the minimum impact on the Company's public and legal position.*

53 Schofield GB, Biological control in a plutonium production facility, *British Journal of Radiology*, 1980, 53: 398–409. Although the annual medical report related to 1979, it was not presented to the Company Executive until 18 September 1980

Dr Avery proposed that the report, *"as in previous years"*, be widely distributed to Company management and made available to staff and trade unions.

91 Dr Schofield's 1979 report gave the Company Executive detailed notice of the post mortem work, above and beyond that provided in the 1973 report. Its obligations in connection with receipt of that information are considered below.[54]

A national post mortem registry

92 Dr Avery was alluding to the possible introduction of a national post mortem registry. Such a registry could have been based upon its US equivalent, the United States Transuranium Registry (USTR). The USTR relied on voluntary donation of organs by exposed workers. Dr Schofield contrasted his own work with that of the USTR:

> *autopsy specimens have been collected where possible on plutonium exposed personnel both in the USA and in the UK. There are no specific arrangements in the UK for autopsies to be carried out on deceased employees and material has therefore been collected since 1964 on an ad hoc basis when a post mortem examination has been requested by the coroner or when such an examination has been undertaken for medical reasons unconnected with the employment of the deceased person. Arrangements in the USA on the other hand were put on a more formal basis with the formation of the United States Transuranium Registry (USTR). This is a Government sponsored body which is empowered to ask plutonium exposed personnel to allow their bodies to be used for medical research after death.*

93 There was much discussion over the next 15 years of the possible introduction of a UK registry but all attempts at its establishment failed.[55] Representatives from many organisations, including the NRPB, the MRC, BNFL, the UKAEA and the AWE, were involved. Frequent mention was made of the post mortem data held by the industry and the work being undertaken at Sellafield became widely known. Senior management often took part: for example, in November 1989 Mr Coulston and Dr Rex Strong[56] prepared a formal proposal and were active in subsequent discussions.

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54 See paragraphs 295–299

55 See chapter 10, "Registries"

56 Head of Dosimetry Services

Changes to the Board, 1984

94 On 7 June 1984, Dr Avery announced his retirement as Deputy Managing Director. Dr William Wilkinson was appointed Executive Director for Technical, Health, Safety and Environmental matters, acquiring Dr Avery's responsibilities in those areas, and Mr Bolter became Executive Director[57] for Corporate Affairs, while remaining Company Secretary. Mr Mummery and Dr Schofield became directly accountable to Dr Wilkinson.

Dr Schofield dies, 1985

95 Dr Schofield died suddenly on 31 May 1985. He was succeeded as the CCMO by Dr Lawson; the duties of the post remained unchanged. Dr Robin Wood replaced Dr Lawson as SMO at Sellafield until he became the UKAEA's CMO in 1996. Dr Lawson remained CCMO until his retirement on 24 March 1990. His successor was Dr Andrej Slovak, who was in turn replaced in 2003 by the present incumbent, Dr David Macgregor.

Dr Lawson continues the post mortem work

96 By the time Dr Schofield died, organs had been taken at post mortem from 53 former Sellafield employees. The work continued under Dr Lawson and, indeed, became more formalised. On 27 June 1986, Dr Lawson produced a document entitled "Protocol for radiochemical analysis of post mortem tissues":

> *The Coroner will name the pathologist who is to conduct the post-mortem. The Chief Medical Officer or his deputy … will make arrangements with the pathologist to either attend the post-mortem or for the specimens to be collected … it has become the practice to collect autopsy material as follows:*
>
> *(i) One whole lung, or in some cases both*
>
> *(ii) Half the liver and in some instances the whole organ*
>
> *(iii) Spleen*
>
> *(iv) The kidney, either one or both*

57 Board-level Executive Directors are generally appointed with voting rights. A typical Board would comprise a Chairman and executive and non-executive Directors. However, it is not known how the BNFL Board was constituted at this time

(v) *Bones, Sternum*

4 ribs

A femur

(As many anterior vertebral bodies as possible)

(vi) *Mediastinal tissues – for the purposes of dissecting out the tracheo-bronchial lymph nodes*

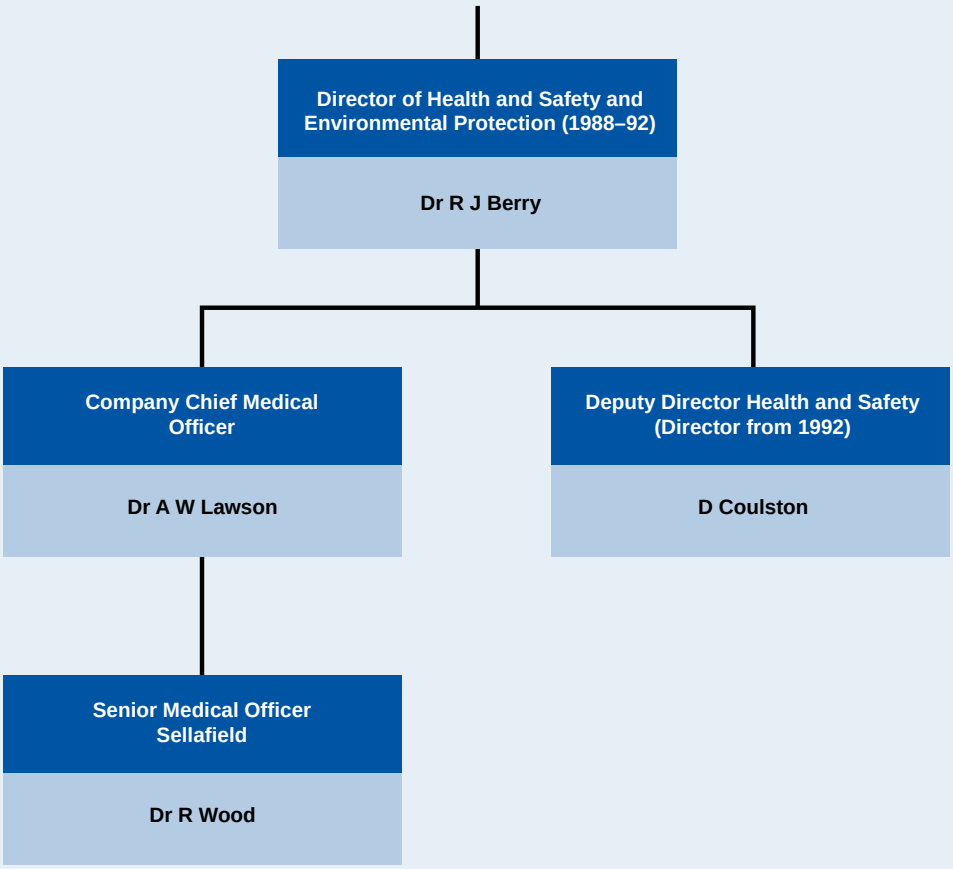
(vii) *Other organs may be required to be collected in specific cases, e.g. brain, testes, portions of intestinal tract etc …*

The individual organs and specimens should be weighed before being put into separate heavy duty polythene bags then the bags should be placed in a large polythene bag contained within a strong waste paper bag … The organs and samples should be stored in the deep freeze after dissecting out the hilar and tracheo bronchial lymph glands which must also be weighed.

Mr Mummery retires, 1987

97 Mr Mummery retired on 30 September 1987. His successor as Director of Health and Safety was Dr Roger Berry, who was also a member of several committees including the International Commission on Radiological Protection (ICRP) and the MRC Committee on the Effects of Ionising Radiation. Figure 5.5 shows the position in 1988.

Figure 5.5: BNFL Occupational Health, August 1988



CCMO's accountability

98 In August 1988 the Health and Safety Directorate produced a position paper on the Company Medical Office, which provided a detailed description of the work of the CCMO, dividing it into six elements. Element 1 was headed "COMPANY MEDICAL POLICY" and began:

> 1. *What do we do?*
>
> (a) *The CCMO is responsible for the co-ordination and functional control of the Occupational Health Services within the Company.*

(b) *The CCMO sets out Company Policy in respect of medically related subjects which are to be followed by the Site Senior Medical Officers.*
(c) *The CCMO initiates and/or conducts relevant research projects.*
(d) *The CCMO produces an Annual Medical Report.*

99 Element 4 was headed "POST MORTEM STUDIES":

1. *<u>What do we do?</u>*
   (a) *Manage an autopsy database for the provision of detailed data on plutonium metabolism.*
   (b) *Prepare medico-legal reports.*
   (c) *Develop improved analytical techniques.*
   (d) *Liaise with external agencies, e.g. United States Transuranium Registry.*

2. *<u>How do we do it?</u>*
   Following a request from H.M. Coroner arrange for the collection and radiochemical analysis of autopsy tissues. Correlate results, coordinate with internal dosimetry.

3. *<u>Who (Group Manager) is accountable?</u>*
   Company Chief Medical Officer – Dr A W Lawson

4. *<u>To what extent is responsibility delegated within the section? – Named individual(s) please</u>*
   Mr Brian Wallace – responsible for maintaining the database, production of statistics and briefs as required.

5. *<u>What interfaces are there/required between Sections?</u>*
   Head of Plant and Personnel Safety – Mr D J Coulston.
   Senior Medical Officer, Sellafield – Dr R Wood.

6. *<u>How are such interfaces managed?</u>*
   Working level discussion.

7. *<u>Are there any CURRENT/IMPORTANT/KEY/POLICY type issues arising?</u>*
   Yes …

   (a) *Major progress has been made in reviewing and appraising the data for the radiochemical analysis of autopsy tissues carried out in the Sellafield laboratories.*
   (b) *Protocol on methodology currently under review.*

100 In October 1988, Dr Lawson published the review of occupational health services which, combined with the Health and Safety Directorate position paper, defined the function of the Company Medical Office and the CCMO's responsibilities.

101 A more formal staff appraisal process included the CCMO from 1987. Documentation prepared for the process identified the CCMO's *"principal accountabilities"* which in March 1988 included:

> 4. *Prepare or invigilate medical documents in respect of common law claims, Coroner's reports or BNF plc Mortality or proposed Morbidity compensation scheme to ensure accurate presentation of the medical facts, to express a considered medical opinion and to minimise the Company's liabilities.*
> 5. *Direct and conduct research on (a) the applications of laboratory cytogenetic techniques and (b) the interpretation of radiochemical analyses of post mortem tissues, to enhance knowledge of radiation dose assessments and to provide a clinical cytogenetic service to the Community Health Authorities.*

102 This is the first direct evidence that BNFL management requested and directed post mortem work. Dr Lawson's appraisers were Mr Pilling, a Board member, and Dr Berry, Director of Health and Safety. The post mortem work was now sufficiently established to be expressly included in the Health and Safety Directorate business plan for 1988/89: *"The Directorate will in the medical area … analyse post mortem data and compare with urinyl* [sic] *analysis data for organ uptake."*

103 The following year, one of Dr Lawson's targets, which Mr Pilling certified as having been achieved, was *"to complete the revision of post-mortem data and establish an improved analytical capability of the computer database"*. The Health and Safety Directorate confirmed in its business plan for 1990/91 that the post mortem database had been validated and completed for Sellafield employees. The validation exercise had been started in 1987 and is discussed in more detail below (paragraphs 206 et seq).

Dr Wood

104 Soon after Dr Wood was appointed SMO at Sellafield, he attended the post mortem of a former Sellafield worker, at Dr Lawson's request, to collect

organs for analysis. This was a task he repeated, again at Dr Lawson's request, on a further two occasions.[58]

Dr Slovak

105 Dr Slovak succeeded Dr Lawson as CCMO in March 1990. He shared his predecessors' views on the importance of post mortem work and was particularly keen that a national post mortem registry be established. He became involved in the UK Occupational Radionuclide Exposure Study (UNIKORNES), a proposal for a UK version of the USTR, based on consent.[59] In 1990 he wrote:

> *we have begun to put together a systematic attempt to look at what dosimetric information might be derived from autopsy data … Obviously this is a bit of a touchy issue and yet we are into the period when many "historic high exposure" workers are reaching old age so something must be contemplated.*

He also visited the USTR with Mr Coulston.

106 Despite Dr Slovak's interest in the information which could be gleaned from post mortem work, organs were taken from a Sellafield worker only once during his tenure and he was not personally involved.

Post mortem work ends, 1991

107 The final occasion on which human organs were removed for analysis at Sellafield was in 1991. The Deputy Coroner for West Cumbria, Mr John Taylor, contacted Dr Wood after the post mortem of a Sellafield worker, told him the cause of death and asked him to arrange for analysis of organs *"in view of pending action by family against the Company"*. The post mortem report notes that the following organs were collected: sternum, four ribs, three lumbar vertebrae, right patella, right femur, spleen, liver, right kidney, right lung, lymph nodes, lingula and trachea. Despite requesting the analysis, the coroner held no inquest and the results were not communicated to him until some two and a half years later, by which time

58 See paragraph 154

59 See paragraph 92 and chapter 10, "Registries"

the death certificate had long since been issued. Mr Taylor's request for analysis, when he had not decided to hold an inquest, was beyond his powers.[60]

108 These organs were eventually analysed in 1993. By then, organs taken from 64 Sellafield workers had been analysed.

SL's assurance

109 The Inquiry was satisfied from its own investigations that there was no evidence of any later analysis of organs at Sellafield but nevertheless asked SL to confirm that:

> a. *following the case of* [name withheld]*, there has been no actual harvesting, retention or laboratory analysis of autopsy material from former BNFL employees on any of the SL sites; and*
> b. *from 2004*[61] *to the present, there has been no actual harvesting, retention or laboratory analysis of autopsy material from former BNFL employees on any of the SL sites.*

In its closing submissions to the Inquiry, SL responded:

> *On the basis of the extensive investigations and evidential searches SL has undertaken (including searches beyond its own documents), SL confirms that as far as it is aware, no actual harvesting, retention or laboratory analysis of autopsy material has taken place on any site owned or operated by SL during either of the periods referred to above.*

110 The Inquiry accepts that evidence.

How did organs come to be analysed at Sellafield?

Identifying individuals of interest

111 In his 1967 paper[62] Dr Spoor highlighted the importance of early identification of suitable individuals:

60 See chapter 3, "Law and Guidance"

61 The Human Tissue Act 2004 received Royal Assent that year

62 See paragraph 64

> *All necessary steps should be taken to ensure that the Medical Officer is informed of those post mortems which are likely to be of interest. It may be desirable for the Medical Officer to have a list of those employees whose bodies are, from this point view, of potential interest.*

Against that background the Inquiry was anxious to understand first, how it was that Dr Schofield and his successors became aware of the deaths of Sellafield workers and, second, given that organs were not taken on every occasion, what factors led to their being taken from any particular individual.

Flagging

112 The Inquiry made extensive efforts to determine whether any structured arrangement existed to identify employees or former employees while alive as being of particular interest, so that on their deaths the CMO was in a position to attempt to ensure organs were taken at post mortem for analysis: the "flagging" of individuals. No witness to the Inquiry gave evidence of any such arrangement; and both Ms Erica Irlam, who was secretary successively to Dr Schofield and Dr Lawson from 1972 to 1990, and Ms Sheila Jones, who has worked in an administrative capacity for the Medical Department at Sellafield since 1974, were adamant that they had seen nothing of this nature in either the filing system or the occupational health records themselves.

113 The Inquiry did note that the covers of the occupational health records of seven of the Sellafield workers whose organs had been taken at post mortem bore the word *"autopsy"*. However, it was impossible to determine when or by whom the word had been written. Ms Jones said that the inscription had not been used during her time in the department, although different coloured stickers were used to identify the records of workers who were dead or who had retired on medical grounds. Her work had involved her seeing many thousands of occupational health records and the Inquiry found her evidence compelling. It may be that the inscription simply recorded the fact that a post mortem had taken place; and it might have been made many years after the event.[63] The Inquiry therefore concludes that it does not constitute evidence of flagging.

63 Perhaps in the exercise to revalidate the data in the 1980s: see paragraphs 206–210

Three cases

114 However, the Inquiry did investigate three cases in which the records at the very least suggested that some steps had been taken during the workers' lives to ensure that organs could be obtained when they died. Mr Ronald Gee[64] was a former Springfields worker who died from acute myeloid leukaemia on 14 May 1980 in the Royal Victoria Hospital, Blackpool. In 1974, he had been involved in an incident at Springfields in which he had been exposed to significant quantities of uranium. Thereafter he had undergone regular whole body monitoring at Sellafield. His death was reported to the Coroner for Blackpool, who authorised the pathologist to take organs at post mortem for analysis by the independent NRPB. The Inquiry noted an entry dated 22 August 1979 in Mr Gee's occupational health records, probably made by the Springfields SMO, Dr Robin Goodfellow:

> *Spoken to Dr* [Neil] *Flanagan.*[65] *Not a clear diagnosis. Has responded well to chemotherapy and will be discharged tomorrow (?). Dr Flanagan will cooperate in supply of organs at eventual p.m. – but he seems to be going into remission at the moment.*

115 No contact could be made with Dr Goodfellow, but although it was some 30 years since the note had been made, Dr Flanagan did speak to the Inquiry. He could not recall the telephone discussion after such a long time, but he thought the note extremely unusual. First, it was strange that there had been any discussion about a post mortem when a man was being actively treated, particularly because such treatment was expensive and would not be undertaken lightly. Second, it was not his practice to seek the relatives' consent for post mortem where a death was thought to be due to acute myeloid leukaemia; he would not report it to the coroner, as the cause was already known; and he would have had no authority to deal directly with any organs taken at any post mortem.

116 The telephone call in 1979 could be interpreted as an attempt to persuade Dr Flanagan to report Mr Gee's eventual death to the coroner so that he might order a post mortem examination at which organs could be removed.

117 However, given a suggestion that Mr Gee's leukaemia might have been connected with his employment in general and the 1974 incident in particular, it was proper for his death to have been referred to, and investigated by, the coroner. It cannot therefore be said that it was the

64 Mr Gee is discussed in more detail in chapter 13, "The Families"

65 Consultant haematologist at the Royal Victoria Hospital, Blackpool

approach in August 1979 which led to organs being taken at post mortem. The coroner's decision to instruct an independent third party, the NRPB, to analyse the organs was sensible.

118 In two other cases, however, the Inquiry concludes that there is good evidence of flagging. The first, AA, was a Sellafield worker.[66] He had been involved in a major and highly unusual contaminative event and Dr Schofield would have been particularly interested, for scientific reasons, in obtaining his organs for analysis. He took early retirement from Sellafield on medical grounds and moved away from the area. His general practitioner was traced and Dr Schofield inquired after AA's health, recording that he was *"alive and fairly well … PM will be kept in mind … will be notified to us"*. It is apparent both from documents seen by the Inquiry and from actions taken after AA died that Dr Schofield considered it vital to gain access to his organs at post mortem.

119 When AA died, suddenly, a general practitioner (not the doctor to whom Dr Schofield had spoken) was initially prepared to certify the cause as coronary thrombosis, a condition then thought to have no connection to radiation. However, for reasons which are not clear, AA's death was reported to the coroner, who, for reasons which again are not apparent, asked Dr Hylton Smith,[67] at the NRPB, for advice. Dr Smith noted:

> [the coroner] *wanted to know whether there was a justification for ordering an inquest in the circumstances; or as an alternative, to discuss with the family the desirability in their interest of arranging a post-mortem examination so that tissues could be obtained for analysis. I pointed out that although there was no legal obligation for the coroner to order an inquest, the high scientific interest in the case made it prudent to hold a post-mortem examination.*

This note is an amended version of the author's original, which recorded one of the coroner's other reported options to *"let the funeral go ahead in view of the fact that the family did not appear to be concerned about the possibility of a radiation-associated death"*.

120 The importance to Dr Schofield of this case is perhaps shown by the fact that he asked Dr David Smith, consultant pathologist at West Cumberland Hospital, to perform it (Dr Smith declined, not wishing to intrude upon another pathologist's patch). When the post mortem did go ahead,

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66 The Inquiry knows the identity of the deceased but cannot publish his name as the next of kin have not come forward and his anonymity must therefore be preserved

67 Head of the Biology Department

Dr Schofield attended, accompanied by Dr Lawson and *"a small team of physicists from Windscale"*.

121 A particularly extensive range of organs was removed.[68] Dr Schofield made them available to the NRPB and Dr Stewart Rae[69] prepared a report for the coroner, concluding:

> *no relationship has ever been demonstrated … between a body content of plutonium and death from coronary thrombosis and hypertension. Furthermore I am not aware of any theoretical considerations which would indicate such a relationship was probable. Therefore, although our investigations have shown … a considerable body burden of plutonium, in my opinion there is no evidence to suppose that this contributed significantly to his cause of death.*

122 A separate analysis had also been performed at Sellafield. In his own report to the coroner, Dr Schofield drew the same conclusions as had Dr Rae, and for the same reasons. These were conclusions which were entirely in accordance with views he had expressed on previous occasions. At the inquest, the pathologist agreed with both Dr Rae and Dr Schofield and a verdict of natural causes was returned.

123 The Inquiry considered whether Dr Schofield had engineered referral of the death to the coroner, attempting to obtain organs in a case of great scientific interest. SL suggested to the Inquiry that it was perfectly proper for the coroner to investigate and to ask for organs to be taken at post mortem and analysed to help assess the cause of death: *"It was not for the Coroner to assume without investigation that the coronary thrombosis had nothing to do with radiation exposure."*

124 The Inquiry presumes, given the coroner's reaction, that whoever reported the death to him mentioned AA's history of radiation exposure and he therefore was duty bound at least to make initial inquiries to determine whether it was possible that the death had been caused by radiation. That investigation properly started with a post mortem examination. However, once it was realised that the initial impression that the death was caused by heart disease was correct, there was no coronial justification for any further investigation. The conclusions reached by Dr Rae and Dr Schofield were based upon general principle, rather than on the analytical results. They (and presumably also Dr Hylton Smith) would have been able to inform the coroner, in advance of analysing any organs, that the death could not have

68 See paragraph 169

69 Assistant Director (Medical), NRPB

been caused by exposure to radiation, a view they both later expressed in their reports.

125 The machinations both before and after AA's death lead the Inquiry to conclude that this was a case in which Dr Schofield was prepared to go to extraordinary lengths in order to ensure that he obtained organs at post mortem.

126 The second case, BB, in which flagging appears to have occurred was a Sellafield worker who had initiated a claim for damages, alleging that his cancer was occupationally related. Within three months of BNFL receiving intimation of the claim, Dr Schofield spoke to the worker's general practitioner and then to BNFL's solicitors:

> *I … asked* [the solicitor] *his opinion regarding a request from me for an autopsy when* [BB] *dies.* [He] *agreed that this was entirely in order. I have discussed the matter with* [BB's] *general practitioner … and indicated to him that a claim has been made and he has made a note to this effect on his medical documents and as a result when* [BB] *dies the case will be referred to the Coroner. It will then be up to us to ask the Coroner for permission to obtain organs for plutonium estimation.*

127 SL described the note as *"very revealing of Dr Schofield's cautious approach"*. It submitted that the solicitor's advice was *"entirely appropriate"*, since BB's allegation that his illness was caused by radiation made referral of his death to the coroner inevitable. The Inquiry does not agree: referral would have been inevitable only had BB died of the cancer alleged to have been caused by radiation. If BB had died not of his cancer but of a condition (such as heart disease) then thought not to be related to radiation, there would have been no requirement for the coroner to have become involved.[70]

128 SL further submitted that the results of radiochemical analysis:

> *would also be directly relevant to the prospect of a civil claim being successful, which was another of Dr Schofield's duties for BNFL.*

While this may have been true, it would not have justified coronial investigation: the coroner's role had (and has) no connection to civil claims for damages.

129 The Inquiry construes Dr Schofield's approach to BB's general practitioner as attempting to persuade a fellow medical practitioner in due course to refer the death to the coroner whatever the cause.

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70 Provided, of course, that there were no other circumstances, such as a road traffic accident, which made investigation necessary

Conclusion

130 These are exceptional cases and the Inquiry concludes that in general no arrangements were in place to identify particular individuals before death as being of interest upon their demise.

131 How then did Dr Schofield come to be able to attend post mortems and obtain organs for analysis at Sellafield?

Initial contact with Dr Schofield: radiation cases

132 With only four exceptions, organs were supplied to Dr Schofield from coronial, rather than hospital, post mortem examinations, the vast majority[71] of which were performed for the Coroner for West Cumbria.

- From 1958 to 1979, Mr Gough was Coroner, assisted by Mr Walker as Deputy Coroner.
- From 1979 to 1994, Mr Walker was Coroner and Mr Taylor initially Assistant Deputy and, from 1984, Deputy Coroner.
- From 1995, the Coroner was Mr Taylor.

Mr Gough, Mr Walker and Mr Taylor were partners in the same firm of solicitors in Whitehaven. Mr Gough and Mr Walker both died before the Inquiry was established, but evidence was heard from Mr Taylor.[72]

133 Mr Taylor said that when he had been appointed Assistant Deputy Coroner, Mr Walker had explained that it should be borne in mind that the death of any Sellafield worker might be linked to radiation:

71 Organs were taken for analysis from former Sellafield workers in 64 cases, and in 53 of those cases the Coroner for West Cumbria had authorised the post mortem from which those organs were taken

72 Mr Taylor retired shortly after giving evidence to the Inquiry

Clearly if an inquest was to be held then it was necessary to have sufficient evidence to enable there to be proper consideration of the verdict of industrial disease. Mr Walker would therefore ask Dr Schofield … to assist in the examination of autopsy specimens to determine whether or not the deceased had been exposed to high doses of radiation. Mr Walker explained this process to me and it was one which I subsequently adopted. My practice in a Sellafield case was to ring Dr Schofield so that I could get from him the deceased's history of exposure to radiation. I would not ring Dr Schofield on each and every occasion of a death of a Sellafield worker: I would restrict those calls to cases where there was a suggestion either on the part of the GP or the family that there had been exposure to radiation …

It was not always the case that organs were taken in the event of the death of a Sellafield worker. If Dr Schofield or the pathologist suggested to me that the death was a possible case where there was a relationship to radiation exposure I would authorise organs to be taken … I cannot now recall the precise sequence of events ... I can only suggest that in practice when I telephoned Dr Schofield he would in some cases say that there had been a high radiation dose and it might be that this had caused the deceased's cancer and that he would take the relevant organs from the body for analysis. It would be usual for that telephone call to take place prior to the post mortem examination and I would then be on notice that there was the possibility of a finding of an industrial disease ... My understanding is that if I spoke to Dr Schofield he would then contact the pathologist and say that he would like to attend the post mortem because there was the possibility of the death having been due to radiation.

134 Mr Taylor's evidence satisfactorily explains how Dr Schofield would become aware that a Sellafield worker had died of a condition possibly linked to his occupation and was to undergo coronial post mortem. The Inquiry found evidence in the coroner's archives to support Mr Taylor's account: in all the Sellafield cases which came to inquest the coroner had made contact with Sellafield almost immediately after being notified of the death. Several cases were also identified in which the coroner had asked the Sellafield CMO or SMO whether he was interested in obtaining organs but the invitation had been declined as the deceased had not been a plutonium worker.

Coronial decision making

135 Contact of this nature gave Dr Schofield considerable influence over coronial procedure: the occupational health physician of the deceased's former employer was in effect being asked whether it was possible that the deceased's death might have been caused by his employment. While it was good practice to obtain a proper occupational history, the coroner himself had to retain control of the decision-making process. It was for him to determine whether there should be a post mortem and whether radiochemical analysis of any organs was appropriate.

136 Mr Taylor appears on occasion to have failed to exercise that control.

- In one instance, involving a Sellafield worker who had died of lung cancer, Mr Taylor's note of his conversation with Dr Schofield includes *"Not thought to be involved with radiation. Don't want to be at P.M. but would like a lung."* At post mortem, as well as a lung, the liver and sternum were taken for analysis at Sellafield.
- In another case, also a death from lung cancer, Mr Taylor's note read, *"Per Dr Lawson – in his opinion not connected with his work but have P.M. and collect tissue."* Organs taken included the liver, spleen, sternum and lung.

137 No inquest was held in either of those cases. In neither, therefore, could Mr Taylor properly have requested the radiochemical analysis.[73] His notes imply his satisfying the obvious desire of the Sellafield doctors to obtain organs for analysis, without concern for the consent of the deceased's relatives, which was also required. The second could be read as acquiescing in Sellafield's request not only for the removal of organs but for the post mortem itself.

Initial contact with Dr Schofield: non-radiation cases

138 In the majority of cases investigated by the Inquiry in which radiation was not considered a relevant factor, the worker was employed at Sellafield when he died. The community was tight-knit and word of any death would spread quickly. BNFL had measures in place to support the family after a worker's death, a welfare officer visiting bereaved families often as early as the next day to offer support and assistance. Obviously, in these circumstances, any death in service would very quickly have come to Dr Schofield's attention.

73 Coroners (Amendment) Act 1926; see chapter 3, "Law and Guidance"

139 Post mortems undertaken for the Coroner for West Cumbria usually took place at West Cumberland Hospital. The Inquiry heard evidence from three of the hospital's consultant pathologists – Dr David Smith, Dr Philip Whitehead and Dr Thomas Bird – who had provided organs to Dr Schofield, and from Mr William Chapman, the mortuary technician from November 1979 to November 1996. The practice of taking organs from deceased Sellafield workers had been going on for a long time before Mr Chapman took up his post and he felt unable to challenge the pathologists: he did as he was told. Mr Chapman said that when he started working in the mortuary Dr Smith had asked him to prepare a list each morning of the name, age and address of each body. He presumed that after receipt of the list Dr Smith would speak to either Dr Schofield or his secretary, Ms Irlam, with a view to the identification of any Sellafield workers, but he never heard such a conversation.

140 Mr Chapman reported that after a while he began to receive occasional calls directly from Ms Irlam, who would ask if a particular body, which she identified by name, was in the mortuary. He recalled that the answer was always yes. Ms Irlam denied having spoken to any mortuary technician at the hospital but the Inquiry found her evidence unconvincing. Mr Chapman's evidence is consistent with Dr Schofield's having heard of a death either through the coroner or in the ordinary course of events at work.

141 Further evidence of direct contact between Dr Schofield and the pathologists at West Cumberland Hospital was provided by Dr Smith, who confirmed that he had discussed the provision of organs with Dr Schofield:

> *At some point, and I cannot now remember when or in what circumstances, Dr Schofield asked if I could collect specimens from post mortems undertaken on Sellafield workers who had been occupationally exposed to plutonium … Dr Schofield explained that it was important to find out what had happened in the cases of workers who had been occupationally exposed to radiation. It was also clear that there would be the possibility of litigation following the deaths of some of the nuclear workers whom I examined and in cases like that I felt obliged to collect specimens and would have judged myself incompetent if I had not done so … I cannot now remember whether I was given a written list of the organs which Dr Schofield required or whether he simply told me what he needed …*

> *Dr Schofield would ring me, sometimes at home or when I was in the laboratory, and advise me that a certain worker had died. He would sometimes tell me that he had discussed the case with the Coroner and that the decision had been made that there would be a post mortem. He would then ask if I could collect the specimens. I do not know how Dr Schofield identified the cases in which he was interested, nor how it was that he knew of the deaths.*

142 Dr Smith added that the arrangement had continued unchanged when Dr Lawson became BNFL's CCMO in 1985. Mr Chapman said that Dr Lawson would occasionally ring him at home in the evening following the death of a Sellafield worker and ask that a particular post mortem be delayed until he could attend.

143 That there should have been such communication between the pathologist and the CCMO is concerning: there could have been no coronial justification for the analysis of organs when there was no suggestion of a causal link between the deceased's occupation and his death and no inquest was planned. Mr Taylor told the Inquiry that he had no idea what was going on:

> *I was not however, party to what I presume to be an informal agreement between the pathologist and Dr Schofield … I do find it surprising now on reading those post mortem reports that organs were taken in cases where the death could not be said to be related to exposure to radiation. I can only presume that Dr Schofield had rung Dr Smith and expressed a desire to have the organs, contrary to what he had previously told me.*

144 The pathologist would telephone the coroner immediately after the post mortem to tell him the cause of death. If he had decided not to hold an inquest, Mr Taylor did not read the typed post mortem report when it arrived in his office,[74] merely handing it to his secretary for filing. The first time he had read many of the reports, several of which explicitly recorded the removal of organs for Dr Schofield, was when shown them by the Inquiry, many years later. He accepted that had he taken the trouble to read them at the time, he would have noted that record and:

> *In those circumstances I have no doubt I would have telephoned Dr Schofield and queried the position given that he had previously stated that he was not interested in having organs in those cases.*

145 The Inquiry was surprised that Mr Taylor did not read reports of post mortem examinations which he himself had commissioned. His failure to

74 Generally, the post mortem reports were one or two pages long and were received a week or two after the examination had been performed

do so was unacceptable; he remained ignorant that organs were being removed without his consent from bodies under his control and hence was unable to take any steps to bring an end to the abuse. It should be noted, however, that in cases in which Mr Taylor did know that organs had been removed for non-coronial purposes, he failed to act.

146 The Inquiry had hoped to have received more cogent evidence of the system of communication between Sellafield and West Cumberland Hospital. Sadly, Dr Schofield and Dr Lawson were dead and Ms Irlam was unable to recall the details of her 18 years of service.

Information gathering at Sellafield

147 It was, of course, always for the coroner to decide whether organs should be analysed; and it may be that he did sometimes make that decision when the death might have been due to industrial disease and an inquest was to be held. However, there is clear evidence that Dr Schofield was often instrumental in determining whether organs should be taken. How did Dr Schofield decide whether a particular individual was of sufficient interest for him to obtain organs for analysis?

148 The Inquiry heard that once Dr Schofield had notice of an impending post mortem he would investigate the deceased's history at Sellafield. Standing instructions in the Medical Department there dictated that any recently deceased worker's occupational health records were to be brought to him, so that he could enter the date of death and review the medical history.

149 Dr Schofield would also obtain information from colleagues. Ms Jennifer Woodhouse worked in the Health Physics Department from 1969 to 1982. She ran the plutonium dosimetry service, which undertook the routine monitoring of workers' plutonium intake. From time to time Dr Schofield would inform her that a worker had died, asking if he had worked with plutonium and had ever tested positive for plutonium in his urine. Ms Woodhouse told the Inquiry: *"Essentially he wanted to know if the deceased was 'of interest'."*

Organ collection: attendance at post mortem

West Cumbria

150 The Inquiry heard that organs were collected from West Cumberland Hospital by staff from Sellafield. When he wanted to obtain organs for

analysis, Dr Schofield would often attend the post mortem himself. Mr Chapman said that he and the pathologist would arrange to hold such post mortems at a time convenient for Dr Schofield, usually between 10.00 and 10.30. Mr Edgar Cartwright[75] would often accompany Dr Schofield. Ms Jones revealed that, on occasion, organs were collected by Mr Cartwright's deputy, Ms Rose Fleming, or even, when nobody else was available, Ms Irlam. The Inquiry has not spoken to Ms Fleming; Ms Irlam denied ever having collected organs. Whoever went would take the organs to Sellafield, in a coolbox, by car.

151 Mr Chapman said that he would hand the organs of interest to Dr Schofield and return the others to the body, which he would then close. He would also remove the femur, which would not usually have been examined during the post mortem, and give this too to Dr Schofield, reconstructing the leg with a broom handle or similar stick.

152 Dr Smith said that if nobody from Sellafield was able to attend the post mortem and he had been asked to retain organs he would put them in the freezer, in plastic bags or containers, to await collection. Dr Smith did not himself take anything to Sellafield and thought that Dr Schofield would probably have liaised directly with Mr Chapman.

153 Similar arrangements were in place when Dr Lawson became CCMO. He had attended post mortems on Dr Schofield's behalf to collect organs and so was familiar with the procedure. Mr Chapman said that Dr Lawson would liaise with the pathology department to arrange a convenient time for the post mortem:

> *Sometimes I would be able to let him know when a post mortem was going to be performed because the pathologist and I had drawn up the schedule the afternoon before; on other occasions I would transfer the call to the pathologist so that he could make arrangements directly with Dr Lawson as unlike Dr Schofield he did not have a fixed time when he used to come to the mortuary and he would try to fit in with us. Dr Lawson would sometimes attend with Mr Cartwright but that was not always the case, unlike Dr Schofield who always seemed to be accompanied by him.*

In 1986, Dr Lawson defined the arrangements for the collection of organs in some detail.[76]

75 Senior Medical Laboratory Scientific Officer at Sellafield

76 See paragraph 96

154 Dr Wood too attended post mortems to collect organs. The first occasion was very soon after his appointment at Sellafield. He told the Inquiry that he was given quite specific instructions:

> *I was given a collection of polythene bags by … Edgar Cartwright, and a list of the tissues required. The list was not produced especially for me but was instead a list which was held readily to hand ... I was advised by Edgar Cartwright that each sample should be put into a separate bag and sealed, and then all of those bags should be put into another bag which should also be sealed. Everything was then to be brought back to him.*

Dr Wood remembered attending another post mortem:

> *Again, I was provided with a list of tissues which I should bring back but on this occasion the list had changed. The shaft of the femur was no longer required and instead the patella and testis had been added to the list. I cannot now remember who it was who asked me to attend at the post mortem, but I believe that I obtained the new list from the new senior technician in the medical laboratory, who was Rose Fleming … The other thing which I remember about attending this post mortem is that I think I had it in mind that the laboratory was unable to analyse the material immediately. With Edgar Cartwright having retired a further request was made of me in connection with this death so that I was asked to undertake some simple preparation of the tissue once I had obtained it. This involved dissecting from the gross specimens the hilar lymph nodes. That would not have been a difficult thing to do and I remember putting these into dishes for the furnace and then having to put them into a chest freezer until such time as the laboratory called for them.*

155 Personnel from the Dosimetry Department also attended post mortems; Mr Coulston recalled that between 1972 and 1979 he attended around four to seven examinations. He was not there to collect organs but:

> *to monitor proceedings with a view to ensuring that there was no spillage of material which was potentially radioactive and might cause contamination during the course of the autopsy. I used standard radiological detection equipment from Geiger counters up to equipment which was more complex for that time.*

156 Mr Coulston was in charge of the whole body monitor (WBM)[77] at Sellafield. From time to time, Dr Schofield made lungs taken at post mortem available to him to assist in calibrating the machine. Mr Coulston would place them in a "phantom",[78] which would then be assessed in the WBM. The lungs would then be returned to Dr Schofield for radiochemical analysis and the WBM results could be compared with those of the radiochemical analysis.

Other regions

157 Although in the vast majority of cases in which organs were taken for analysis the post mortem was authorised by the Coroner for West Cumbria,[79] coroners in other areas were sometimes involved. Organs were still collected by Sellafield staff. Both Dr Schofield and Dr Wood attended post mortems outside West Cumbria and on one occasion Ms Irlam collected the organs of an Aldermaston employee from Basingstoke; she denies this, but the audit trail is clear and she must be mistaken.

158 SMOs from the other sites also helped. The SMO at Capenhurst, Dr Eric Barker, assisted in two cases involving workers from that site.

- In one,[80] as Dr Schofield noted, *"Dr Barker did not hear … until late in the day that the post mortem had been undertaken and he was unsuccessful in getting in touch with* [the pathologist] *in order to collect autopsy samples for radiochemical analysis."* No further action was taken until Dr Schofield was told by the coroner's officer that the coroner, having spoken to a colleague, had decided that organs should be analysed and had asked the pathologist to perform a second post mortem. Dr Barker accordingly attended, collected the necessary specimens and delivered them to Dr Schofield. Although Dr Schofield suggested to the coroner that the organs could be divided between him and the NRPB for independent analysis, and kept some of the organs in the deep freeze at Sellafield pending such examination, the Inquiry has seen no evidence that it actually happened. Plainly, Dr Schofield considered that organs would have been provided to BNFL at the outset had Dr Barker managed to get in touch with the pathologist; the implication is that that reflected his own experience in West Cumbria.

77 See chapter 2, "Science"

78 A representation of a human thorax with similar radiation-absorbing properties

79 See paragraph 132

80 John Grain: see chapter 13, "The Families"

- In the other, Dr Barker again missed the original post mortem but was able to obtain the organs afterwards from the pathologist after the coroner had asked that radiochemical analysis be carried out.

In both cases there was coronial authority for the organs to be analysed.

159 Similarly, after the death of a Sellafield worker who had transferred to Winfrith,[81] the SMO there, Dr Laylee, attended the post mortem and obtained organs for analysis under the coroner's authority. Dr Laylee was thanked by the UKAEA CMO, Dr Maurice Hill, for *"being so successful in getting the samples; no doubt your close liaison with local hospitals and the patient's doctor helped."*

160 At Springfields, too, the SMO, Dr Goodfellow, clearly knew what was expected of him. One example is Mr Gee, discussed above;[82] Dr Goodfellow attended the post mortem and retrieved the lungs and trachea, two ribs and the sternum for analysis at Sellafield.

Delayed post mortems

161 The Inquiry heard that on one occasion the post mortem examination was delayed for 24 hours so that a representative from BNFL could attend. Mr Michael Brennan[83] died on Saturday 14 February 1987 in the operating theatre at West Cumberland Hospital from a ruptured abdominal aortic aneurysm. His death was appropriately reported to Mr Taylor on the Monday morning. Mr Brennan's son recalled:

> *Arrangements were made for the post mortem examination to be undertaken on Monday … but I was told by either my mother or brother that it had been put back to Tuesday … because BNFL were to attend … We were never asked whether it was alright for BNFL to attend but simply told that they would be there ... At the time I did not think anything of the delay in post mortem: it is only recently that I have found out what actually happens at a post-mortem examination but then I did not think there was anything sinister or unusual in BNFL's request.*

81 James Connor: see chapter 13, "The Families"

82 See paragraphs 114–117

83 Mr Brennan is discussed in more detail in chapter 13, "The Families"

In fact, it was unusual for a family to be told that someone from BNFL had attended the post mortem: in many cases they remained in ignorance until they made contact with the Inquiry and were shown the post mortem report.

162 Dr Lawson attended the post mortem and Dr Smith supplied him with vertebrae, ribs, sternum, a femur, both lungs, both kidneys, liver, spleen, marrow, and mediastinal and hilar lymph nodes. The organs taken had no possible connection to the cause of death. Consent to their removal was not sought from Mr Brennan's family. No inquest was held.

Re-opening bodies

163 The Inquiry received conflicting evidence on whether bodies were re-opened after the post mortem was finished. Dr Smith denied that it ever happened, whether the deceased had worked at Sellafield or not. Mr Chapman, in contrast, said that it was not uncommon for him to be asked in the ordinary course of his duties to re-open bodies so the pathologist could examine organs which had not been adequately examined in the course of the post mortem:

> *it was not uncommon for funeral directors to be kept waiting at the hospital to collect a body because even after post mortem examination and reconstitution the body had subsequently been reopened for one reason or another. Sometimes this would be to enable the pathologist to look at an organ which he had omitted to examine or, in the Sellafield cases, it could be to provide Dr Schofield with the organs he requested but which had not been saved for him at post mortem examination.*

164 Mr Chapman remembered once being asked by Dr Smith to retrieve the body of a Sellafield worker from the mortuary fridge because Dr Lawson wanted to obtain organs. On that occasion, as Dr Lawson requested, he had re-opened the body, recovered the organs and removed for him a femur, some ribs and some vertebrae. The details Mr Chapman provided were consistent with the facts of a number of cases, so the Inquiry was unable to identify the deceased: it was not possible to find any evidence to confirm Mr Chapman's account.

165 On one occasion, the funeral of a Sellafield worker, Gerard Grears, was postponed at the last moment because a second post mortem examination had taken place, at which organs were removed for radiochemical analysis. The facts are complex and are discussed in detail in chapter 13, "The Families".

Post mortem reports

166 The bulk of the post mortems undertaken in West Cumbria at which organs were taken for analysis at Sellafield were performed by Dr Smith (20), Dr George Ghazala (15) and Dr Whitehead (ten) although many different pathologists were involved over the years and at other locations. The three West Cumbrian pathologists had different approaches to recording the fact of organ removal in their post mortem reports.

- Dr Ghazala was appointed in 1983 and died in 1999. He recorded organ removal in all 15 cases in which he was involved, in 13 of those listing which organs were removed.
- Dr Smith was appointed in 1967 and retired in 1998. He gave complete information on only one occasion, although he mentioned organ removal in a further nine.
- Dr Whitehead was appointed in 1970 and moved to Bristol in 1979. Like Dr Smith, he listed the removed organs in only one report. He mentioned removal in a further two.

167 In 17 post mortems performed by Dr Smith and Dr Whitehead, the fact that organs had been taken and provided to BNFL for analysis was not mentioned. Dr Smith said:

> *that is not a deliberate omission on my part to keep secret the fact that this was done and simply reflects my failure to note it ... in some of my post mortem reports … I have specifically referred to the retention of organs, whilst in other cases I have not.*

Dr Whitehead said:

> *If I removed any organs at post mortem but did not return them to the body then my usual practice was to record this on the post mortem report. Examples of this can be found in* [three of the ten] *… in the other* [seven] *cases where organs were provided to Sellafield … no such note was made. I cannot now explain why my general practice was not followed in those cases.*

168 The Inquiry cannot conclude that the failure properly to record retention in the post mortem reports constituted a deliberate attempt at concealment. Sufficient information was given in enough of the reports for coroners to have become aware of what was taking place, had they paid proper attention.

What organs were taken?

169 Although it had been known to those specialising in the field since at least the 1950s that plutonium in the body tended to concentrate in bone, lung and liver, the pathologists who removed the organs would have had no real idea which were of importance in radiochemical analysis and so would have done as they were asked. An extraordinary range of organs was taken in the Sellafield cases. The liver was taken in all 64 cases and one or both lungs in 63. Vertebrae, sternum, ribs, mediastinum/lymph nodes, spleen, kidneys and femur were removed in the majority of cases.[84] Testes were taken in 26 cases while other organs taken from time to time included the brain, heart, patella and tongue. In AA's case,[85] the extent of retention was vast: both lungs, brain, ribs, sternum, vertebral bodies, liver, both testes, both kidneys, spleen, heart, both complete femora, leg muscle, thyroid, aorta and glands, mesentery, ileum, stomach, mediastinal glands and mediastinal tissue.

170 There is no evidence that Dr Schofield himself (or anyone else at Sellafield) removed the organs from the body in any case; several witnesses told the Inquiry that there was no such direct involvement.

Organs irrelevant to the cause of death

171 Dr Smith conceded that *"in some of the cases where I removed organs it could not be argued that radiation was of any possible relevance to the death and I assumed that Dr Schofield was taking organs in those cases for 'control' purposes"*. He accepted that this was inappropriate. One obvious example was Michael Brennan.[86] Another was Mr Edward McMullen,[87] a Sellafield worker who had died in West Cumberland Hospital a month after sustaining a head injury at home. His death was reported to the Coroner for West Cumbria, Mr Gough, and after the post mortem Dr Smith certified the cause as bronchopneumonia due to the head injury. The post mortem report does not refer to organs being removed, but analytical records at Sellafield show that Dr Schofield received anterior vertebral bodies, sternum, two ribs, a lung, kidney, liver, spleen, mediastinum, muscle, tissue and glands. An inquest was opened and concluded by Mr Gough, who recorded a verdict of

84 In 57, 55, 52, 49, 47, 41 and 35 of the 64 cases respectively

85 Where the deceased had been involved in a major contaminative event many years before his death: see paragraph 118

86 See paragraphs 161 and 162

87 Mr McMullen is discussed in more detail in chapter 13, "The Families"

misadventure without sight of the analytical results, which were not yet available.

172 Mr McMullen's organs were analysed not at the coroner's request, but for research. There is no evidence of consent on the part of the relatives. Dr Smith conceded that the organs analysed had no relevance to the cause of death and said that he had removed them only *"because I was specifically asked to by Dr Schofield"*. Mr McMullen had been permanently excluded from work with plutonium in 1961: his scientific interest to Dr Schofield is obvious.

173 Dr Smith said that he told the coroner whenever he removed organs for Dr Schofield and the coroner had never objected to the practice. Mr Taylor, the only West Cumbrian coroner from whom the Inquiry was able to hear evidence,[88] denied that he had been so informed. This conflict cannot be resolved from the documents seen by the Inquiry, but on either account Dr Smith's provision of organs to Dr Schofield in cases where there was no history of exposure to radiation (whether for *"control purposes"* or not), or where the cause of death could not be linked to radiation, was unjustifiable.

Storage of organs pending analysis

174 Organs brought to Sellafield were weighed, labelled and stored in a fridge freezer in Building 405 (B405) which housed both the Medical Department and the analytical laboratories. A form naming the deceased and listing the organ weights would then be sent to Ms Jones in the Medical Department where it would be kept in a box file in a locked cabinet. After the building was extended in the early 1980s, the organs were kept in a freezer in a room on the top floor of B405, with a "no entry" sign on the door, reserved for that purpose. The room was kept locked; Mr Cartwright was in charge of the key.

175 The organs would remain in the freezer until laboratory time was available for their analysis.[89] A form detailing the weights of the organs and the personnel number (but not the name) of the deceased would accompany the organs to the Analytical Services Department. Dr Schofield would specify the radionuclides to be assayed.

176 Analysis of post mortem samples was a complex process. Given the laboratory's other routine commitments, on many occasions there was considerable delay before it could be done. It was not uncommon for it to

88 His predecessors had died before the Inquiry was constituted

89 See paragraphs 180–182

take more than six months for the analytical process to be concluded; in eight cases the time exceeded 12 months, in two it was nearly three years and the longest was more than four. Such delay, which no doubt reflects pressure of work in a busy laboratory, would be unacceptable if the analyses were genuinely for coronial purposes, since the inquest could not take place until the results became available. Ms Jones remembered the laboratory being cleared of other work when organs were being analysed (as happened at Harwell)[90] but analysts who had worked at Sellafield had no such recollection.

Analysis

177 The Inquiry heard evidence from several Sellafield analysts. Their work was predominantly urinalysis; by 1980 the laboratory was processing up to 40 samples of urine each day and between ten and 20 faecal samples per week.

178 The Inquiry heard that analysis of organs was an infrequent event, and that evidence is consistent with the number of cases collected by Dr Schofield and his successors. The work was usually undertaken by one of the senior and most skilful analysts. No pressure would be placed on the individual to finish the analysis: the priority was to get the job done properly.

179 The Inquiry was told that the medical officer would telephone the laboratory to ask for post mortem specimens to be analysed. If the work could be done promptly, the analyst would collect the organs in silica dishes; each had an identification number and contained cellulose powder to aid the reduction of the organs to ash.

Analytical process

180 The analytical process was started by ashing the organs in a high-temperature furnace overnight. The following morning, if no radioactivity could be detected in the ash (as was in practice always the case), the process was continued by dissolving it in strong acid. Ultimately, a liquid solution was produced which was kept in a glass or plastic container, ranging in size from 250ml to 1 litre depending upon the size of the original sample.[91]

90 See chapter 6, "The United Kingdom Atomic Energy Authority"

91 The analytical process is set out in more detail in chapter 2, "Science"

181 Three aliquots were taken from the solution and the radionuclide to be analysed[92] was electroplated onto steel discs. The discs were then transferred to counting trays, 1-inch diameter containers made of stainless steel, where a sensitive detector was used to quantify the radioactivity of the sample. At the end of the process, the analyst would have three sets of results; if they were consistent, they were sent to the Medical Department.

182 Those working in the laboratory were not told the cause of death or given any information on the history of exposure to radiation, nor were they able to identify the individual from whom the organs had been taken. They did not know what the Medical Department intended to do with the results or even whether the analysis had been requested by the coroner. Their role was simply to process the specimens and provide the results, which were recorded on the form sent with the organs from the Medical Department. Ms Jones then married up the personnel number with the name of the deceased and filed the final data sheet.

Onward transmission of organs

183 In the first three Sellafield cases, the analysis was performed at Woolwich and Harwell. In the early 1970s, Dr Schofield sometimes sent organs to Dr Donald Popplewell[93] at the NRPB, presumably as a check on the results from the laboratory at Sellafield. Dr Popplewell told the Inquiry that he first analysed a human organ in 1972; a paper[94] he published in 1975 described results from two Sellafield workers who had died that year. Both were coronial cases; the Inquiry has seen no evidence that the coroner was aware of the arrangements Dr Schofield made with the NRPB.

184 When litigation had been initiated or was in prospect, the organs were sometimes divided and shared with the family's medical expert (who on occasion attended the post mortem), to allow for an independent analysis. Otherwise, the only analysis took place at Sellafield.[95] This may reflect both that the analytical process required as much tissue mass as possible and that there were very few laboratories in the UK capable of carrying out such analysis.

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92 Usually plutonium, but sometimes also americium

93 Group Leader and Principal Scientific Officer at the NRPB: see chapter 8, "The National Radiological Protection Board" for further details of the NRPB's role and Dr Popplewell's duties

94 Popplewell DS, *Determination of the Plutonium Content of Post Mortem Tissues from Two Workers who were Exposed to Plutonium*, NRPB Report, NRPB-R38, September 1975

95 There were of course exceptions: in one particularly unusual case, lung samples were sent to Harwell; in another, the nature of the deceased's work at Sellafield made it inappropriate for his organs to be analysed there and the work was done by the NRPB

185 Aware of the close links established by both Dr Schofield and Dr Lawson with researchers in the US, the Inquiry investigated carefully whether any organs had been sent to the United States Transuranium and Uranium Registries (USTUR)[96] and found no evidence that this had ever happened. However, Dr Schofield did send analytical results derived from 35 nuclear workers to the US and Dr Lawson continued to exchange information; in total, data from 51 UK cases[97] were sent to the USTUR. In every case the individual's name was disclosed and in the majority clinical and occupational information was also provided: this was an obvious breach of confidence. The data provided have never been publicly evaluated or used in studies by US researchers and have since been erased from the USTUR.[98]

186 Analytical data were also passed to organisations such as the NRPB. Dr Dolphin, who had worked for the UKAEA's RPD before moving to the NRPB, refers to Dr Schofield's work in a paper in 1970[99] and co-authored Dr Schofield's first published paper on the post mortem work in 1974.[100]

Reports to the coroner

187 When no inquest was held,[101] the analytical results were generally not sent to the coroner. There were only four exceptions and there is no evidence to suggest that the coroner, who had in two of those cases issued the death certificate almost three years before, reconsidered the death in any way. The general reasons for delay in analysis have been discussed in this chapter (see paragraph 176) but these are extreme examples.

188 Even in the 24 Sellafield cases in which an inquest was held, the results were often not sent to the coroner beforehand: half of the inquests concluded before the analysis had been completed.[102] The failure to wait for the results struck the Inquiry as bizarre, particularly given the circumstances of some cases: in one, for example, the coroner knew the pathologist had taken

96 See chapter 10, "Registries"

97 Forty-six post mortem cases and one biopsy case involving Sellafield workers, and four post mortem cases relating to Aldermaston workers, sent in three batches of 14 cases (by Dr Schofield in the mid-1970s), 21 cases (by Dr Schofield in the early 1980s) and 16 cases (probably by Dr Lawson in 1985)

98 For further information, see chapter 10, "Registries", paragraphs 44–47

99 Dolphin GW, The biological problems in the radiological protection of workers exposed to ^{239}Pu, *Health Physics*, 1971, 20: 549–57

100 See note 47, above

101 Thirty-six cases. Given that the coroner had not opened an inquest there was in any event no legal basis for special examination: see chapter 3, "Law and Guidance".

102 In four of those cases the analytical results would have been of no significance whatsoever to the inquest, as death followed an incident wholly unconnected to radiation exposure, such as a fall or accident

organs for radiochemical analysis and yet completed the inquest just two days later when the analysis had probably not even begun; and in another, the analysis was completed just one month after the inquest, which could easily have been delayed to allow that evidence to be presented.[103]

189 In another case, Dr Lawson communicated the results and his interpretation of their significance to the coroner[104] by telephone. The coroner then, contrary to the provisions of the Coroners Rules, "closed" the inquest in his own office, writing to the widow to inform her of his decision. The interpretation of the results had not been formally received in evidence, as the Rules required, and the widow had been afforded no opportunity to question Dr Lawson. The coroner later represented wrongly to the widow that the tests undertaken *"involved biopsy samples only"*.

190 In other cases, the results presented to the coroner at the inquest were incomplete: all the organs obtained at post mortem were analysed but only some of the results were reported. For example:

- in one case the post mortem report records that both lungs, a kidney, the whole liver, lymph nodes, a femur, the sternum, three ribs, three vertebral bodies and the spleen were taken; BNFL's laboratory documentation also records analysis of testis; yet the results from the testis, ribs and femur were not sent to the coroner;
- in another, the results from lymph nodes, spleen and ribs were not sent;
- in a third, the lymph nodes, kidneys, testes, ribs and patella were all analysed in addition to the organs actually referred to in Dr Lawson's report.

191 SL's explanation to the Inquiry was that it *"may well have been a matter left to the expert discretion of the Chief Medical Officer"* to decide which results to include in his report. Dr Strong suggested that Dr Lawson was not simply offering a reproduction of the analytical results but was giving an expert opinion, which he could base on whatever he regarded as the most important of the results: the exclusion of some data was merely an exercise of discretion. SL also observed that in some instances the levels of radioactivity revealed by analysis of some organs were so low when compared to the levels in the other organs referred to in the report[105] that a

103 Mr Taylor was involved in neither of those cases, respectively John Simpson and Malcolm Pattinson: see chapter 13, "The Families"

104 For the avoidance of doubt, the coroner was not the Coroner for West Cumbria; its duty to preserve the family's anonymity prevents the Inquiry from providing more detailed information

105 By a factor *"of 100 or more"*

view had clearly been taken (and on occasion communicated to the coroner) that there was no point in including the results in the formal report.

192 The Inquiry considers that the reports should have contained all the analytical results, with an explanation of why some were considered unimportant. However, it has seen no evidence that any significant result was excluded from any report.

193 Mr Taylor was asked about the discrepancy between the post mortem reports, which in these instances detailed which organs had been taken for analysis, and the expert reports which did not include all the results. He said that he had simply not noticed the discrepancy but accepted that a proper reading of the papers before him at the time would have alerted him to the position.

Disposal

194 The analytical process was destructive. The Inquiry was told that some residual solution would be kept in case there was a problem with the analytical procedure; due to the low throughput of specimens it was easy to spare a couple of shelves where they could be stored. That evidence was consistent with a note in the occupational health records of one of the Sellafield workers from whom organs were taken at post mortem: in November 1983, Dr Schofield was reported as indicating that samples were retained in liquid form *"indefinitely"*.

195 Any residual ash which had not been dissolved was retained and stored in plastic containers. The counting trays were held until the analyst was confident that the results were correct and then disposed of by placing them into a cardboard tube, with a metal lid, which was then sent to Drigg.[106]

196 In 1992, the analytical services laboratories were moved to the Geoffrey Schofield Laboratories (GSL) at the Westlakes Science and Technology Park, a few miles from Sellafield. It was obviously planned that analysis of organs should continue: the building included a laboratory specifically designated for the purpose. However, the Inquiry found no evidence to suggest that any organs were ever received by the GSL.[107] All discs,

106 The Low Level Waste (LLW) Repository near the village of Drigg, four miles south of Sellafield, has operated as a national LLW disposal facility since 1959. Since a major upgrade in 1995, waste has been compacted and put in containers before being placed in concrete vaults

107 The last time in which organs taken at post mortem were analysed was in 1991; those organs were probably ashed at Sellafield but as the results were not produced until 1993 it is likely that some of the *"wet chemistry"* was undertaken at the GSL

solutions and ashed samples were moved and stored in the new post mortem laboratory.

Retention at Sellafield

197 SL has assured the Inquiry that no human tissue is now stored at Sellafield. This issue was raised at some point between 1999 and 2003 by the then CCMO, Dr Slovak;[108] after a search of both existing and former Medical Department facilities, Dr Slovak was advised that no tissue had been found. During an associated search for human tissue at the GSL, several bottles containing concentrated nitric acid solutions[109] had been found in a cupboard and SL *"assumed that* [the solutions] *were disposed of* [at the time] *according to the normal laboratory practice adopted in respect of hazardous chemicals"*, but was unable to provide any evidence to support this hypothesis.

198 The Inquiry came across the cupboard in question on a visit to the laboratories. It was locked but was opened at the Inquiry's request. An inventory of the contents was prepared and photographs taken. Several ashed samples, some containing small fragments of bone, were present. Inspection of laboratory records and other documents allowed those samples to be traced to two Sellafield workers whose organs had been retained at post mortem. Their relatives have not made contact with the Inquiry and best practice demands that the Inquiry does not initiate contact with them.[110]

199 The specimens are not covered by the provisions of the Human Tissue Act 2004: they do not constitute *"relevant material"*, as defined by the Act,[111] since, even though some bone fragments remain, all the cells have been destroyed. Regardless of the legal niceties, SL *"considers that as a matter of present day ethics, the samples should properly be treated with respect and dignity, as material derived from human tissue"*. It has therefore agreed to

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108 Presumably in response to the issues of organ retention raised by the Alder Hey and Bristol inquiries: *The Royal Liverpool Children's Inquiry Report*, HC12-II (TSO, 2001) and *Learning from Bristol: The Report of the Public Inquiry into Children's Heart Surgery at the Bristol Royal Infirmary 1984 –1995*, Cmd 5207 (TSO, 2001)

109 Documentation indicates that the solutions related to 11 former Sellafield workers

110 Brazier M. Organ retention and return: problems of consent, *Journal of Medical Ethics* 2003, 29: 30–33. *"A final question was raised about how to return organs which were taken a long time ago and which the family had no idea had been retained. The* [Retained Organs] *Commission advises that unless families contact you, the best policy is to remain silent. Some hospitals and coroners have not done this and have proactively and independently contacted families. The result has been a lot of heartache."*

111 The Human Tissue Act 2004, s51 defines *"relevant material"* as *"material … which consists of or includes human cells"*

keep the ashed specimens for a year to enable the relatives, should they come forward, to be involved in the decision regarding disposal.

200 The cupboard also contained ashed blank specimens,[112] an ashed filter paper[113] and 13 tins of counting discs. Each disc had a unique identifier engraved on the back. While it would have been possible to use the identifier to associate a name with each disc, SL did not consider this to be appropriate: it regards the discs as laboratory equipment, since they contain only the radionuclide separated out for measurement and no material derived from human tissue. The Inquiry agrees.

Post mortem and other analytical data

201 Mr Brian Wallace was Medical Systems Manager at Sellafield from 1981 to 1991. He assisted the Inquiry in understanding what documentation was generated by the post mortem work and how the data were held. He told the Inquiry that, in or around 1983, Dr Schofield decided that all the analytical data from the post mortem work should be put on to computer: until then they had been held on paper, the post mortem data in the Company Chief Medical Office and the *in vivo* data (from urinalysis etc) in the bioanalytical laboratory. After the historical information had been entered, any new data would be put on to computer immediately upon receipt. Access to the computerised data was heavily restricted and very few people had unlimited access.

202 The Company Medical Office position paper produced by the Health and Safety Directorate in August 1988[114] confirmed that Mr Wallace was *"responsible for maintaining the* [post mortem] *database, production of statistics and briefs as required"*. However, the CCMO was considered to bear ultimate responsibility for the database: on 1 November 1989, Dr Lawson noted:

112 Relating to analyses carried out in respect of two other Sellafield workers but not derived from their respective tissue

113 Once a sample was ashed, producing an inorganic ash, it was subjected to dissolution using nitric acid. The resulting solution was filtered using a filter paper. Any insoluble residue in the filter paper was ashed, with the filter paper, to remove silicates. This ash, relating to the procedure undertaken to analyse a sample from the ribs of a former Sellafield worker, was what was identified in this instance

114 See paragraphs 98 and 99

> *the Company Autopsy Database is essentially Sellafield medically related data … former employees can be readily identified and in some cases clinical details are contained within the files. It follows therefore that this database must be under the jurisdiction of a designated medical officer.*
>
> *Our current autopsy database is held by me as Company Chief Medical Officer based at Sellafield. However following my retirement responsibility for the conduct of the post-mortem tissue analyses and retention of the database will automatically fall on Dr Robin Wood as Sellafield Senior Medical Officer. In addition he will be the immediate point of contact for H.M. Coroner in West Cumbria in the event of an inquest necessitating the radiochemical analysis of post-mortem tissues. In my opinion therefore Dr Wood should be the named person with responsibility for this medically confidential database.*

203 Although Dr Lawson anticipated that when he retired Dr Wood would inherit responsibility for the database, Dr Wood told the Inquiry that he had received from Dr Lawson only:

> *a list of names which contained post mortem information. Essentially this was dosimetry data and its importance, I understood, was that the names on the list related to all those individuals who were ex-Sellafield employees for whom analytical post mortem work had been undertaken. The list was possibly three pages in length and identified the individuals by name. The extent of the analysis was also clear in that the organs taken were listed with the results noted as activities either by way of picocuries or becquerels. There was also information as to wet and dry weights.*

He was adamant that he received no other data from Dr Lawson:

> *In particular, he did not hand over to me any lever arch or ring binder files, nor did he mention to me that further data and information was held on computer. I did know in a general sense, however, that efforts were being made to transfer historical written records to electronic records. He did not make any reference to the fact that more information might be held elsewhere but simply asked me to take charge of the list.*

Dr Wood duly retained the list, unused, until his own retirement some six years later when he gave it to Ms Wendy Battersby, in the Dosimetry Department.

204 It is evident from a manuscript note headed *"autopsy data search"*, which is undated but was prepared in 1992 or 1993[115] by Mr Wallace, that the post mortem database consisted of more than that simple list. The note confirms the SMO's responsibility and gives further background on the information held, but also indicates that Mr Wallace himself was now in possession, on loan, of the *"master autopsy file"*:[116]

> 1. *Medical dossiers do not mention that an autopsy has been performed on an individual. Our medical data search therefore does not identify autopsy cases.*
> 2. *Risley supply us with the organ/cause of death for compensation cases but don't tell us if there has been an autopsy.*
> 3. *Until recently the master autopsy file was held by the SMO and was difficult to access (I presently have this in my office on extended loan).*
> 4. *Autopsy data has been treated on a "need to know" basis by medical dept. making it difficult to find out if an autopsy has been done. A reliable list of cases was not available in the past …*
>
> <u>*Current position*</u>
>
> 1. *I have the master file of autopsy data in my office. The data is therefore readily available and a master list of names is available to the assessors.*

205 It is not clear what became of the *"master autopsy file"*, but given that no further post mortem work was undertaken after 1991 it is perhaps unsurprising that it was not a primary concern of subsequent CCMOs at Sellafield. Dr Macgregor, who has been CCMO since April 2003, told the Inquiry that he became aware of the historical post mortem work not through receipt of any discrete file but rather from Dr Schofield's 1980 paper.[117] It was not until 2005, when he became involved in a project in which it was proposed to look retrospectively at the post mortem data held at Sellafield, that he began to look for relevant documentation. He found six

115 The note refers to searches carried out in December 1991 and so must post-date that; it also bears an inscription stating that it was copied to another individual on 13 April 1993. It was probably prepared in connection with the Compensation Scheme for Radiation-Linked Diseases (see paragraphs 252–256)

116 It is unclear why Mr Wallace should have held the file at this point given his recollection that in 1991 he had moved to the accountancy department from his previous position of medical systems manager

117 See note 53, above

lever arch files of analytical data in the Medical Department and retrieved the occupational health records, some of which had been archived, of the individuals named in them. His concern that organs appeared to have been taken even when the death was not obviously related to radiation ultimately led to the establishment of the Inquiry,[118] to which he has disclosed all relevant documentation that he has managed to trace.

Errors in the data

206 In 1987, Mr Wallace merged the post mortem data held in the Medical Department with relevant data held in the bioanalytical laboratory. On 13 May 1987, he advised Dr Lawson that he had completed the task and provided him with two sets of data: the first was for 55 ex-Sellafield workers and the second (including one biopsy) was for nine workers, not necessarily all from Sellafield, who were still unidentified:

> *The data has not been validated and because of the secrecy associated with these particular analyses and that the samples cover a 25 year period it may not be possible to complete such an exercise.*

207 In about 1988, Mr Wallace began to obtain more information from West Cumberland Hospital about organ weights as detailed in post mortem reports to assist his evaluation of the data. It is likely that this review was in preparation for a conference in Malvern of the Society for Radiological Protection (SRP), at which Dr Lawson was to present the analytical results of organs taken from 61 Sellafield post mortem cases.[119] On 5 December 1988, Mr Wallace reported to Dr Lawson:

> *As you are aware I have for some time been concerned about the accuracy and completeness of the Autopsy data held by the Company Medical Office. In order to truly evaluate the dataset, Trevor Bates, the Group Manager of the Radiochemical laboratory, made available to me all the radiochemical analysis results that he holds on a non-attributable basis and by comparing these with CMO records and those in the medical department archives I have succeeded in attributing 61 data sets to Sellafield individuals. It is probable that none of the few data sets still requiring positive identification refer to former Sellafield employees, so I now regard this cohort as complete.*

118 See chapter 1, "Introduction"

119 Lawson AW, Wraight JC, Wallace B, Bunker A and Strong R, Plutonium deposition in man: Comparison between excretion and autopsy analyses, in Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP* (*Malvern, June 1989*) (Institute of Physics Publishing, 1989)

Data quality

The first specimens were obtained for analysis in 1962. Not surprisingly, because of the secrecy associated with the analysis of such sensitive samples and what now appears to have been inadequate validation within the medical office, I have discovered a range of errors and inconsistencies.

Mr Wallace tabulated the inaccuracies. He observed that in six cases the errors *"involve an order of magnitude*[120] *in the assessment of the burden to organ as quoted in Factual reports to H.M. Coroner"* and concluded that *"for meaningful analysis to be achieved it will be necessary to recalculate the burdens according to the current protocol"*.

208 Mr Wallace told the Inquiry that the only response to his memorandum was correction of the data on the computer system. His work was not checked and the coroner was not informed. The Inquiry was anxious to explore the inaccuracies and their possible effect both on the quality of the data (and any research arising out of consideration of those data) and on the evidence which had been given to coroners in the form of expert reports. SL was therefore asked to review Mr Wallace's work and to comment on the significance of the identified inaccuracies.

209 Mr Wallace was unable to assist the Inquiry in identifying the six cases in which incorrect data had been put before the coroner. However, Dr Strong, who led the review, was able to identify what he believed to be the six reports and to explain the significance of the errors, which arose predominantly from mistakes in the conversion of units from curies to becquerels and from confusion between ashed weights and wet weights. It was accepted that the coroner had been given bad information but Dr Strong thought that in five of those six cases the errors made no material difference to the outcome, either the verdict at inquest or the determination of entitlement under the Compensation Scheme for Radiation-Linked Diseases (the Compensation Scheme).[121]

210 In the case of Mr Robert McLean, a Sellafield worker who died in March 1987, the error was more significant.[122] Dr Lawson's report to the coroner underestimated skeletal plutonium content by a factor of six and americium content by a factor of four. The correct figures were handwritten on the report held by the coroner but there is no evidence that the impact of

120 That is, the result was incorrect by at least a factor of ten

121 See paragraphs 252–256 and chapter 7, "The Trade Unions and the Compensation Scheme"

122 Mr McLean's case is discussed in more detail in chapter 13, "The Families"

the alterations was discussed at the inquest, nor that the estimate of Mr McLean's radiation dose was altered to reflect the change. Had the correct radiation dose been calculated, the inquest jury would have heard that Mr McLean had been exposed to radiation at well over the normal background level and would at least have considered a verdict of industrial disease. There might also have been implications for an application which was made by Mr McLean's family under the Compensation Scheme.

Conflict of interest

211 The potential for a conflict of interest in BNFL carrying out and reporting on the analysis of organs following the deaths of its workers was obvious. By definition, if the organs had been legitimately taken at coronial post mortem, their analysis would bear upon the cause of death. The analysis would constitute a coronial special examination; an inquest would have been opened; and the coroner, sitting with or without a jury, would have to consider the verdict of industrial disease, the results of the radiochemical analysis being obviously relevant. Dr Schofield's interpretation of those results (which by themselves were meaningless to both the coroner and the jury) was, therefore, at least potentially determinative of the inquest verdict.

212 An inquest is held purely to establish the cause of death; the rules expressly forbid any determination of civil liability. Nevertheless, BNFL considered any inquest verdict to be of considerable importance and relevant to possible subsequent litigation. Before Mr Gee's inquest,[123] BNFL attempted[124] in a series of letters to persuade the coroner that he was not permitted to return a verdict of industrial disease, as this would appear to determine civil liability.[125] The coroner rejected the argument but in due course an open verdict was returned. BNFL's correspondence, contending that a verdict of death by industrial disease could influence what might be decided by the civil court, highlights the potential conflict of interest when its own CCMO was retained by the coroner to give independent expert evidence which might be central to the verdict.

123 See paragraphs 114–117

124 Through its Chief Legal Adviser and Deputy Company Secretary, Mr Peter Green

125 The argument was based on the imposition by the Nuclear Installations Act 1965 of strict liability (that is, no need to show fault) for any injury caused by radiation emitted from material on the site or from waste discharged from the site

213 Dr Schofield, of course, also owed contractual duties to his employers. As CCMO he was required to *"represent the Company's interests in medico-legal matters as necessary"*.[126] Dr Lawson's duty as CCMO was more sharply defined: his most important *"principal accountability"* was said to be preparing:

> *medical documents in respect of common law claims, Coroner's reports or BNF plc Mortality or proposed Morbidity compensation scheme to ensure accurate presentation of the medical facts, to express a considered medical opinion* ***and to minimise the Company's liabilities****.* [emphasis added][127]

The duty to minimise the Company's liabilities clearly sits uneasily with acting as an expert for the coroner, especially as the *"Performance measures"* by which Dr Lawson was to be assessed included *"Amount of compensation paid"* in civil claims for damages. The Inquiry does not suggest that there was anything improper about the analytical process: indeed, the integrity of the laboratory staff, unaware of the identity or history of the deceased, cannot be questioned. Rather, the potential for lack of objectivity lay in the CCMO's interpretation of the results.

214 Dr Schofield himself recognised this potential in two cases in which he was instructed to advise families in connection with claims for damages. In 1975, solicitors instructed by the family of a former Aldermaston worker wrote to BNFL's Company Secretary, Mr Scott, asking BNFL to undertake an independent analysis of organs taken at post mortem. The Treasury Solicitor, acting on behalf of the deceased's former employer, the AWE, had instructed the NRPB to analyse the organs. The solicitors identified a potential conflict of interest:

> *We, of course, appreciate that your Company is in fact a Government body, but the opportunities for analysis are such that there is no one else we know can do it, and we are therefore obliged to seek your assistance.*

215 Dr Schofield discussed the possible conflict with his employer:

> *The general feeling was that we could not honestly refuse this request for help since no other laboratory in the country was capable of producing adequate results from this sort of investigation but it was pointed out that the solicitor should realise that they may be open to criticism in asking BNFL to help in this matter …*

126 As confirmed in April 1979: see paragraph 87

127 As confirmed in March 1988: see paragraph 101

He also discussed it with the solicitor concerned:

> *he fully understood the situation but again as he pointed out he really had no alternative but to ask us to do this work for him. I pointed out the difficulties that might arise for him and these he fully understood.*

Dr Schofield's approach in this case was perfectly proper.

216 The following year, Dr Schofield was asked, in similar circumstances, to advise the family of the late Mr James Connor, a former Sellafield worker who had transferred to Winfrith. The coroner had commissioned expert evidence from the NRPB. Again, Dr Schofield alerted the family's solicitors to the potential conflict of interest:

> *As you may understand, in many ways, the Company cannot be regarded as being an entirely independent contractor for the work since of course it is part of the United Kingdom Nuclear Energy Industry. However we have carried out similar analyses in respect of another legal claim on this understanding.*

217 However, when he prepared his report, Dr Schofield sent it not only to his instructing solicitors but also to Mr Scott, who in turn forwarded it to BNFL's Legal Department. Further, Dr Schofield copied to the BNFL Legal Department all the letters he sent to his instructing solicitor. Those actions were quite wrong. On one occasion, the family's solicitor wrote to BNFL to ask whether there had been any exposure to radiation which might have been relevant to Mr Connor's illness. Dr Schofield was asked to comment by BNFL's Legal Department and detailed an incident many years previously which might have been relevant. The Legal Department amended his description of events, obtained his approval for those amendments, and then sent the information to the family's solicitors. Accordingly, information was provided to the family's solicitors by the medical expert whom they had instructed, but under the auspices of the other side's Legal Department. The uncomfortable nature of Dr Schofield's position in this case is clearly evident.

218 Dr Schofield's conduct as an expert in Mr Connor's case is outside the Inquiry's Terms of Reference but exemplifies the problem that arose when he was asked by coroners to report after analysis of organs. In both the cases mentioned, the NRPB was already involved and the solicitors' options were limited. In cases which came before the Coroner for West Cumbria,

however, it would have been easy for the coroner to have made use of the NRPB's independent expertise if he felt that there was a genuine need for organs to be analysed.[128]

219 Perception of fairness was another factor that coroners should have taken into account. Geoffrey Southward's son Colin[129] said that he had found out only shortly before giving evidence to the Inquiry that Dr Schofield had attended his father's post mortem. He expressed his *"shock"* at this discovery, and doubted that it had been right for Dr Schofield to be present, given that he had later been instrumental in BNFL's defence of the family's claim for damages:

> *Going back to your question "What do I think a post mortem would be?" it's somebody, a person, undertaking a post mortem, independently, trying to come up with an idea of why that person died, and when I saw* [the post mortem report]*, all of a sudden I remembered back to the seven year fight we had against Dr Schofield, basically, this is where it came up, and then to see that he was actually in that post mortem room, and from looking at this, conducting the show, really, to me it seemed it was him who was calling the shots, "I would like an organ to go here, an organ to go there".*

220 Even at the time, some families perceived a conflict of interest. The widow of one former Sellafield worker, engaged in litigation against BNFL, wrote to Dr Schofield:

> *I recently received a copy of the Post Mortem report ... I was more than surprised to find that you conducted the examination for plutonium content. As we already had started proceedings against B.N.F.L. … surely these tests should have been done by an independent Doctor?*

Another widow said after the inquest into her husband's death:

> *I am concerned that BNFL hold all the cards with the tissue taken away from the post mortem. It would be better, for BNFL even, if there was someone independent in the country who could investigate.*

221 In stark contrast to the two widows quoted above, the Coroner for West Cumbria wholly failed to appreciate the potential for a conflict of interest. Mr Taylor told the Inquiry that in those cases in which he certified the death (thereby concluding his investigation into its cause) before the

128 Dr Popplewell at the NRPB had begun analysing organs for plutonium in 1972: see chapter 8, "The National Radiological Protection Board"

129 See chapter 13, "The Families"

analytical results were available, he nevertheless allowed BNFL to perform the analysis in the expectation that if the results were *"positive"*, BNFL would send them to him. He conceded not only that this was to trust the employer, who might ultimately be found to have had some responsibility for a death, voluntarily to provide evidence which might be harmful to its position, but also that he took no steps to ensure that such information was provided. The Inquiry considered this stance to be naïve and Mr Taylor conceded that in those cases he did not fulfil his duty to investigate the cause of death. The following exchange (which related to one particular case) from the Inquiry's oral hearings shows the inadequacy of Mr Taylor's "investigations":

> ***Counsel to the Inquiry:*** *You never knew. These tissues could have been glowing in the dark for all you know, and you would never have found out.*
>
> ***Mr Taylor:*** *I accept that. I relied on BNFL to tell me what the true results were.*
>
> ***Counsel:*** *So your involvement in this case really served no purpose at all, did it?*
>
> ***Mr Taylor:*** *I managed to get the man buried at the end of the day, that is the only usefulness in this case.*

Co-operation

Payment

222 The families' perception of a possible lack of independence would not have been helped by the fact that, remarkably, BNFL did not charge the coroner for its analytical work. Analysis of post mortem samples was labour intensive and very costly; one analyst who had worked in the Sellafield laboratory suggested to the Inquiry that cost may have been one of the reasons why analysis of organs ceased. Interestingly, BNFL did charge for analysing the organs of the Aldermaston worker referred to in paragraph 214: the worker's union ultimately suggested that BNFL might waive its charges in view of the scientific interest in the results but the suggestion was received without enthusiasm by Mr Scott:

> *should* [BNFL] *waive charges and bear these costs itself or seek only a nominal contribution. Either course seemed to us inappropriate in circumstances where we were being asked to act as an independent contractor, in effect. Any waiver of normal charges could be used to call our motives into question. The scientific interest and knowledge gained were very marginal, since there was never any real question of a significant plutonium uptake.*

Against that background, the Inquiry considers it bizarre that the Coroner for West Cumbria should never have received a request for payment for BNFL's analytical services.[130] Mr Taylor was asked why he thought no charge was levied:

> *I was obviously under the impression that they were doing it as a goodwill exercise … With the benefit of hindsight it would obviously have been better if someone totally independent could have done it.*

223 The Inquiry found no evidence to suggest that either the pathologists or the mortuary technicians ever received payment from Dr Schofield, Dr Lawson or BNFL for their assistance in the provision of organs. BNFL maintained close links with the local hospital, which included making charitable donations and extended as far as the provision of some medical services, and indeed the community as a whole, but there is nothing to suggest that those links were exploited financially to persuade individuals to co-operate. As Dr Roger Berry, the former Director of Health, Safety and Environmental Protection at BNFL, told the Inquiry, it was quite natural that Sellafield, as the major employer in the area, should want such close links:

> *It was important given Sellafield's position that we kept in with the local medical people. There was the potential for ill informed bad publicity for the Company as to the possible consequences of radiation exposure and we considered it important that the medical professionals did not perpetuate that bad publicity by giving a false impression as to the risks and dangers of radiation exposure. By keeping closely involved with the local medical community we could ensure that the doctors were properly educated as to the risks. BNFL also contributed financially to the local hospital and this would have strengthened those links.*

130 The NRPB always charged coroners for analysing organs as an independent contractor, usually in the region of £1,000 to £2,000

Personal links

224 Dr Schofield himself established close working relationships with doctors at West Cumberland Hospital, particularly the consultant pathologists. One, Dr Whitehead, told the Inquiry that very soon after his arrival in 1970 he was invited by Dr Schofield to *"have a look round Sellafield with him"* and during that tour:

> *he told me that he was undertaking research into the radiation exposure of workers for whom he was medically responsible. This seemed to me to be a valid and worthwhile project. Having made sure that the Coroner had no objections I then arranged for Dr Schofield to receive the human tissue samples he required.*

This approach echoes that made to Dr Smith, with whom his relationship was sufficiently strong for Dr Schofield to ask him on one occasion to travel some 400 miles to perform a post mortem for a coroner whose local pathologist was reluctant to proceed.[131] As Dr Schofield, Mr Gough and Mr Walker are dead, the Inquiry has been unable to explore their relationships but has been told that Dr Schofield was friendly with both Mr Gough and Mr Walker.

Use of the data

225 The potential scientific benefits of the post mortem work were obvious. The principal aim was to compare *in vivo* estimation of plutonium uptake, by urinalysis, with actual organ content of plutonium, determined by radiochemical analysis. It was widely suspected that the equation used to calculate plutonium uptake from urine data, known as the Langham formula,[132] was inaccurate and in 1985 Professor Stephen Jones, who at the time managed the dosimetry group at Sellafield, confirmed that it did indeed over-estimate plutonium uptake up to tenfold.

226 Professor Jones published a more accurate formula,[133] derived from a re-analysis of Langham's original urinalysis data together with some additional urinalysis data from Langham's subjects. His paper mentions examination of analytical results of organs taken from 27 Sellafield workers.

131 See paragraph 120

132 See chapter 2, "Science"

133 Jones SR, Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake, *Radiological Protection Dosimetry*, 1985, 11(1): 19–27

Data from five of those were particularly helpful in validating the new formula, although those from the remaining 22 were also of use: as Professor Jones told the Inquiry: *"I don't think, without doing* [the comparison]*, the study would have stood up … as a scientific conclusion which said: using this function would be a good way of doing plutonium dosimetry"*. His formula became widely accepted and was in due course approved by the Nuclear Installations Inspectorate.

227 In its submissions to the Inquiry, SL accurately set out some of the scientific benefits of the post mortem work:

> *The radiochemical analysis of tissue samples obtained from workers at autopsy has enabled those involved with radiological protection to interpret with confidence the results of routine monitoring measurements, such as urinalysis results. This assurance that the findings of routinely available measurements could be used to provide acceptable and reliable levels of radiological protection permitted the (often intense) demands for the production of essential materials for use in weapons or electricity generation to be met while also meeting the contemporaneous requirements of radiological protection. The results of studies of autopsy tissues sampled from nuclear industry workers have formed part of the assessments made by authoritative scientific committees when examining the hazards posed by radioactive materials, such as the assessment of plutonium metabolism conducted by the ICRP and the assessment of plutonium toxicity conducted by the Committee on Protection against Ionising Radiations of the MRC.*

228 The results of the post mortem work have also been used in epidemiological studies of the Sellafield workforce which investigated the risks to health of occupational exposure to radiation and radioactive substances.[134]

Publications

229 Several scientific papers which used the data were published. The early work on Springfields workers was described in papers by Dr Alan Butterworth and Dr F Meichen, and alluded to by Dr Dolphin in a paper [135]

134 See, for example, Omar RZ, Barber JA and Smith PG, Cancer mortality and morbidity among plutonium workers at the Sellafield plant of British Nuclear Fuels, *British Journal of Cancer*, 1999, 79: 1288–1301

135 See paragraphs 32, 35 and 41

in 1964. Publications[136] in 1973 and 1974 referred to the work in an overview of UK and US studies which illustrated why research on the radionuclide content of human organs was of greater value than research on animals.

230 The data derived from the Sellafield workers generated rather more publications. Dr Dolphin, Dr Schofield and Dr Lawson were contributors to or sole authors of the following papers:

- Dolphin: The biological problems in the radiological protection of workers exposed to ^{239}Pu.[137] In this paper, presented in May 1970, Dr Dolphin referred to *"data about the distribution of Pu in man following occupational exposure from the analysis of tissue obtained at post mortem"*.
- Schofield and Dolphin: UK experience on the medical aspects of radiological protection of workers handling plutonium.[138] This paper described the results from ten Sellafield cases: see paragraph 76.
- Schofield: Biological control in a plutonium production facility.[139] This paper refers to 29 analyses having been carried out since 1964, concluding: *"it is fairly clear that the plutonium is preferentially deposited in the bones, liver, lung and the tracheo-bronchial lymph nodes … It is important that there should be a continuing accumulation of autopsy data to allow more comparisons to be made with in vivo estimations"*.
- Schofield: Comparisons between in-vivo estimates of systemic Pu deposition and autopsy data.[140] By now Dr Schofield was able to report on 37 nuclear workers, of whom 30 had been occupationally exposed to plutonium; he remained of the view that *"many more cases need to be investigated … Due to the variable concentrations of plutonium in the different bones efforts to obtain whole bodies for assay should be undertaken"*.
- Lawson et al: Plutonium deposition in man: comparison between excretion and autopsy analyses.[141] Dr Lawson noted that *"Our autopsy database now has records for 61 former Sellafield employees"*.

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136 Hursh JB and Spoor NL, Data on man, in Hodge HC, Stannard JN and Hursh JB, eds., *Uranium, Plutonium, Transplutonic Elements: Handbook of Experimental Pharmacology* (Springer-Verlag, 1973), pp 197–240; Adams N and Spoor NL, Kidney and bone retention functions in the human metabolism of uranium, *Physics in Medicine and Biology*, 1974, 19: 460–71

137 See note 99, above

138 See note 47, above

139 See note 53, above

140 Schofield GB, Comparisons between in-vivo estimates of systemic Pu deposition and autopsy data, in *Radiological Protection – Advances in Theory and Practice. Proceedings of the 3rd International Symposium of the Society for Radiological Protection*, vol 2 (1982), pp 525–9

141 See note 119, above

231 Several papers by others not directly involved in the post mortem work referred to the data:

- Jones: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake.[142] This was the seminal paper in which the revised urinary excretion function for plutonium was presented: it is discussed at paragraphs 225–226 and in chapter 2, "Science".
- Adams: Inference of uptake and retention of plutonium from its cumulative urinary excretion and post mortem autopsy data.[143] This paper referred to the 1985 Jones paper and discussed interpretation of urinary monitoring and post mortem findings in an individual who had been occupationally exposed to plutonium and from whom bone and liver were taken at post mortem.
- Strong and Jones: A review of the development and application of a plutonium urinary excretion model at the nuclear fuel processing site of British Nuclear Fuels plc.[144] Uptake estimates from personal air samplers and urinary/faecal sampling were compared *"with data obtained at autopsy on over 20 ex-plutonium workers at Sellafield"*.
- Omar, Barber and Smith: Cancer mortality and morbidity among plutonium workers at the Sellafield plant of British Nuclear Fuels.[145] This was a study of mortality to the end of 1992 of all 14,319 workers (including 5,203 plutonium workers) employed at Sellafield between 1947 and 1975 and of cancer incidence from 1971 to 1986. It concluded that the workers' mortality from cancer was 5% lower than in England and Wales and 3% lower than in Cumbria. Workers at Sellafield exposed to plutonium were considered to be at no overall significantly increased risk compared with other radiation workers. The paper referred to the 1985 Jones paper and to other papers which had examined post mortem data.

232 Research papers were published within BNFL. The most common, in relation to radiation protection, were the Dosimetry Technical Reports (DOSTR), two of which considered post mortem data:

142 See note 133, above

143 Adams N, Inference of uptake and retention of plutonium from its cumulative urinary excretion and post mortem autopsy data, *Radiation Protection Dosimetry*, 1986, 14(3): 219–22

144 Strong R and Jones SR, A review of the development and application of a plutonium urinary excretion model at the nuclear fuel processing site of British Nuclear Fuels plc, *Radiation Protection Dosimetry*, 1989, 26: 141–4

145 See note 134, above

- DOSTR 16 (April 1990) noted that post mortem data for plutonium in testes were available for 19 former Sellafield workers and looked in detail at 11 of those cases.[146]
- DOSTR 18 (July 1990) compared pre-1971 and post-1970 urine data, using also data from six post mortem cases.[147]
- DOSTR 36 (March 1996) examined the partitioning and clearance times of plutonium in the liver and skeleton, referring to post mortem data from 64 Sellafield cases.[148]

233 Another internal paper, not part of the DOSTR series, set out a protocol for use in epidemiological studies which involved assessing plutonium uptake and individual organ dose.[149] The paper referred to six exposure cases selected at random from the available post mortem records and noted that *"these represent approximately 10% of the cases for which autopsy data is currently available"*.

234 Occasionally, individual cases would be written up in more detail, for example:

- Donoghue, Dyson, Hislop, Leach and Spoor: Human exposure to natural uranium: a case history and analytical results from some postmortem tissues.[150] The paper discusses the results of analysis of organs taken from a Springfields worker who had died of natural causes.
- Popplewell: Determination of the plutonium content of post mortem tissues from two workers who were exposed to plutonium.[151] Dr Popplewell described results from two Sellafield workers who had died in 1975.
- Roberts et al: Confirmation of in vivo uranium-in-chest survey by analysis of autopsy specimens.[152] The results of analysis at Sellafield of organs from a Springfields worker are described.

146 Wraight JC, Comparison of autopsy data for plutonium in testes with assessments from urine sample data, BNFL internal paper, DOSTR 16, 1990

147 Froggatt NRT and Lennox A, Technical background for the exclusion of the pre-1971 urine sample data when assessing chronic exposure to plutonium, BNFL internal paper, DOSTR 18, 1990

148 Ainsworth S, Examination of the deposition and clearance of plutonium-alpha in bone and liver using autopsy and urinalysis data, BNFL internal paper, DOSTR 36, 1996

149 Woodhouse J and Wraight J, A protocol for the assessment of dose from internally deposited plutonium for use in epidemiological studies, BNFL internal paper, August 1990

150 Donoghue JK, Dyson ED, Hislop JS, Leach AM and Spoor NL, Human exposure to natural uranium: a case history and analytical results from some postmortem tissues, *British Journal of Industrial Medicine*, 1972, 29: 81–9

151 See note 94, above

152 Roberts AM, Coulston DJ and Bates TH, Confirmation of in vivo uranium-in-chest survey by analysis of autopsy specimens, *Health Physics*, 1977, 32: 435–7

Future use

235 The database of analytical results built up over the years is a potentially valuable source of information for further work: indeed, it is unique in the UK. Pending the outcome of the Inquiry, SL has quite properly refused to allow the data to be used. The Inquiry heard evidence from relatives of several of the deceased men, who are implacably opposed to such use because of the way in which the data were obtained; they want them destroyed. The Inquiry acknowledges their deeply-felt concerns but believes that destruction would be inappropriate: the data are potentially of great benefit to those working in the nuclear industry and should be made available, anonymised, for use in appropriate research.

236 The Inquiry heard from one researcher who wishes to use the data. Mr Anthony Riddell worked at Sellafield from 1979 to 1994 and, while there, co-authored a paper which described techniques by which organ-specific dose estimates (derived from urinalysis data) could be generated for use in an epidemiological study of death and cancer rates in over 5,000 Sellafield workers. By the time the paper[153] was published, the ICRP had produced a new model for assessing radiation dose to the lung. Mr Riddell therefore reviewed his findings, applying the updated model to the original data. The results appeared significant and he therefore sought permission to gain access to the post mortem data.

237 The Inquiry has explored with Mr Riddell the rationale behind his expressed need for access to the post mortem data. It is satisfied that the data would assist him in work which may be of great significance to the existing Sellafield workforce.

Why did the post mortem work end?

238 The last post mortem at which organs were taken and provided to Sellafield was in 1991. If the work was of such scientific value, why was it not continued?

239 There does not appear to have been any particular event which ended the post mortem work. Dr Schofield obviously had an intense personal interest in it and, irrespective of the knowledge or encouragement of his employers over the years, it could be considered very much his project. Dr Lawson

153 Riddell AE, Battersby WP, Peace MS and Strong R, The assessment of organ doses from plutonium for an epidemiological study of the Sellafield workforce, *Journal of Radiological Protection*, 2000, 20: 275–86

worked closely with Dr Schofield for a considerable time (from 1962 to 1965 and from 1973 until 1985) and it would have been natural for him to continue the post mortem work. However, after Dr Schofield's death in 1985, organs were taken from only 11 more Sellafield workers and while in some the reason can be described only as scientific interest,[154] radiation exposure could potentially have been of relevance to the death in most. The three-year gap between the last two cases, in 1988 and 1991, and the delay of more than 18 months in the preparation of the analytical results in the final case, suggest that the work was by then not considered a priority.

240 Dr Lawson was clearly interested in the post mortem work. While he was CCMO, the data were re-evaluated (by Mr Wallace) and Dr Lawson personally presented the 1989 Malvern paper.[155] When he retired in 1990, any impetus to continue the work was lost. His successor, Dr Slovak, was based at Risley, not at Sellafield, and did not have the same personal connections with the workforce as his predecessors; and the SMO, Dr Wood, was uninterested, holding the list of the names of former workers for whom there was post mortem data *"unused"* until his own retirement.

241 By 1991, doctors' attitudes to the wishes of patients and their families were changing. In contrast to earlier times, when the good which might result from research may have been considered more important than those wishes, there was a growing recognition that consent was necessary before any organ could be removed for research. The focus by this time was very much on establishing a national post mortem registry, akin to the USTUR, based on consent. Dr Slovak was heavily involved in discussion of such a registry[156] but eventually he was forced to conclude that the idea was unrealistic, advising Mr Coulston in April 1992 that the Sellafield workforce was hostile to the idea of further studies of any kind and that financial support for the project in BNFL was insecure.[157] In 1995, Dr Slovak advised the BNFL Company Health and Safety Executive Committee that *"the idea of doing large-scale autopsy studies should be abandoned"*.

242 It is also relevant that by 1991 the Compensation Scheme had been in place for some time, was working successfully and was about to change its rules, effectively to exclude post mortem data from consideration.[158] Civil claims

154 For example, Mr Brennan and Mr McMullen: see paragraphs 161–162 and 171–173

155 See paragraph 207

156 See paragraph 105

157 See chapter 10, "Registries"

158 Unless consideration benefited the claimant, which was in practice almost never the case

for damages arising from direct exposure to radiation had virtually ceased and there was therefore no incentive to take organs for litigation purposes.

243 Finally, a sizeable amount of data had been amassed. In addition to the 64 Sellafield cases, there were data relating to workers from other sites.[159] Professor Jones had long since reached practical conclusions[160] as to the relationship between *in vivo* urinalysis and post mortem findings in respect of organ-specific plutonium uptake, which had led to changes in the methods of routine evaluation of the workforce's uptake. There was little appetite for more data.

244 The combination of these factors meant that the post mortem work came to a natural end in the absence of any one specific catalyst.

Knowledge of the post mortem work

245 Many people were aware of the analysis at Sellafield of organs taken at post mortem. The analysts and those working in the Medical Department obviously knew of the practice, although the detail may not have been clear to them: certainly the analysts were not told of its rationale. The work was fairly widely discussed and information about it disseminated, at Sellafield and at other nuclear sites. In 1976, 50 copies of a BNFL internal report,[161] which set out the analytical procedure to be followed after organs had been obtained, were distributed to individuals and libraries at seven BNFL and UKAEA sites.[162]

246 The work was therefore certainly not a secret. In 1978, after the death of a Sellafield worker who had retired some years previously, Mr Jack Creighton, Works Secretary, sent a memorandum to Mr Scott advising him of the death and noting *"Usual samples are being handled by Dr Schofield"*. The memorandum was copied to Mr Pilling (General Manager), Mr John Doran (Deputy General Manager), Mr John Donoghue (Health and Safety Manager), Mr Alan Hurst (Personnel Services Manager) and Dr Schofield himself: the distribution gives insight into the extent of awareness of the work at Sellafield.

159 See paragraphs 337–340

160 See paragraphs 225 and 226

161 *Analytical method for the determination of plutonium in autopsy samples*, BNFL Report 245 (W), 1976. The author is given only as Technical Manager, Analytical Services

162 Sellafield, Capenhurst, Springfields, Harwell, Dounreay, Risley and Winfrith

247 It was also discussed with the SMOs at other sites. On 12 May 1983, Dr Schofield presented the results of analysis from 35 cases to a meeting of the SMOs; the minutes record that details of post mortem materials and assessment of organ content would be circulated separately. One of the SMOs present (Dr Goodfellow, Springfields) had already assisted Dr Schofield to obtain organs and another (Dr Barker, Capenhurst) was to help subsequently.[163]

248 The staff of the Dosimetry Department at Sellafield also knew of the work because of close liaison with the Medical Department in order to comply with statutory duties to monitor the workers' exposure to radiation. Dr Strong told the Inquiry:

> *With the benefit of hindsight it was probably upon reading the 1985 Jones paper*[164] *that I first became aware that BNFL had involvement with autopsies and with the information resulting therefrom. Subsequently I was personally involved either in cases where there had been requests from the Coroner to one or the other of our Medical Officers (which would lead through to the radiochemical analysis of organs/tissues and to questions to the dosimetry team as to what this actually meant in terms of radiation dose) or, as I would normally become involved in anything unusual, I was also asked to play a role in a number of personal injury claims which were brought against BNFL in the late 1980s where interpretation of the radiochemical results of the analysis of organs/tissues was required. Until the Jones paper there was no reason for me to have heard about the autopsy work.*

249 The Health and Safety Department staff would also have been aware of the post mortem work: indeed, Dr Berry had come across it in his capacity as ICRP Commissioner before his arrival at BNFL.

250 The extent of the workers' knowledge is less easy to determine. Certainly the unions knew: they arranged legal representation for families to pursue civil claims for damages and became aware of the removal and analysis of organs in the course of those claims. Indeed, it is apparent that in some cases the union knew that organs had been removed when the family did not.

251 In the early 1980s, attention moved from civil claims to the proposed Compensation Scheme. Discussions on the use of post mortem data took place between management and unions. The extent to which these filtered

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163 Dr Goodfellow in the cases of Mr Gee (see paragraphs 114–117) and one other; Dr Barker in the cases of John Grain and one other (see paragraph 158)

164 See paragraph 226

down to the workforce is unclear but it seems likely that the sensitivity of the subject meant that the vast majority of those working at Sellafield did not know.

The Compensation Scheme for Radiation-Linked Diseases

252 The Compensation Scheme was established in November 1982 by BNFL and its recognised unions to provide a framework which allowed compensation to be paid in appropriate cases without the need for litigation. It initially applied only after the worker's death, but was extended in 1987 to include radiation-linked illness. The Compensation Scheme now includes most UK nuclear employers and unions.[165]

253 The methods to be used in assessing applications under the Compensation Scheme were discussed at meetings of a Joint Working Party (JWP), chaired by Dr Avery, at which management and unions were represented. Mr Mummery was a member of the JWP and Dr Schofield attended meetings from time to time. Both Dr Schofield and Mr Mummery were also members of a separate Management Working Party. Use of post mortem data was a recurring item on the agendas of both Working Parties, further evidence that senior management and unions were aware of Dr Schofield's work.

254 At a JWP meeting in December 1982, BNFL proposed *"to use autopsy data, if it were available, and personal monitoring results otherwise"* and the proposal was in due course accepted. In October 1984, BNFL prepared a protocol for the taking of organs, with a covering note:

> 1. *This note describes the protocol for the sampling and assay requirements in the event of autopsy specimens being made available to the Company's Medical Officer by the relevant Pathologist …*
> 2. *The objectives are:*
>   (a) *To provide information to assist in the better understanding of the metabolic behaviour of radionuclides in the body.*
>   (b) *To provide additional data for the assessment of radiation dose in the case of deceased employees qualifying under the terms of the Compensation Scheme for Radiation Linked Diseases …*
> 3. *Table 1 defines the minimum sampling requirements for the range of nuclides observed in the Nuclear Industry …*

165 For a full consideration of the Compensation Scheme, see chapter 7, "The Trade Unions and the Compensation Scheme"

4. *Objective "one" represents the current requirements and objective "two" represents the additional requirements for the Compensation Scheme.*

255 In total, post mortem data were available for 25 cases (20 workers from Sellafield, four from Springfields and one from Capenhurst) submitted to and/or considered under the Compensation Scheme.[166] In only one case is there any evidence that organs were taken because an application had either been made or was thought likely; and in that case it was the coroner who requested the organs to be taken *"in view of pending action by Family against the Company"*.

256 In June 1992, the rules of the Compensation Scheme were revised so that:

> *No individual would be disadvantaged under the scheme by the inclusion of autopsy data in the internal dose assessment, along with personal monitoring data, as the scheme will always be based on that result, from either autopsy or monitoring data, which is most beneficial to the claimant.*

Thus post mortem data could no longer be used to defeat a claim.

Secrecy

257 Despite a large number of individuals being aware of the post mortem work, it was still regarded as sensitive. Mr Wallace referred to *"secrecy"* in two memoranda to Dr Lawson[167] and in a third memorandum noted that *"autopsy data has been treated on a 'need to know' basis by the medical department"*.

258 In evidence to the Inquiry, Mr Wallace struggled to explain his choice of words; he suggested that he had intended to refer to the *"sensitive nature"* or *"confidentiality"* of the data. That approach was also adopted by SL, which drew a distinction between the existence of the post mortem work, about which it asserted that BNFL had never been secretive (referring to published papers which discussed the data and open discussions with the unions in connection with the Compensation Scheme) and the obvious need, for reasons of confidentiality, to prevent identification of individuals from whom organs had been taken.

166 SL advised in its opening submissions that around 1,400 mortality and morbidity cases had been considered since the Compensation Scheme began, of which around 600 were BNFL cases; in a further 170 cases BNFL and other Compensation Scheme employers were jointly involved

167 See paragraphs 206 and 207

259 Notwithstanding Mr Wallace's reference to *"secrecy"*, the Inquiry does not conclude that the existence of the post mortem work was deliberately kept hidden because it was recognised or feared that it was illegal or in any way underhand. It is much more likely that the work was considered *"sensitive"* in that it was not something which one would want to publicise, because of its nature and circumstances rather than anything more sinister.

Misleading information to the Home Office

260 In 1986, Mr Paddy Ashdown MP asked the Home Secretary, the Rt Hon Douglas Hurd MP, *"How many autopsies have been performed at the request of H M Coroners at the medical laboratories of British Nuclear Fuels plc during the past ten years"*. The request was passed to Dr Lawson and on 6 November 1986 Ms Grace Howden[168] responded that the CCMO had *"provided a radiochemical analysis of organs/tissues made available to him for that purpose"* in ten cases (one in 1978, five in 1983, two in 1984, one in 1985 and one in 1986). That information was wrong: the true numbers were significantly higher. SL was unable to explain to the Inquiry the numbers given, noting only that they were much closer (but not identical) to the numbers of reports generated for coroners than the number of post mortems carried out at coronial request.

261 No audit trail exists which might explain why the Home Office was given incorrect information; SL cannot assist and the Inquiry is reluctant to speculate. There is no obvious reason for the mistake. It seems unlikely that there was any desire to suppress information, given that some figures were provided and that by this time articles had been published in scientific journals.

BNFL's corporate knowledge

262 Dr Schofield's annual medical report for 1973 contained much information on the post mortem work[169] and more detail was given in the annual medical report for 1979.[170]

263 The Board and/or senior management would in any event have been aware of the existence of the post mortem data from various sources. It was

168 BNFL Corporate Relations

169 See paragraph 75

170 See paragraph 89

mentioned at meetings of Health and Safety Managers: for example, the minutes from one such meeting, on 15 May 1985, record:

> *In reply to a query … concerning the availability of autopsy data to dosimetry laboratories for the purpose of comparison with in vivo sampling, the Chairman* [Mr Mummery] *said that it was important to ensure that a full and proper comparison of results from the two methodologies was available … the formal Company position is that the Company Chief Medical Officer is responsible for the autopsy data pertaining to Company employees and that such information is available on a confidential basis to individual laboratories for the purpose of assessing the efficacy of routine personal monitoring techniques.*

There were references to the post mortem work in papers prepared for the Company Health, Safety and Environmental Committee (CHSEC).

264 The post mortem data were also mentioned in meetings between management (including Dr Avery, Mr Pilling and Mr Mummery) and unions on the Compensation Scheme and in discussions regarding a national post mortem registry[171] which involved, for example, Mr Coulston, Dr Strong and Dr Berry.

265 Indeed, it seems clear that over time the analytical post mortem work became positively encouraged: it was mentioned in Health and Safety Directorate position papers, formed part of the business plan and was an appraised part of the CCMO's work. This is unsurprising as the work was potentially of benefit to the Company and its workers: for example, Professor Jones's findings[172] led to improvements in monitoring of the workforce's exposure to radiation. It follows also that if urinalysis over-estimated actual plutonium uptake, there was value to BNFL in data from analysis of organs, to help defend claims for damages.

266 However, whether the Board's knowledge of the existence of the post mortem work extended to its detail is another issue. It may have assumed that the analysis was always performed at coronial request in cases proceeding to inquest: it may not have been evident that in some cases the true purpose was simply scientific interest. Dr Schofield's annual medical report for 1979 gave details of the work undertaken but did not specify how the organs were obtained:

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171 See paragraph 92

172 See paragraph 225

> *material has therefore been collected since 1964 on an ad hoc basis when a post mortem examination has been requested by the coroner or when such an examination has been undertaken for medical reasons unconnected with the employment of the deceased person.*

That was not, in the Inquiry's opinion, sufficient to put the Board on notice that something untoward might be being done; the Board could reasonably have assumed that the coroner and/or pathologist would release organs only with appropriate authority.

267 There is evidence that some senior managers knew that the work was done for scientific reasons. In 1980, after the death of a Springfields worker, Mr H E Dibben[173] advised the SMO, Dr Roger Bursey, to contact the pathologist:

> *to see if he could make the usual arrangements in relation to contaminated organs, in order to add to our statistics of the correlation between analytical results of lungs against the whole body monitoring determination.*

However, there is no suggestion that Mr Dibben would have expected the pathologist to provide the organs unless there were proper grounds for doing so.

Pathologists

Relevant law

268 At a coronial post mortem, the pathologist must preserve material, such as organs, if he considers they bear upon the cause of death. If organs are to be used for medical education, treatment or research not directly related to establishing the cause of death, consent must be obtained from the deceased's family. In the majority of the cases considered by the Inquiry, the organs removed did not bear upon the cause of death; they were made available to Dr Schofield and/or Dr Lawson for research and the family's agreement ought therefore to have been obtained.[174]

173 General Manager, Springfields

174 See also chapter 3, "Law and Guidance"

Guidance on the law

269 The Human Tissue Act 1961 came into force on 27 September 1961. It provided that organs could be taken at post mortem for purposes unconnected with the death only if the deceased had agreed or if his relatives did not object. A circular[175] explaining its provisions was sent to coroners and a memorandum[176] providing a rather more detailed explanation was widely distributed within the NHS. The memorandum advised:

> *A person lawfully in possession of a body of a deceased person who has not requested that his body or parts of it be used may only authorise removal of parts if, having made such reasonable enquiry as may be practicable, he has no reason to believe that the deceased had objected or that the surviving spouse or any surviving relative objects to the body or the specified part being so dealt with. The nearest relative available should be asked if he objects or has reason to believe that any other relative would object, but hospital authorities are not expected to ask that relative for a statement that no other relatives object.*

An appendix to this memorandum summarised the Act section by section. It was made absolutely clear that the need to establish that relatives did not object to the removal of organs for research applied to coronial post mortem just as it applied to hospital post mortem.

270 The guidance explained the Act's provisions clearly, but some confusion remained. On 3 September 1966, the *British Medical Journal* published a note entitled "Law and the Corpse". Its "Legal Correspondent" informed doctors that the Human Tissue Act imposed no duty to inquire of the relatives as to consent for donation of tissues/organs unless there was *"some reason to believe that they object"*. It is surprising that anyone who had read either the Act or the guidance could have given such incorrect advice.

271 In June 1975, a circular[177] was issued to NHS authorities. The guidance was in similar terms to that which had been given in 1961 and added by way of clarification:

> *Specific consent is not necessary, merely a lack of objection. What enquiry is reasonable and practicable must depend on the facts of each particular case.*

175 HO 182/1961

176 HM (61) 98

177 HSC (IS) 156

272 The 1975 circular was complemented in August 1977 by a further circular,[178] distributed to regional and area health authorities, boards of governors and community health councils. It was issued in response to public concern over the removal of pituitary glands at post mortem. Authorities were asked to bring it to the attention of *"all concerned, to review their procedures for authorising the removal of organs and tissue under the Act and to consider the adoption of the model post mortem declaration form"*. It noted:

> *It is … essential that Health Authorities and the doctors working with them are aware of the relevant provisions of the Human Tissue Act 1961 … Authorities are reminded that if, during a post mortem examination, it is proposed to remove organs or tissue for the purposes specified in Section 1 of the Act, the provisions of the Act must be observed. In particular ... removal of tissue may be authorised only if, after having made such reasonable enquiry as may be practicable, the person lawfully in possession of the body has no reason to believe that the deceased had expressed objection or that a surviving spouse or other relative objects. Specific consent is not required by the Act … While the Act does not require a written declaration to be made by the surviving spouse or other relative, the Department considers it desirable that in appropriate cases that person should be invited to sign a post mortem declaration form … This would be a precaution against the possibility of unauthorised removal and also would afford evidence, generally sufficient evidence, that the requirements of the Act as to the enquiries to be made has been complied with … The provisions relating to the removal of tissue for therapeutic use and for medical education and research apply when a post mortem examination is ordered by a coroner as they apply to any other post mortem examination, save that their removal requires also the consent or approval of the coroner.*

No-one who read that circular could be in any doubt that the agreement of the relatives (and, at coronial post mortem, the consent of the coroner) was required before organs could be removed for research. Documentation held by North Cumbria Acute Hospitals NHS Trust showed that this circular was copied in January 1977 to both Dr Smith and Dr Whitehead.

178 HC (77) 28

273 An article in the *British Medical Journal* in August 1978 noted:[179]

> *for many years the removal and the use of other tissues have been controlled by custom and tacit approval by the authorities rather than the Human Tissues* [sic] *Act ...*

and warned starkly that:

> *All these innocent activities are illegal unless brought strictly within the terms of the Human Tissues* [sic] *Act … In many areas the practice of taking tissues in coroners' cases without any permission is continuing, with those concerned presumably relying on the ethical justification that the good that accrues from the use of such tissues will see them through any adverse comment. The climate of public opinion and the keen eye of the press make it imperative, however, that correct procedures be followed.*

274 In 1985, Professor Bernard Knight, consultant pathologist, writing in the *Bulletin of the Royal College of Pathologists* provided yet further clarification of the need for consent:

> *The retention of tissues for teaching and research is not covered by the coroner's permission and the coroner cannot grant such permission, as it is not within his remit to do so. He can forbid the use of any tissues for such purposes, but positive permission must be obtained under the terms of the Human Tissue Act, 1961 ... In spite of frequent claims to the contrary, the coroner has no authority to give permission for such removal. A significant proportion of the contents of pathology museums are undoubtedly from coroner's cases and are, in the strict terms of the law, illegally retained.*

The West Cumberland Hospital pathologists

275 Several pathologists from different hospitals were involved in the supply of organs to Dr Schofield and his successors. It would not have been proportionate to trace them all, given the passage of time and the peripheral involvement of some, limited to an occasional case. The Inquiry therefore concentrated on the pathologists who had worked at West Cumberland Hospital: 57 of the 64 Sellafield post mortem examinations were handled there. Of those, 47 were performed by four pathologists: Dr Smith (20),

179 Editorial: Postmortem tissue problems, *BMJ*, 1978: 382

Dr Ghazala (15), Dr Whitehead (ten) and Dr Bird[180] (two). All four had also provided organs from randomly-selected members of the public to the NRPB for its population studies.[181] Dr Ghazala died in 1999 but the Inquiry heard evidence from the other three.

Dr Smith

276 Dr Smith recalled that Dr Schofield had wanted the organs for research. He accepted that in some cases radiation had been of no possible relevance to the death but said that he had assumed in those cases that Dr Schofield was taking organs for control purposes. Dr Smith failed to appreciate the legal requirement for the relatives' consent as well as coronial approval. He took the view that where litigation was likely he was *"obliged"* to take organs and that had he not done so he could have been criticised for having *"prejudiced BNFL's ability to defend itself against any subsequent claim for damages"*.

277 While accepting that in several cases he had wrongly removed and retained organs, he claimed that the coroner knew of the practice and had no issue with his conduct.[182] He observed that he had sometimes recorded on his post mortem reports that organs had been supplied to Dr Schofield and had assumed (reasonably but, as it transpired, wrongly) that the coroner would read them: he commented that the coroner had never expressed any concern.

278 Dr Smith also highlighted to the Inquiry his ignorance of the law:

> *at no stage did I have any teaching or training in respect of the Human Tissue Act 1961. When the Act was introduced I was working as a Registrar in Pathology at Hope Hospital. I do not think I was even aware at the time that it had been introduced and certainly no one told me about it. Even now I have never seen the Act itself ... My understanding during the period with which the Inquiry is concerned is that if a written consent for a hospital post mortem had been signed then that pretty much gave me consent to take whatever organs I thought necessary, even if they did not relate directly to the cause of death. In some ways it was important to take normal organs so that one could build up one's knowledge of what tissues/organs normally looked like. My understanding in relation to Coroners' post mortems was*

180 Dr Bird was a consultant haematologist, who also undertook post mortem work

181 See chapter 8, "The National Radiological Protection Board"

182 See paragraph 173

similar. Until the 1985 article written by Bernard Knight I thought that any organs could be removed under the Coroner's control. After 1985, however, my understanding was that only organs directly relevant to the cause of death could be taken. To that extent I interpreted Professor Knight's article as reporting a change in the law.

Dr Smith accepted, however, that some of the cases in which he had supplied organs to Dr Lawson post-dated Professor Knight's article and that he did therefore in those cases continue to take organs over and above that which he knew at the time was permissible.

Dr Whitehead

279 Dr Whitehead said that Dr Schofield had told him that he was undertaking research into the radiation exposure of the workers for whom he was medically responsible and that he had considered this to have been a valid and worthwhile project. *"Having made sure that the Coroner had no objections"*, he had arranged for Dr Schofield to receive the human tissue samples he required. Like Dr Smith, Dr Whitehead accepted that he had sometimes given Dr Schofield organs which could not have been of any relevance to the cause of death (in one case, for example, providing him with lung, liver, spleen, ribs and sternum from a man who had died as a result of injuries sustained in a road traffic accident) but he believed his actions had been expressly sanctioned by the coroner. Shortly after coming to West Cumberland Hospital, he had met Mr Gough:

With regard to Sellafield we discussed what human tissue samples should be taken, how they should be collected and sent to Sellafield and whether or not Dr Schofield … could be present at post mortem examinations. We discussed the legality of transferring any human tissue samples to Sellafield and he told me that if I was ever in any doubt as to what I should do I could always ring him up and speak to him. At no point in any of my subsequent work did I knowingly do something which the Coroner would not have wanted me to do and in particular in no case was it my decision to send a sample to a third party other than in the usual instances of histology or other routine tests. With regard to Coroner's post mortems I did not do anything without the specific authority of the Coroner.

280 Dr Whitehead elaborated:

> *I believed that there was a distinction between work undertaken directly for the purposes of the Coroner, which would principally involve ascertaining the cause of death, and work sanctioned by the Coroner for someone else's purposes. The organs sent to Sellafield for Dr Schofield's purposes were usually for him in particular rather than for the Coroner ... I believe that there was always a clear understanding and knowledge between the Coroner and myself as to what samples were being taken and where they were going. I make this comment based upon the content of my initial discussion with the Coroner when I first came to West Cumberland where the taking of human samples from ex-Sellafield workers was agreed. This was not something that I subsequently addressed with the Coroner on every individual case and I worked on the basis that the general authority given to me at that initial meeting held good for each subsequent case. In each of the cases where I provided organs to Dr Schofield I had authority to do so from the Coroner.*

281 Dr Whitehead removed organs for Dr Schofield over a seven-year period from 1971 to 1978, and he reported to Mr Walker as well as to Mr Gough. He may well have considered himself to have had authority from the coroner to act as he did but he took no steps to ensure that he had the consent of the relatives to remove the organs. Mr Gough could not have provided Dr Whitehead with a general authority of the type suggested: he could have given his own general consent but obviously had no authority to give consent on behalf of relatives.

282 Like Dr Smith, Dr Whitehead was ignorant of the law:

> *During the time I worked in the West Cumberland Hospital I did not read the Human Tissue Act 1961 and I did not have any knowledge of that legislation.*

He failed to appreciate the need for the relatives' consent to the removal of organs for research and shared the general belief of doctors in the 1970s that the pathologist could take whatever samples he wanted at a coronial post mortem and do whatever he liked with them.

Dr Bird

283 The third pathologist at West Cumberland Hospital from whom the Inquiry heard evidence was Dr Bird. He was the only one of the three who denied

any personal involvement in the provision of organs to Sellafield. However, the documentary evidence that Sellafield had received organs taken at two post mortems which he had performed was inescapable. Dr Bird accepted that the organs had reached Sellafield but suggested that someone else within the pathology department must have made them available to Dr Schofield without his knowledge. While that may seem unlikely, the evidence is insufficient for the Inquiry to conclude more than that the organs were transferred to Sellafield in wholly inappropriate circumstances.

Breach of the Human Tissue Act

284 In view of the plethora of coherent guidance, the Inquiry was surprised that the pathologists from whom it heard evidence should have been so ignorant of the law which underpinned their work. The Act itself was but two pages long and it was very clear from repeated government guidance that organs could not be removed at a coroner's post mortem for research unless reasonable steps had first been taken to ensure that the relatives did not object.

285 The pathologists' own evidence indicates clear breaches of the Human Tissue Act 1961. Irrespective of any belief that the coroner knew of and authorised their actions, their failure to ensure the relatives' consent had been obtained was reprehensible. It is right to observe, however, that their lack of understanding of the Act's provisions reflected widespread ignorance among pathologists in general.[183]

Coroners

286 Of the 53 cases in which organs were taken at post mortem[184] ordered by the Coroner for West Cumbria:

- Mr Gough dealt with 23, of which eight proceeded to inquest (although two of those inquests were held to inquire into accidents unconnected with work);
- Mr Walker handled 20, of which seven proceeded to inquest (one of which was heard before Mr Taylor);
- Mr Taylor dealt with ten, of which three proceeded to inquest.

183 See paragraphs 308–323

184 Four of the 57 cases referred to at paragraph 275 were hospital post mortems

287 The coroners would encounter deaths whose cause, such as leukaemia or multiple myeloma, might in some way be linked to work at Sellafield; deaths from obviously natural causes, such as ischaemic heart disease, unconnected to employment; and deaths from causes, such as a road traffic accident, in which the occupational history was clearly irrelevant. Only in cases in the first category could it have been legitimate for the coroner to request radiochemical analysis (a special examination) of organs removed at post mortem, as only in those cases could the analysis be relevant to the cause of death. The decision to hold an inquest had to be made before any such special examination could be ordered.

288 Even when the analysis could be justified, it is inexplicable that the results of analysis were not always before the court at the inquest.[185] Mr Taylor, the only coroner for West Cumbria alive to give evidence to the Inquiry, said:

> *if an inquest was to be held then it was necessary to have sufficient evidence to enable there to be proper consideration of the verdict of industrial disease.*

If the results were not then given in evidence at the inquest, how could that be done?

289 Dr Smith and Dr Whitehead both claimed that the coroner knew that organs would be taken for Dr Schofield's research even if irrelevant to the cause of death. Mr Taylor denied any knowledge of this practice, which he described as *"an informal agreement between the pathologist and Dr Schofield"*. However, he would have been aware of what was happening if only he had troubled to read the post mortem reports. Mr Taylor's failure to read those reports, which he himself had commissioned, was inexcusable. The Inquiry has noted above[186] that in some cases explicit reference to (inappropriate) removal of organs was made in the report. Mr Taylor had the opportunity to recognise the mischief and bring it to an end. He failed to do so.

Trade unions

290 It cannot be disputed that the unions were aware that organs were removed from the bodies of Sellafield workers. They supported their members in civil claims against BNFL, in which it was contended that exposure to radiation

185 See paragraph 188 for examples of cases when the inquest proceeded without the analysis having been undertaken

186 See paragraph 143

had caused injury. Organs would often be taken when cases were brought after members' deaths: the Coroner for West Cumbria would often advise the unions' solicitors that a post mortem was to be undertaken, allow an expert nominated by them to attend and afford them the opportunity of making arrangements to provide (part of) the organs to their expert. In the course of discussions between unions and BNFL management preparatory to the introduction of the Compensation Scheme, there was a good deal of attention on the use to be made of post mortem data. The unions therefore knew that such data were held at Sellafield: they appear also to have been provided with a copy of Dr Schofield's 1979 annual medical report, which addressed the post mortem work in some detail.[187]

291 In some cases, while the union knew that organs were taken so that analytical data might be used, the widow actually bringing the claim was unaware of what was happening and was not asked to agree to it. A prime example is Malcolm Pattinson:[188] Mr Gough himself told the union's solicitors of his death on the day it happened, they instructed an independent medical expert to attend the post mortem and they knew that organs were taken for analysis. However, Mrs Pattinson herself was not told what was happening, still less asked to agree to it: she did not instruct the union to act on her behalf until some five weeks later. There is no evidence that either the union or their solicitors made any attempt to contact her in the interim and they therefore acted without authority, albeit in what they perceived to be her best interests.

292 It may be that on occasion the unions failed to take the family's wishes into account: after one death from cancer, the post mortem report commented:

> *The widow has stated that she does not wish to proceed, though I understand from Mr Gough that the Union do intend to.*

and in the same case, a BNFL file note was made after the inquest:

> *From visits by our Welfare Officer we were aware that the widow did not want to pursue any legal action and deplored the Trade Union activity in the matter.*

No claim was pursued.

293 However, the Inquiry accepts that in general the unions acted in what they perceived to be their members' best interests. The Inquiry rejects any suggestion of collaboration between management and unions to allow organs

187 See paragraph 89

188 The events surrounding Mr Pattinson's death are considered in detail in chapter 13, "The Families"

to be removed irrespective of the family's wishes. The unions were also entitled to expect their own legal advisers to obtain proper instructions from the families. There was clearly potential for conflict between the unions' interests on behalf of the workforce as a whole and the family's interests in any individual case: that potential demanded the families be given appropriate legal advice.[189]

294 In cases in which an independent medical expert instructed by the union co-operated in arrangements for the removal of organs for analysis, it may be that the pathologist and Dr Schofield assumed that the family had agreed to its being done.

BNFL's position

The Board

295 If the BNFL Board had known that organs were being supplied to Dr Schofield without consent and had recognised that this was contrary to the Human Tissue Act 1961, it would clearly have been mandatory for it to have brought the practice to an end. As discussed above, it certainly had direct knowledge of the existence of the post mortem work, at least by 1973. However, while it knew of the work, it was not at that time aware of the detail. If there is to be any criticism of the Board, it could therefore relate only to the absence of an appropriate system to supervise Dr Schofield's research.

296 In January 1977, a Company notice was issued, indicating that the duty of the Director of Health and Safety to keep policy under review included consideration:

> *of laws, regulations, codes of practice and consultative documents, of internal documents, of longer term R & D requirements and of the need to publish reports on aspects of the Company's activities.*

297 It is arguable that the proper exercise of that duty would have required Mr Mummery to ensure that Dr Schofield's work complied with all legal and ethical requirements. However, the Inquiry believes that that would have been a counsel of perfection. Mr Mummery could not realistically have been expected to consider every occasion on which organs had been taken for analysis at Sellafield in order to satisfy himself that the provisions of the

189 This is explored further in chapter 7, "The Trade Unions and the Compensation Scheme"

Human Tissue Act had been observed. He would have been entitled to expect the coroner and the pathologists to have acted appropriately, so that organs came to Sellafield only where legally permitted.

298 As time passed, the Board's association with the work developed. It gained more detailed knowledge from the annual medical report of 1979. In the mid to late 1980s, the post mortem work became an item for consideration at appraisal[190] and a part of what was required of the Company Medical Office; it was even mentioned in the Health and Safety Directorate business plan.[191] It was well known by this time that consent was required before organs could lawfully be removed: discussions on the proposed national post mortem registry had emphasised the need for consent and BNFL was aware of the problems which the NRPB had encountered in obtaining organs for its population studies. Again, it is arguable that the Board should have better understood the nature of the work and that inquiries should have been made as to the provenance of the organs; but even had it done so, it would have been reasonable for it to have accepted assurances from the CCMO as to their legitimacy, particularly given the involvement in most cases of the coroner.

299 The Inquiry does not therefore criticise the Board of BNFL for failing to appreciate that organs were being provided to Dr Schofield and Dr Lawson in inappropriate circumstances. It is, however, concerned by the lack of supervision of the medical officers. In 1979, the SMO's freedom of action in respect of research was said to be *"limited only by his ethical responsibilities"*.[192] Sadly, albeit with the benefit of hindsight, that remit was too wide. No arrangements were in place to monitor research undertaken by the CMO or SMO, or to require the medical officers actively and directly to address ethics with the Board. That would not have posed a problem had the coroners and pathologists always acted in accordance with their professional duties, but they did not; and as a result organs were inappropriately removed.

Dr Schofield and Dr Lawson

300 The CCMOs were, of course, in direct contact with the pathologists and coroners who actively assisted them. SL submitted that it should be inferred from their conduct that they did not appreciate that they were doing

190 See paragraph 101

191 See paragraphs 102 and 103

192 See paragraph 86

anything untoward. It observed that both published their work, making no attempt to conceal their activities: indeed, Dr Schofield himself said[193] that *"The initial purpose in carrying out the radiochemical analysis of post mortem tissue was entirely scientific"*. Both, particularly Dr Schofield, acted at a time when the prevailing culture was very different from today's and when it was not fully appreciated that a permission for coronial post mortem did not provide *carte blanche* for organs to be removed for research.[194]

301 However, while their freedom in respect of research may have been limited only by ethical responsibilities, there is no evidence that those responsibilities were ever addressed. In January 1980, the Faculty of Occupational Medicine of the Royal College of Physicians issued guidance on ethics for occupational physicians, which concluded that ethical problems of research in occupational medicine did not differ from those of medical research in general and observed:

> *Since occupational physicians may be perceived by workers as part of management it is particularly important to ensure that informed agreement is freely given. It is strongly recommended that when any occupational physician proposes to undertake research of a clinical nature he should consult with an ethical committee or independent experienced physicians to discuss the protocol before starting the project.*

It is possible to argue over whether the description *"research of a clinical nature"* can properly be applied to the post mortem work; but in any event there is no evidence that Dr Schofield or Dr Lawson ever consulted *"an ethical committee or independent experienced physicians"* or ever adequately considered the work's ethical basis.

302 It is also of concern that in cases which he considered to be of particular interest Dr Schofield appears to have taken unusual steps to obtain organs; attempts which he sometimes made to ensure that deaths were reported to coroners could be regarded as a manipulation of the coronial process.[195]

303 It is further arguable that because of their proximity to the pathologists and coroners with whom they established such close working relationships, and given that the research was their own, Dr Schofield and Dr Lawson should have taken particular care to ensure that all legal requirements were met. The legality of removing organs at post mortem for research was discussed

193 See paragraph 57

194 See the conclusions of the *Isaacs Report: The Investigation of Events that Followed the Death of Cyril Mark Isaacs* (TSO, 2003)

195 See paragraphs 118–129

at a MOCC meeting on 9 December 1969. Soon afterwards, advice was obtained from Dr Graham's medical defence organisation:

> *Once granted permission to undertake the post mortem there is no need for the pathologist to ask specifically for permission to remove and preserve any particular organ.*

That advice was wrong but Dr Schofield was entitled to accept and rely upon it.

304 Ultimately, it was the pathologists, apparently in ignorance of the Human Tissue Act, who willingly provided organs to the Sellafield medical officers and it was the coroner who had the ability to ensure that proper pathology process was followed. Had the pathologists done their job properly, they would have ensured that consent to the removal of organs for research had been obtained. Had the coroner done his job properly – and here blame lies not only with Mr Taylor but also with his predecessors as Coroner for West Cumbria – then there could have been no abuse. It was the coroner who failed to realise that his own pathologists were acting in breach of the requirements of the Human Tissue Act and so failed to remedy the situation.

Proposals for further work

305 The Inquiry has seen no evidence that, save for the early lung tissue and lymph node work, organs were removed from people who had never worked at a nuclear site for analysis at Sellafield. However, there was obvious interest in what any such work might reveal and BNFL recognised its potential value.[196] It was intended on occasion to conduct this type of study at Sellafield. In March 1976, Dr Schofield noted that analysis on behalf of the family of a deceased Aldermaston worker had shown the concentration in the testis to be higher than in other soft tissues:

> *As an exercise, to chase this point up, I am proposing to collect some testes from post mortems on non-Windscale workers and to compare the concentration of plutonium in these organs with that found in an equal mass of, say, thyroid and also perhaps a rib.*

196 Professor Richard Wakeford, Principal Research Scientist at BNFL, later described the NRPB's population studies in a letter dated 24 June 1994 as *"one of the most valuable pieces of work in determining the levels of exposure of long-term residents in the vicinity of Sellafield to plutonium"*

306 In September 1977 a BNFL paper[197] considered how air sampling data collected by the NRPB at Ravenglass, about five miles north of Sellafield, might relate to levels of plutonium in organs of non-occupationally exposed individuals. The authors concluded that while low, the levels would probably be detectable:

> *it would be prudent to obtain post mortem samples from an area remote to Windscale for comparison with local samples.*

307 The Inquiry has seen no evidence that either of these proposed studies actually took place.

Benchmarking

308 Much of the post mortem work undertaken by Dr Schofield and his successors at Sellafield took place without the requisite consent of the deceased's relatives. The practices exposed at Sellafield cannot be viewed in isolation and must be considered against the custom and practice of the time: "benchmarking".

Pathology practice

309 The Inquiry heard evidence from several eminent and experienced pathologists, some of whom were directly involved in the provision of organs. All said that custom and practice in the 1950s and thereafter, up until the 1980s, was very different to current expectation. In particular, there was a belief that coronial authority for a post mortem meant that organs were freely available. Dr Vijay Joglekar, a consultant pathologist based in South Cumbria who provided organs to the NRPB for its population studies,[198] told the Inquiry:

197 Ward FA and Woodhouse JA, Consideration of the possibility of detecting plutonium uptake by members of the general public by post mortem, BNFL internal paper, 1997

198 See chapter 8, "The National Radiological Protection Board"

> *I am anxious to point out that consent was viewed and interpreted in a completely different way to how it is viewed today. I recognise that consent for a hospital post mortem was an absolute requirement ... However, in the Coroner's post mortems my understanding was that I had the blanket approval from* [the Coroner] *to proceed and provide organs to the NRPB … At the time it did not seem as if anything extraordinary was being undertaken or that I was doing something which I should not have done.*

Professor Sir Bernard Tomlinson, who organised similar provision from Newcastle, said:

> *I believe that if a similar request were made today then a pathologist would recognise that to comply he would need both the permission of the Coroner and the consent of the next of kin. I do not think, however, that pathologists in the 1980s necessarily understood that, and would have considered post mortem permission from the Coroner to be sufficient.*

Radionuclide research

310 SL drew the Inquiry's attention to a number of studies conducted by other organisations and researchers at the same time as Dr Schofield's post mortem work. Some of those studies involved analysis of organs removed at post mortem to detect radionuclides or other materials. They indicate that the work done at Sellafield was not conducted in isolation and that such research was not confined to the nuclear industry. Other organisations, researchers and academics undertook similar research both in the UK and elsewhere, for example in Japan and Russia.[199]

311 A number of studies related to the analysis of organs for their radionuclide content by organisations outside the nuclear industry. Examples include:

- analysis for alpha activity of bone from 31 adults from Cornwall, 17 from Cumberland and 12 from London, carried out by the Institute of Cancer Research, London, published in 1958;[200]

199 For example, Okabayashi H and Watanabe H, Concentration of plutonium in Japanese human bone, *Journal of Radiation Research*, 1973, 14: 363–8 (measurement of plutonium deposits in Japanese human bone samples following nuclear explosion tests conducted since 1962); Muksinova K, Kirillova EN, Zakharova ML, Revina VS and Neta R, A repository of bio-specimens from Mayak workers exposed to protracted radiation, *Health Physics*, 2006, 90: 263–5 (organs taken at post mortem from 700 deceased workers employed at the first nuclear weapons facility in Mayak, a nuclear fuel reprocessing plant)

200 Turner RC, Radley JM and Mayneord WV, Alpha-ray activities of humans and their environment, *Nature*, 1958, 181: 518–21

- a study at Aberdeen University into iodine-131 content of ten human thyroid glands removed at post mortem in London between December 1958 and March 1959, published in 1959 and funded by the MRC;[201]
- a Radiological Protection Service study into uranium in human bone samples taken at random from hospital cases, published in 1971 and supported by the MRC and Department of Health and Social Security;[202]
- a study at the University of Leeds into the plutonium content of tissues, including liver, lung and vertebra, taken at post mortem from 12 patients who had died in 1980/81.[203]

Thyroid glands

312 Some researchers concentrated on studies which required the removal of a single organ. The Inquiry heard that in the 1980s it was not uncommon at West Cumberland Hospital for thyroid glands to be removed at post mortem for research. Dr Bird said that while a consultant in Newcastle he had conducted a study involving the removal of the thyroid gland at 1,000 post mortem examinations; he had continued the project when he arrived at West Cumberland Hospital, obtaining thyroid glands from 150–200 post mortem examinations, hospital and coronial, between 1983 and 1985.[204] The glands were removed purely for research but Dr Bird did not publish his results.

313 In October 1984, Dr Smith agreed that he and Dr Ghazala would provide ten thyroid glands from individuals who had not worked in the nuclear industry to Dr Colin Bowlt[205] for research into radioiodine levels; over a fortnight in November 1984 Dr Smith in fact supplied 14 glands.

201 Robertson HA and Falconer IR, Accumulation of radioactive iodine in thyroid glands subsequent to nuclear weapon tests and the accident at Windscale, *Nature*, 1959, 184: 1699–1702

202 Hamilton EI, The concentration and distribution of uranium in human skeletal tissues, *Calcified Tissue Research*, 1971, 7: 150–62

203 Burkinshaw L, Bayhreyni-Toossi MT and Spiers FW, Plutonium content of tissues of members of the general public, *Journal of the Society for Radiological Protection*, 1987, 7: 27–32

204 Some of the examinations were conducted by Dr Bird's colleagues

205 Department of Radiation Biology, St Bartholomew's Hospital, London

314 A little over a year later, on 14 December 1985, Dr Bowlt wrote to *The Lancet*:[206]

> *The Black report on the incidence of cancer in the area around the Sellafield nuclear reprocessing plant in Cumbria pointed to the need for more measurements of radiation doses received by the public … We have studied 14 thyroids taken at necropsy from people who had lived within 36 km of the Sellafield works.*

The letter indicated that 53 glands from southern England and 16 from Scotland had also been examined.

315 Dr Bowlt published another paper in 1987, describing iodine levels in thyroid glands from more than 160 adults from six main areas, including West Cumbria, taken during the nine weeks immediately after the Chernobyl incident on 25 April 1986. There is no indication within the paper as to who provided the material or in what circumstances but Dr Smith accepted that he had continued to supply thyroid glands to Dr Bowlt.

316 In 1989, Dr Bowlt published a third paper[207] looking at radioiodine in 130 thyroid glands removed at random at post mortem examinations on adults in Cumbria between November 1984 and September 1987. The paper does not suggest any attempt to exclude former nuclear workers from the study.

317 Eventually Dr Smith felt unable to continue to supply thyroid glands. On 23 March 1994, Dr Smith replied to a further request from Dr Bowlt:

206 Bowlt C and Howe, JR, Radioactive iodine-125 and iodine-129 derived from environmental pollution in members of the public, *The Lancet*, 1985, 2(8469–70): 1420

207 Bowlt C and Tiplady P, Radioiodine in human thyroid glands and incidence of thyroid cancer in Cumbria, *BMJ*, 1989, 299(6694): 301–2

> *there is a problem which could have serious repercussions for me … We can collect thyroid glands from* [hospital] *autopsies, but they will be few … in the mid 1980's Professor Bernard Knight issued a short statement in the Bulletin of the Royal College of Pathologists to the effect that a Coroner does not have any authority to authorise the removal of tissues or organs for therapeutic purposes or research from a Coroner's post mortem. The Coroner here, whilst most sympathetic and willing to help, has confirmed this view. As you appreciate, Sellafield is a very emotive issue and we have to tread carefully. If I collected thyroid glands from Coroner's post mortem examinations without any authorisation and this came to light, then I would be in serious trouble. In the past we have collected specimens from post mortem examinations for the Radiological Protection Board but have not done so for a number of years now for the above reason. Attempts have been made for the consent of relatives to be obtained prior to the carrying out of Coroner's post mortem examinations, but the matter has not been resolved … I am very willing to collect the specimens you require, and the Coroner here is also sympathetic, but this appears to be the stumbling block at the moment.*

On 15 June 1994, Dr Smith did send six thyroid glands *"collected a number of years ago … in a deep freeze up until today"*. The Inquiry has seen no evidence that thyroid glands were supplied after that date.

318 Dr Bowlt's work falls outside the Inquiry's Terms of Reference as analysis was undertaken away from nuclear facilities; the thyroid glands were not analysed at Sellafield and no-one there was involved in their supply. However, the Inquiry refers to the papers because it cannot exclude the possibility that some of the glands were taken from former Sellafield workers. A table in the 1970 AWE paper[208] enabled the Inquiry, by searching the coroner's archives in Whitehaven, to identify all but one of the adults from whom the thyroids had been taken and to establish that none of those deceased had been a nuclear worker. Dr Bowlt's papers contained no such tables and it was therefore not possible to identify the individuals from whom glands had been taken for his studies. The Inquiry has made contact with both Dr Bowlt and his co-author, Dr Peter Tiplady: unsurprisingly, neither still has any documentation which would have assisted in identifying the subjects.

319 Dr Bird too kept no records which might have allowed the individuals from whom he removed thyroid glands to be identified. The Inquiry has not searched the hospital or coroner's archives to try to identify those

208 By Dr Dean and Dr Trevena: see paragraphs 60–62

individuals: the work lies outside its Terms of Reference and such a search would in any event not allow identification with any degree of certainty.[209] It is likely that the bulk, if not all, of the glands used by both Dr Bird and Dr Bowlt were taken from people who had not worked in the nuclear industry but it cannot be said with certainty that no former Sellafield workers were involved.

Non-nuclear research

320 Other studies involved analysis of organs taken from employees of non-nuclear industries to investigate the effects of materials such as coal dust, barium dust, shale dust, asbestos, lead, cadmium and other metals. Examples are:

- a paper in 1956 describing analysis of 71 lungs from coal miners in South Wales and 15 silicotic lungs from tin miners and granite workers in Cornwall who were known or suspected to have had pneumoconiosis, and from miners who had died from other causes between March 1946 and March 1947: the author worked at the Postgraduate Medical School of London and the Safety in Mines Research Establishment, Sheffield;[210]
- a study, published in 1975, by the London Hospital Medical College of asbestosis in lung samples removed at post mortem from 260 men and 178 women between September 1965 and December 1966;[211]
- analysis for lead content of various tissues and organs from 129 bodies at Lostock Green biological laboratory of the Associated Octel Company Limited between 1966 and 1973;[212]
- analysis of 1,352 lungs from coal miners provided over a 14-year period from late 1972 by Pneumoconiosis Medical Boards and a small number from local hospitals, published in 1989 and carried out by the Institute of Occupational Medicine with financial support from British Coal and the European Commission;[213]

209 The post mortem reports did not mention removal of the thyroid; and it was taken in only some of the post mortem examinations at West Cumberland Hospital between 1983 and 1985

210 King EJ, Maguire BA and Nagelshmidt G, Further studies of the dust in lungs of coal-miners, *British Journal of Industrial Medicine*, 1956, 13: 9–23

211 Doniach I, Swettenham KV and Hathorn MK, Prevalence of asbestos bodies in a necropsy series in East London: association with disease, occupation, and domiciliary address, *British Journal of Industrial Medicine*, 1975, 32: 16–30

212 Barry PS, A comparison of concentrations of lead in human tissues, *British Journal of Industrial Medicine*, 1975, 32: 119–39

213 Ruckley VA, Fernie JM, Campbell SJ and Cowie HA, Causes of disability in coalminers: a clinico-pathological study of emphysema, airways obstruction and massive fibrosis, *Institute of Occupational Medicine Research Report*, TM/89/05, 1989

- a paper in 1983 describing analysis for cadmium, zinc and calcium of parts of kidneys removed at 290 post mortems at Glasgow Royal Infirmary, under contract to the Department of the Environment.[214]

321 The purpose of the work undertaken outside the nuclear industry echoes that which was carried out in respect of the Sellafield workers, namely scientific research and evidence in claims to the Pneumoconiosis Medical Panels. SL submitted that not one of these (and other) studies, analysing human tissue removed at post mortem for radiochemical or non-radiochemical materials, expressly indicated that consent had been appropriately obtained for the removal of the organs and that in some instances it would be fair to assume that consent had not been obtained as the samples appeared to have been taken opportunistically.

322 The Inquiry accepts that the nuclear industry was not the only employer engaged in research upon its workforce, nor were Dr Schofield and Dr Lawson the only individuals undertaking such work. However, the Inquiry's Terms of Reference confine its investigation to UK nuclear facilities and in any event it is not possible from the publications cited to determine whether consent was obtained. Nevertheless, the samples used in the studies of miners and asbestos workers were usually either small histological sections[215] or lungs supplied to Pneumoconiosis Medical Panels in the course of applications for compensation. In contrast to the Sellafield cases, whole organs do not appear to have been removed solely for research. Nuclear workers would not have anticipated that organs would be removed at post mortem, whether for a claim or for research; but it seems reasonable to assume that miners would have known of the arrangements relating to Pneumoconiosis Medical Panels.

323 Whether or not consent was obtained in other studies relates only to custom and practice. It does not affect the Inquiry's assessment of the legal position of the Sellafield work. The relevant legislation was in force, unchanged, from 1961. It should have been observed: poor practice or non-compliance elsewhere cannot excuse or justify departure from the law.

214 Scott R, Aughey E, Reilly M, Cunningham C, McClelland A and Fell GSF, Renal cadmium content in the west of Scotland, *Urological Research*, 1983, 11(6): 285–90

215 Removed as a matter of routine at post mortem by the pathologist to assist in determination of the cause of death

Numbers

324 On 18 April 2007, the Rt Hon Alistair Darling MP, the then Secretary of State for Trade and Industry, made a short statement to the House of Commons *"on the examination of tissue taken from some individuals who had worked in the nuclear industry and who died between November 1962 and August 1991"*, referring to *"65 cases in which tissue was taken from individuals which was then analysed for the radionuclide content of organs"*. The number in his statement came from a preliminary brief prepared the day before by Dr Macgregor, BNFL's CCMO.

325 The Inquiry has obviously been anxious to reach its own conclusions as to the numbers of cases in which organs were taken at post mortem and analysed at Sellafield. Dr Macgregor's figures are broadly accurate. They do not include the early work at Springfields or the lymph node study at Sellafield but this does not reflect any failing on his part: he would not have known of the earlier work. He gave considerable assistance to the Inquiry and his efforts to assist the families after the issue of organ retention came to light were commendable.

326 The true extent of the post mortem work can be summarised as follows.

Analysed at Sellafield

Lung tissue, 1950s

327 Information on this work is limited: see paragraph 30. The available documentation suggests that eight specimens of lung tissue were taken at post mortem and analysed at Sellafield.

Lymph nodes, 1960s

328 Again, information is limited: see paragraphs 47–51. The available documentation suggests that lymph nodes were taken at post mortem and analysed at Sellafield after 18 deaths in West Cumbria and 100 in the Newcastle area.

Sellafield workers, 1960–91

329 Between 1960 and 1991, organs were taken at post mortem for analysis from 64 former Sellafield workers: seven in the 1960s, 27 in the 1970s, 29 in the 1980s and just one in the 1990s (in 1991). Of those 64 men, 42 were still employed at Sellafield when they died, one was working at Winfrith (having previously worked at Sellafield) and the remaining 21 had either retired or were working outside the nuclear industry. Not all had been occupationally exposed to plutonium. All but four of the 64 sets of organs were analysed at Sellafield: the first three were analysed at Woolwich and/or at Harwell, and the fourth by the NRPB at Dr Schofield's request.

330 The Inquiry looked at all 64 Sellafield cases in detail. In all but four cases, the post mortem was undertaken at the request of the coroner. The removal and analysis of organs could be considered as part of a legitimate coronial investigation only if:

- the pathologist believed that the results of analysis would be relevant to the cause of death;
- the coroner decided to hold an inquest and requested that the organs be analysed;
- the results of that analysis were adduced in evidence at the inquest.

In only 11 of the 60 coronial cases were those requirements satisfied.

331 In 35 Sellafield cases the organs were removed and subjected to radiochemical analysis purely in the interests of scientific research: the results would have been of no value in determining the cause of death. In those circumstances, the organs could properly be removed only with the consent of the coroner and of the family of the deceased, neither of which was sought or obtained.

332 In a further eight cases, the pathologist could reasonably have believed that analysis of organs which he removed at the post mortem examination would be relevant in determining the underlying cause of death: however, in those eight cases the coroner did not order the analysis, which was nevertheless done at Sellafield. That analysis took place only in the interests of scientific research: accordingly, the primary purpose of analysis in 43 of the 60 coronial post mortems was scientific research.

333 In the final six cases the organs were removed at a time when litigation arising out of the illness which had caused the death was either in prospect or actually initiated. The coroner did not request any analysis and the results were not sent to him. The motive for obtaining the organs was the evidential value of the results in litigation.

334 There were four cases where organs were taken at hospital post mortem examinations. In three, the cause of death was obviously not connected to radiation exposure and BNFL's interest appeared to be scientific research. In the fourth, it seems that Dr Schofield was informed by the man's union that he had requested that his organs be taken for analysis after his death.

335 A more detailed consideration of the 64 Sellafield cases can be found in chapter 13, "The Families".

336 Analysis was also undertaken in the 1970s in two cases in which tissue was obtained in the course of surgical operations.[216] In one, the worker concerned was unaware that the tissue was to be taken; in the other, the absence of proper records means that the Inquiry cannot consider the circumstances.

Springfields workers

337 Dr Schofield also received organs taken from several nuclear workers from Springfields, Capenhurst and Aldermaston. Four had worked at Springfields and all came to inquest. In three, the analysis had been requested by the coroner and the results were given in evidence. The position in relation to the fourth case is unclear: although there was an inquest at which the possibility of an occupational link to death was explored, no mention was made of organs having been taken for analysis nor is there any evidence of the coroner having requested analysis. In one further case, there is evidence that the coroner initially requested the NRPB to analyse organs but then decided not to proceed with the analysis in view of the low exposures at Springfields. Analysis of a lung biopsy from a living Springfields worker was also undertaken: the Inquiry has no information as to the circumstances.

Capenhurst workers

338 Organs from two men who had worked at Capenhurst were analysed at Sellafield. In both, the organs were removed at a second post mortem under coronial authority and the results produced at the inquest. The circumstances in which the organs came to be made available to Dr Schofield were unusual but the coroner did approve what was done.

216 See paragraphs 77 and 78

Aldermaston workers

339 Analysis was also undertaken in five or possibly six Aldermaston workers.[217] In one, Dr Schofield acted as an expert witness on behalf of the family[218] and while there is no evidence of consent the context suggests that it was given; in another, the death was thought to be possibly linked to exposure to radiation and Dr Schofield gave evidence at the inquest, having analysed the organs at the request of the pathologist; in a third, there is evidence of consent to the donation of the entire body. Information on the other two cases is sparse but neither came to inquest. In one, the lung, liver and vertebrae were delivered to Dr Schofield by the Aldermaston SMO, Dr Murray Roberts, but it is unclear in what capacity Dr Schofield was acting; in the other, the Inquiry considers it likely that the widow agreed to the analysis.[219]

Dounreay worker

340 Finally, Dr Schofield received organs taken from a Dounreay worker in the early 1980s. The removed organs are detailed in the post mortem report and both the removal and analysis appear to have been at coronial request. Dr Schofield was instructed by the family; he died before the inquest was held but his report was given in evidence at the hearing.

Analysed elsewhere

Sellafield workers

341 Between 1980 and 1985, the NRPB's population studies involved analysis of organs taken from individuals who had never been occupationally exposed to plutonium.[220] The studies required that the organs did not come from nuclear workers but, perhaps inevitably given the dominance of Sellafield as an employer in West Cumbria, organs were removed from Sellafield workers in seven cases (five direct employees and two employed by contractors). The analysis was undertaken by the NRPB.

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217 In one case there was an intention to remove organs but it is not clear whether organs were removed or analysed: in 1988 Dr Lawson and the AWE attempted to clarify the point, without success

218 See paragraphs 214 and 215

219 See also chapter 9, "The Atomic Weapons Establishment"

220 See chapter 8, "The National Radiological Protection Board"

342 Organs from one man who had worked at Sellafield and was employed at Risley when he died were analysed by the NRPB in 1990 at the request of the coroner. BNFL was involved only to confirm the occupational history.

Springfields workers

343 Published papers do not assist the Inquiry to determine the exact number of cases in which organs were taken from Springfields workers. The 1958 UKAEA report[221] mentioned in paragraph 32 listed 19 cases (seven employees and 12 others as controls) and the 1962 Meichen paper[222] listed ten employees but did not indicate whether they included the seven employees from the 1958 paper. In one further case[223] in 1969, analysis appears to have been performed at Harwell; in two cases in the late 1970s, analysis was undertaken by the NRPB at coronial request.

Thyroid glands

344 Eighteen thyroid glands were provided to researchers at the AWE in 1968. In the 1980s, 14 glands were taken at post mortem for Dr Bowlt's initial research; his 1987 paper includes data from 32 glands from West Cumbria; his 1989 paper, from 130; and Dr Smith sent six more glands to him in 1994.

How robust are the numbers?

345 The passage of time since the events under consideration has made the Inquiry's task difficult. Documents have been lost or destroyed in routine housekeeping; potential witnesses have died or are in poor health. Of those who might have been of assistance, Dr Schofield, Dr Lawson, Mr Bates, Mr Mummery, Mr Gough, Mr Walker and Dr Ghazala are dead; Dr Barker is unwell; and Dr Goodfellow could not be traced. However, the Inquiry did hear evidence from many individuals who were able to describe the arrangements surrounding the post mortem work.

346 The strongest indication that the numbers advanced by the Inquiry are correct is, however, the documentation. With the assistance of SL the Inquiry has had access to an extraordinarily wide variety of documents,

221 See note 11, above

222 See note 15, above

223 Reported by Donoghue and others: see paragraph 234

including personal records (dosimetry, personnel and occupational health records), analytical records, legal files, minutes from a range of meetings of different committees and other bodies, computer records and internal technical, medical and scientific reports. From time to time, disclosed documentation suggested a further line of investigation: for example, an unfamiliar name in a list in which the other names were within the known post mortem cohort. In any such instance, the Inquiry was able call for documents specific to that individual, and to cross-check hospital and coronial[224] records, but nothing was found to implicate any additional case.

347 The Inquiry is accordingly confident that its identification of cases in which organs were taken at post mortem and analysed at Sellafield is complete. There is a wealth of contemporaneous documentation to support this conclusion, including:

- November 1973: a letter from Dr Schofield mentions *"eleven autopsies"*;
- 1973: Dr Schofield's annual medical report refers to 13 cases having been analysed for plutonium at Sellafield;
- 1974: a paper by Dr Schofield and Dr Dolphin[225] refers to data obtained from *"ten workers at Windscale who were exposed to plutonium and who have come to autopsy"*: a table sets out the causes of death and the Inquiry is satisfied that it is familiar with all the cases;
- 1979: Dr Schofield gives the Mackenzie Davidson Memorial Lecture:[226] *"autopsy specimens have been collected from 29 cases since 1964, 26 of these being from plutonium workers and the remaining three being personnel who were employed on a nuclear site but not specifically exposed to plutonium"*;
- 1982: an annexe to an internal paper by Dr Schofield gives results from 28 cases, listing the names (all of which are familiar to the Inquiry) and the dates and causes of death;
- June 1982: Dr Schofield's published paper[227] states that in the UK analyses have been performed on 37 cases, of which 30 were occupationally exposed to plutonium and died between 1964 and 1980 (it is not said that all of the 30 cases were Sellafield workers);

224 The Inquiry team searched the coroner's archives in Whitehaven to examine all records from 1956, the earliest available date

225 See note 47, above. The discrepancy between the ten cases referred to and the 13 cases mentioned in the 1973 annual medical report reflects the time between preparation of the paper and its publication

226 See note 53, above

227 See note 140, above

- 13 December 1982: at an NRPB meeting on the proposed national post mortem registry,[228] Dr Schofield refers to data accumulated from 35 cases;
- 2 May 1984: Dr Schofield sends details of 42 Sellafield cases to the Department of Health in connection with the Black Inquiry:[229] the names are not provided but the Inquiry has used the dates and causes of death to confirm that all the cases are familiar;
- April 1988: Mr Coulston presents a paper[230] at a conference organised by the International Atomic Energy Agency: *"the company's Chief Medical Officer currently has access to over 50 cases of partial body autopsy"*;
- 12 September 1988: Mr Wallace writes to Dr Strong *"with the exception of the most recent cases which are still being analysed attributable autopsy data is available for a total of 62 former Sellafield employees"*: the names are listed, all of which are familiar to the Inquiry;[231]
- 22 September 1988: minutes of a meeting of the Internal Radiation Dosimetry Group include *"Dr Strong commented that BNFL Sellafield has post mortem data on about 60 workers"*;
- 5 December 1988: Mr Wallace writes to Dr Lawson *"Trevor Bates … made available to me all the radiochemical analysis results that he holds … and by comparing these with CMO records and those in the medical department archives I have succeeded in attributing 61 data sets to Sellafield individuals"*;
- June 1989: Dr Lawson presents a paper:[232] *"Our autopsy database now has records for 61 former Sellafield employees"*;
- 1990: a very lengthy document,[233] apparently prepared for the leukaemia litigation, includes a section on post mortem work indicating data are available for 61 former Sellafield employees;
- August 1990: a paper[234] prepared by Ms Woodhouse and Dr John Wraight refers to six cases selected at random from the available autopsy records, said to *"represent approximately 10% of the cases for which autopsy data is currently available"*;
- 18 April 1991: a draft paper by Ms Woodhouse includes an appendix listing 54 *"Sellafield autopsy cases"*: the names were not provided but the

228 See chapter 10, "Registries"

229 See chapter 8, "The National Radiological Protection Board"

230 Coulston DJ, Monitoring and assessment of occupational exposure to long retained transuranic radionuclides – a contemporary view, IAEA conference paper, IAEA-CN-51/74, 1988

231 The original typed version of the note refers to 61 names and was amended by hand at some point

232 See note 119, above

233 Tagg B, The safety organisations and safety arrangements at Sellafield: 1948 to 1990, BNFL internal paper, 1990

234 See note 149, above

Inquiry is satisfied from the dates and causes of death that it is familiar with all of them;[235]

- March 1996: an internal BNFL Dosimetry Section study[236] states that autopsy data are available for 64 cases, which are detailed in a memorandum prepared in November 1995 and all are familiar to the Inquiry (the total in the study is accurate although by chance: the first case in which organs were taken at post mortem[237] is not included, perhaps because it had never been attributed an identifying number within the cohort, and a case where no organs were taken[238] is mistakenly counted).

Although the last document listed envisages further post mortem work (*"we recommend that patella be requested to be measured in future autopsies"*), there is no evidence that any in fact took place.

Conclusion

348 In many cases families have been wronged. Organs were removed at coronial post mortem and given to Sellafield for analysis despite being of no possible relevance to the cause of death. When radiochemical analysis was potentially of relevance it was conducted at Sellafield, notwithstanding the obvious conflict of interest. The results were seldom taken into account when the death was certified: they were important not for the coronial investigation but for Dr Schofield and Dr Lawson's own research and/or for litigation. There were widespread breaches of the Human Tissue Act 1961, coronial legislation and the Coroners Rules.

349 Families have been traumatised to discover the true state of their loved ones when interred. Mr Michael Brennan gave compelling evidence on the effect the discovery that organs had been removed from his father's body had had on his family:

235 By this time there were in fact 63 cases but it is likely that the reference to 54 cases is to validated data: see paragraph 206

236 See note 148, above

237 In 1960, see paragraph 37

238 The case is mentioned in Professor Jones's 1985 paper (see paragraph 226): there were interesting urinalysis data but no post mortem data – indeed, the individual is still alive, so far as the Inquiry is aware

> *My family and I have been absolutely devastated as a result of what has gone on. I believe that my father's organs were taken under the instructions of Dr Lawson for research. They were clearly not taken to assist in identification of the cause of death and no consent was obtained. I believe that BNFL could not risk asking for formal permission to remove and retain the organs as there would have been a real risk that any such request would have been rejected by my mother. Accordingly they simply helped themselves and I find it extraordinary that an employer could act in such an arrogant and thoughtless manner. I believe that they showed severe disrespect to my father's body and I find this mutilation very disturbing.*

He was not the only witness to express such feelings. The Inquiry's recommendations[239] are designed to ensure that such abuse can never again be allowed to happen.

239 See chapter 15, "Recommendations"

The United Kingdom Atomic Energy Authority

Chapter 6

The United Kingdom Atomic Energy Authority

Chapter 6

Contents

Creation

1 Before 1954 the Ministry of Supply (MoS) was responsible for all aspects of atomic energy in the UK. On 19 July 1954, the United Kingdom Atomic Energy Authority (UKAEA) was created[1] to take over that responsibility. It was a non-departmental public body managed by a Board of appointed members. Its first chairman was Sir Edwin Plowden. It had broad statutory powers, which included:[2]

> *a) to produce, use and dispose of atomic energy and carry out research into any matters connected therewith …*
> *e) to make arrangements with universities and other institutions or persons for the conduct of research into matters connected with atomic energy or radioactive substances …*

2 The UKAEA retained the structure previously used by the MoS, being divided into three groups:

- the Atomic Energy Research Establishment (AERE) at Harwell, led by Sir John Cockcroft;
- the Industrial Group at Risley, led by Sir Christopher Hinton;
- the Weapons Group at Aldermaston, led by Sir William Penney.

Structural changes

3 In the early 1970s, parts of the UKAEA were transferred to other organisations. Those relevant to the Inquiry were as follows.

- In 1971, the UKAEA Production Group, which formed the bulk of the Industrial Group, was transferred[3] to the newly-created British Nuclear Fuels Limited (BNFL). The transfer included the production facilities at Windscale and Calder Hall (now known as Sellafield) in Cumbria, Chapelcross in Scotland, Springfields in Lancashire and Capenhurst in Cheshire. The Radiological Protection Division (RPD) was transferred to the newly-formed National Radiological Protection Board (NRPB).

1 Atomic Energy Authority Act 1954, s1(1)

2 Ibid, s2(2)

3 Atomic Energy Authority Act 1971

- In 1973, the Weapons Group of the UKAEA (the Atomic Weapons Research Establishment, or AWRE) was transferred[4] to the Ministry of Defence.

4 From 1973, therefore, the UKAEA consisted of the Reactor Group, the Research Group and a head office in London. The Reactor Group included reactor research sites at Dounreay in Scotland and Winfrith in Dorset, and laboratories at Windscale[5] and Springfields. The Research Group remained at Harwell with additional laboratories at Culham in Oxfordshire.

5 Later reorganisations over the years included:

- the formation in 1989 and privatisation in 1996 of AEA Technology, which carried out various commercial activities on the UKAEA's sites;
- the transfer in 2005 of sites at Dounreay, Windscale and Winfrith to the Nuclear Decommissioning Authority (NDA);
- the sale in 2009 of much of its remaining operational capability via UKAEA Limited, a provider of decommissioning, waste management and environmental site remediation services, to Babcock International Group.

Following this last sale, the UKAEA's principal activity is fusion research and management of its Culham site.

6 The UKAEA's role has included research into and production of nuclear energy and also radiation protection. The need to understand the effects of radiation on the human body was relevant to each of these functions either directly or indirectly.

7 This chapter examines the use of human tissue by the UKAEA in research and other circumstances, concentrating on sites which remained under UKAEA control throughout the time under consideration. Before 1971, the UKAEA operated laboratories capable of undertaking analysis of bioassay samples at a number of sites.[6] Three (Sellafield, Springfields and Capenhurst) were transferred to BNFL in 1971; work done there, both before and after 1971, is discussed elsewhere in this Report[7] and so is mentioned only briefly here.[8] Activities at Aldermaston both before and after 1973 are treated similarly.[9]

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4 Atomic Energy Authority (Weapons Group) Act 1973

5 Only the parts of the site transferred to BNFL were renamed Sellafield

6 Sellafield, Springfields, Aldermaston, Capenhurst, Woolwich, Harwell, Risley, Winfrith and Dounreay

7 See chapter 5, "British Nuclear Fuels Limited"

8 See paragraph 23

9 See chapter 9, "The Atomic Weapons Establishment"

UKAEA laboratories

8 Evidence seen by the Inquiry indicates that of the sites which remained under the control of the UKAEA, analysis of human organs and bone took place only at Harwell and Woolwich.

- At Harwell the laboratory most closely associated with analysis relevant to the Inquiry was that of the Health Physics and Medical Division. It was here that the bioassay work took place and it therefore had the equipment necessary for the analysis of human organs. The Chemistry Division laboratory at Harwell also occasionally undertook such analysis.
- The Woolwich laboratory (Woolwich Outstation) was part of the Chemistry Division, albeit on a different site operated by the Ministry of Defence. It closed in 1966 and its staff and functions were transferred to Harwell.

Accountability

9 In 1957, accountability for the UKAEA passed from the Lord President of the Council to the Prime Minister. In 1959, responsibility was passed jointly to the Lord Privy Seal and the Minister for Science. Since then, ministerial responsibility has rested with the respective Secretaries of State at the Departments of Technology; Trade and Industry (DTI); Energy; Business, Enterprise and Regulatory Reform (BERR); and Energy and Climate Change (DECC).

10 A Health and Safety Branch was set up in 1959,[10] with Dr Andrew McLean, Chief Medical Officer at Risley, as its first Director. It was accountable directly to the Board and had three divisions:

- the Safety Division, based at Risley, was responsible for assessing the safety of reactors and plants and providing an inspection service;
- the RPD, based at Harwell, was concerned with the hazards of radiation;
- the Administrative Division liaised with government departments.

As Director of Health and Safety, Dr McLean was accountable to the UKAEA Board for the post mortem work undertaken by the Health and Safety Branch.

10 Following publication of *Report of the Fleck Committee on the Organisation for the Control of Health and Safety in the United Kingdom Atomic Energy Authority*, Cmnd 342 (HMSO, 1958)

11 Post mortem work was discussed from time to time in two UKAEA committees. The first was the Health and Safety Branch's own Management Committee, the minutes of which were extensively circulated around the Branch (Dr Greg Marley, who worked in the Branch and attended the meetings, received 12 copies for onward distribution) and elsewhere including to Dr McLean. The second was the Medical Officers' Co-ordinating Committee (MOCC) which was chaired by the UKAEA Chief Medical Officer (CMO) and attended by medical officers from every UKAEA site. As Director, Dr McLean received copies of all minutes and meeting papers, as did several members of his Branch who also attended. These discussions are described later in this chapter.

12 In 1971, Dr McLean left the UKAEA to become Director of the NRPB.

Demand for organs

13 The earliest research of which the Inquiry is aware involving analysis on UKAEA premises of organs obtained at post mortem was carried out by Dr S R Stitch of the Medical Research Council's (MRC's) Radiobiological Research Unit in 1954.[11] Thereafter, the UKAEA became involved in three areas of work which required analysis of organs:

- it undertook analysis in individual cases;
- it had an important role in the MRC's strontium-90 research;[12]
- it undertook research on the effect of radiation on humans, resulting in a number of published reports, and carried out some commercial research projects.

14 The UKAEA's involvement in this work was driven by two factors. The first was its statutory objective,[13] which gave licence to a wide-ranging research programme to *"produce, use and dispose of atomic energy and carry out research into any matters connected therewith"*. The second was, as the UKAEA itself put it:

> *the reality that the technical expertise needed to carry out this analysis was (between 1954 and 1971) largely concentrated within a handful of laboratories operated by UKAEA and other government bodies.*

11 See paragraph 46 and chapter 4, "Post Mortem Analysis in the Nuclear Age", paragraph 10

12 See chapter 11, "Strontium and the Medical Research Council"

13 Defined by the Atomic Energy Authority Act 1954, s1(1): see paragraph 1

15 The UKAEA told the Inquiry:

> *This early research was directed to monitoring and improving both worker and public safety – to learn about radiation exposure and to ensure that the optimal techniques and approaches were being used to minimise that exposure.*

16 There is no doubt that senior medical and health physics staff at the UKAEA were anxious to obtain organs at post mortem to allow further study of the effect of exposure to radionuclides on workers and that there was widespread knowledge of the efforts being made to obtain organs.[14]

- The minutes of a meeting of the MOCC on 31 May 1962, chaired by Dr Kenneth Duncan,[15] highlighted the need for post mortem analysis: *"There was a long discussion on the importance of obtaining material from post mortem examinations."* The minutes were copied to some 29 people at a dozen or so sites, the Health and Safety Branch in London and the RPD at Harwell, including Dr McLean.
- On 14 June 1967, the MOCC considered a draft paper by Dr N L Spoor of the RPD, which set out proposals to improve methodology for collection of post mortem samples. The minute records that Dr Duncan *"said that the subject underlined the need for post mortem analysis for uranium and more plutonium assessments. Suitable cases were rare."*
- Minutes of a meeting of the MOCC on 14 May 1969 show that post mortem work continued to be discussed.

17 The difficulty in obtaining nuclear workers' organs for research was a recurring problem. One potential solution was to formalise a programme based on consent in life from workers for donation of their bodies after death, similar to the National Plutonium Registry[16] which had been established in the US in 1968. However, the difficulties with such a formal programme were discussed at a meeting of the MOCC on 9 December 1970, chaired by Dr Maurice Hill, Dr Duncan's successor as UKAEA CMO. In response to a question about whether efforts should be made to obtain *"more post-mortem information concerning plutonium levels in the lungs of radiation workers"*, Dr Hill informed the committee that:

14 See chapter 5, "British Nuclear Fuels Limited", paragraphs 40 and 41

15 Then Medical Adviser and later UKAEA CMO

16 See chapter 10, "Registries"

this possibility had been considered before but it was considered undesirable to approach employees before death regarding the donation of their bodies. Every opportunity should however be taken to obtain post-mortem material if this became available.

18 The reluctance to approach workers formally before their deaths or to consider following the Americans in setting up a registry based on consent meant that ad hoc arrangements were relied upon to obtain organs. The success in making those arrangements varied from site to site. A number of factors appear to have been influential:

- the nature of the work carried out at the various sites;
- the degree of enthusiasm for post mortem analysis and the research interests of medical staff;
- the willingness of individuals in the local community, such as pathologists and coroners, to become involved;
- the level of litigation arising from alleged radiation-related injuries or deaths in the workforce.

19 In the 1980s and 1990s, several unsuccessful efforts were made to set up a formal registry in the UK, which foundered because of the lack of political will among the managements of the various nuclear employers. These are considered in detail in chapter 10, "Registries".

Understanding of the law

20 The legality of removing organs at post mortem was discussed at the MOCC meeting on 9 December 1969 and it was agreed that Dr Thomas Graham, Senior Medical Officer at Springfields, should write to the Medical Defence Union (MDU) about *"ethical aspects of the use of post mortem specimens"*. Dr Graham's letter, dated 12 December 1969, states:

> *I would be very glad of any advice or comments you feel able to give on the subject of post mortem material and the doctor's obligations to the relatives. My colleagues and I have been discussing this subject recently. The only points we seem to be clear upon are that (a) permission to carry out a post-mortem examination must be obtained from the next of kin but (b) the Coroner does not need this and can insist despite objections from relatives …*
>
> *The removal of specimens, organs and samples of all kinds seems to be widely practised …*

> *Abhorrent though it surely must be to relatives, once they decide to allow a post-mortem … I would not think they would then be able to stipulate what should or should not be done. But in this belief I could be entirely wrong and I would be greatly interested to hear the views of the experts.*
>
> *This all arose out of a particular case where we obtained tissue specimens for analysis … The man had died of natural causes and we had done this type of thing often before. On this occasion, however, one of the managers asked the question: "Were the relatives asked?" Our belief is that permission was not necessary, that such a request would only have upset the relatives further and that, since no disfigurement was involved, the removal of tissue could not possibly offend.*

21 Mr Douglas Robb[17] replied on 19 December 1969:

> *The points which you make … are, of course, absolutely correct. As to the question of the removal and preservation of organs from a dead body, there is little doubt that prior to the passing of the Human Tissue Act of 1961 this was unlawful, and I am quite sure that the majority of pots which stand on the shelves of medical school museums were filled illegally! The Human Tissue Act however makes it clear that "for therapeutic purposes or for the purposes of medical education or research" any part of a body may be removed provided that permission has been granted for a post mortem examination by the person "lawfully in possession" of the body. In normal circumstances this is either the executor or the next-of-kin. I support your belief that once granted permission to undertake the post-mortem there is no need for the pathologist to ask specifically for permission to remove and preserve any particular organ.*

Mr Robb's *"support"* for Dr Graham's belief was misguided. Neither consent to a hospital post mortem examination nor ordering of a coronial post mortem gave *carte blanche* to the pathologist for wholesale evisceration of the body in the name of research. Organs could be removed only if relevant to the purpose of the examination.[18]

17 Senior assistant secretary at the Medical Defence Union

18 See chapter 3, "Law and Guidance"

22 At a meeting of the MOCC on 9 June 1970, Dr Hill:

> *said that he had received confirmation from the Medical Defence Union that relatives' consent to post-mortem examination constituted approval of the use of the deceased's organs for research purposes. He agreed to copy the letter to members.*

The UKAEA did not investigate the legal position further, having been (falsely) reassured by Mr Robb's advice.

Sites transferred to BNFL

23 Before the UKAEA Production Group was transferred to BNFL in 1971, there were five discrete programmes of work at its sites which involved the analysis of organs taken at post mortem.

- The work done on behalf of the MRC for the strontium-90 studies was by far the largest of the programmes, involving organs taken from 6,072 randomly-chosen individuals (not nuclear workers) who died between 1955 and 1970. The studies are discussed in chapter 11, "Strontium and the Medical Research Council".
- The earliest analysis undertaken at a UKAEA Production Group site was at Springfields in 1954, following the death of a nuclear worker from that plant. Analysis at Springfields of organs taken from other former employees continued from time to time until approximately 1962: the absence of documentation means that the date of the final case is uncertain. It appears that after 1962 these analyses were performed at Sellafield, possibly due to local concerns at Springfields.[19] It is not clear from how many individuals organs were taken for analysis: in 1958 a UKAEA report[20] detailed results from 19 cases (seven employees and 12 others as controls) and a paper[21] in 1962 referred to ten (all employees), but it is not clear whether that figure included the seven from the earlier paper. The Springfields work is discussed in chapter 5, "British Nuclear Fuels Limited".

19 In one further case, in 1969, organs from a Springfields worker were analysed at Harwell: see chapter 5, "British Nuclear Fuels Limited", paragraph 343

20 Butterworth A, *Human data on uranium exposure*, US AEC report HASL-58 (US AEC, 1959)

21 Meichen FW, Medical supervision of employees in the Atomic Energy industry, *Atompraxis*, 1962, 8: 24–6

- The first analytical work of this kind at Sellafield was done in December 1954/January 1955 and involved analysis of eight samples of lung tissue. Lack of documentation means that the Inquiry has been unable to ascertain the circumstances in which that tissue was acquired or whether the deceased were nuclear workers. It is not known why the work was done or whether it was part of any wider programme of analysis. It is described in chapter 5, "British Nuclear Fuels Limited".
- Between 1960 and April 1971, organs taken at post mortem from seven Sellafield nuclear workers were analysed, the latter six under the auspices of Dr Geoffrey Schofield, Senior Medical Officer. Dr Schofield continued his post mortem work after the Sellafield site was transferred to BNFL in April 1971, organs taken from a further 57 Sellafield workers being analysed. Organs taken from individuals who had worked at other sites[22] were also analysed at Sellafield after 1971. Evidence seen by the Inquiry leads it to conclude that Dr Schofield's work was endorsed by his employers, first the UKAEA and later BNFL. As the majority of the analyses were performed after BNFL assumed responsibility for Sellafield in 1971, the work (as done both by Dr Schofield and by his successor, Dr Adam Lawson) is described in chapter 5, "British Nuclear Fuels Limited".
- A number of lymph nodes were analysed at Sellafield in the mid-1960s. Again, documentation is sparse. The lymph nodes analysed (118 cases) appear to have been obtained from West Cumbria (18) and Newcastle (100) but it is impossible to draw any conclusions as to the circumstances in which they were taken, whether consent was obtained or whether the samples derived from nuclear workers. More detail is given in chapter 5, "British Nuclear Fuels Limited".

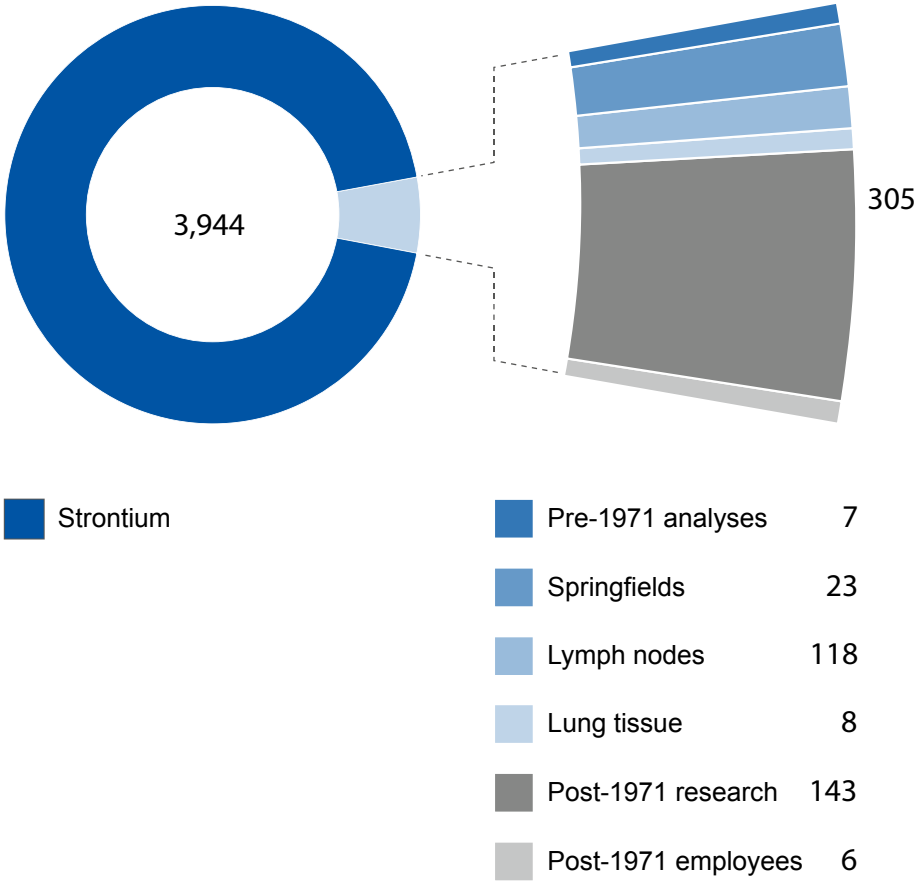
24 The purpose of the strontium-90 studies was to determine the likelihood that nuclear fallout would affect the population in general. It would seem likely that the remaining studies were undertaken because, for the reasons set out at paragraphs 13–19, such work was recognised to be important. After BNFL was formed in 1971, the UKAEA had little direct involvement in post mortem work save for a small number of individual cases[23] and a few research projects in which organs and bone were taken from members of the public.[24] Figure 6.1 shows how the analyses of organs from approximately 4,200 individuals were divided between the various projects and demonstrates the dominance of the strontium-90 studies.

22 Springfields, Capenhurst and Aldermaston

23 See paragraphs 25 et seq

24 See paragraphs 49 et seq

Figure 6.1: Analysis by project



Employees

25 Six UKAEA workers whose organs were removed for analysis at post mortem examination have been identified; analysis was performed in only five of these. An extensive search has been undertaken, which is described elsewhere in this Report, and the Inquiry is satisfied that there are unlikely to be further cases of which it has not been made aware.

CC

26 CC died in the 1970s. He had been pursuing a claim against the UKAEA in respect of exposure to radiation during his employment. Some months before CC died, Dr McLean asked Mr Donald Sim, a lawyer employed by the UKAEA, to consider *"the pros and cons of obtaining post-mortem material for analysis, should this become available"*. The Inquiry has seen no

evidence to suggest that steps were taken at that stage to make arrangements to obtain organs after death or to seek consent for doing so from CC or his solicitor. However, CC's death prompted urgent telephone discussions between UKAEA legal and medical staff about whether, and if so how, they should try to obtain organs.

27 A post mortem took place at the request of the coroner. On learning of the post mortem, a Treasury Solicitor, acting on behalf of the UKAEA, arranged via the coroner for a further post mortem examination to take place the following day in order that organs could be removed for analysis. By this time the pathologist who had performed the original examination had already completed his report and supplied it to the coroner. The second examination was attended by Dr Hill and a pathologist instructed by the widow's solicitors. Dr Hill collected a lung, part of the trachea, part of the femur, sternum and costal cartilages, part of the liver and some lymph nodes. Dr Spoor took the organs to Harwell, where they were divided between the Health Physics and Medical Division and the Chemistry Division[25] for analysis. The UKAEA later used some of the results in the civil claim. It is not clear from the evidence available to the Inquiry what organs were taken by the family's medical representative or whether any organs taken were ever analysed.

28 The UKAEA's analyses had not been completed by the time the inquest was held and were not received in evidence. The coroner had agreed to the organs being removed but the analyses were not required to assist him in determining the cause of death and the removal could therefore have been lawful only if also authorised by the family. Documents seen by the Inquiry suggest that authority was given by both CC's widow and his executors and therefore that the removal complied with the provisions of the Human Tissue Act 1961.

29 Following the post mortem, Dr Geoffrey Dolphin of the RPD wrote:

> *In order to assess the significance of any findings of radioactivity in* [CC's] *tissue, it will be necessary to carry out similar analyses of lungs from a male of approximately the same age as* [CC]. *It was agreed that Dr Dyson should make arrangements to get post mortem tissue from The Radcliffe Hospital, Oxford and I proposed to contact Professor Crawford at St George's Hospital, London for help in the matter.*

25 Then known as the Analytical Science Division

30 It is apparent from reports[26] subsequently produced by the UKAEA that organs were indeed taken from two other individuals to act as controls against which the results from CC could be compared. They had not been employed by the UKAEA and had no history of occupational exposure to radiation. The reports state that they were thought to have been resident in Southern England. One, aged 24, had died in a road traffic accident; his name appears on the relevant UKAEA file. Nothing is known of the second save that he was aged 78. It has not been possible to obtain any further information about the circumstances in which these organs were obtained.

DD

31 DD had worked at Harwell and had been concerned about a possible link between a cancer which he had developed and occupational exposure to radiation. He had requested that upon his death Dr Alexander Stott, the Head of Medical Services at Harwell, should ensure that a post mortem examination was carried out and his organs analysed to investigate any such link. It does not appear that his death was reported to the coroner. Dr Stott obtained permission from DD's widow to harvest and analyse organs at post mortem examination. The results were passed to the solicitor representing the widow and were also presented at a symposium.[27] The paper compares the results with those of two control subjects, who appear to be the same as those referred to in the previous paragraph.

EE

32 EE was recalled by Mr Robert Morrison, who had worked in the analytical laboratory at Harwell at the time and from whom the Inquiry heard evidence. No documentation has been identified which describes the circumstances in which the organs were obtained.

James Connor

33 In the 1970s, the Senior Medical Officer at Winfrith, Dr Alexander Laylee, was congratulated by Dr Hill for managing to secure organs from a Winfrith

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26 Eakins JD and Lally AE, *The Analysis of Autopsy Samples for Plutonium,* R-6547 (AERE, 1970); Newton D, *Some Measurements of Radioactivity in Human Tissues*, R-6697 (AERE, 1971)

27 Eakins JD and Lally AE, The determination of plutonium in autopsy samples, in *Proceedings of the Symposium on the Determination of Radionuclides in Environmental and Biological Materials* (Central Electricity Generating Board, 1973)

(and former Sellafield) employee, James Connor,[28] who had died of leukaemia. The reason for the success was identified as close liaison with the local hospitals and doctors. Dr Laylee held a position as a clinical assistant at the local hospital. He attended the post mortem: it is not clear how this came to pass. The pathologist preserved organs for later analysis; Dr Hill collected them the following week and they were stored in a freezer at Harwell. This appears to have been the limit of the UKAEA's involvement.

34 The coroner asked that the organs be analysed for himself and for the family separately. The analyses were carried out by Dr Donald Popplewell of the NRPB on behalf of the coroner and by Dr Geoffrey Schofield at Sellafield[29] on behalf of the family. No analysis was carried out at Harwell or on behalf of the UKAEA. The coroner heard evidence on the results of the analysis at the inquest from both Dr Popplewell and Dr Schofield. Both the retention of the organs and their analysis appear perfectly proper.

FF

35 FF was a Dounreay worker who had asked that his organs be analysed after his death. Arrangements were made through his solicitor and his medical adviser for Mr Edgar Cartwright of BNFL to attend the post mortem examination. The post mortem report records that organs had been removed and handed to Mr Cartwright for analysis. The organs were analysed at Harwell and at Sellafield[30] and the results presented in evidence at the inquest. The removal and analysis of the organs was perfectly proper.

GG

36 GG died of cancer in the early 1980s. On learning of GG's former employment at Harwell, the pathologist removed organs on his own initiative (as he was entitled to do) in case the coroner thought they might be relevant to the cause of death. The coroner informed him that he did not wish the organs to be analysed. The Inquiry has seen no evidence as to the manner of disposal of the organs. There is no evidence that the UKAEA

28 See chapter 13, "The Families"

29 Mr Connor is included as one of the 64 former Sellafield workers from whom organs were taken at post mortem for analysis, as referred to in chapter 5, "British Nuclear Fuels Limited", paragraph 329

30 FF is the individual referred to in chapter 5, "British Nuclear Fuels Limited", paragraph 340

received the organs and none that they were ever analysed. It is likely that they were treated as clinical waste. No inquest was held.

Consent

37 The analysis of the deceased employees' organs as described above was done in accordance with the law, either at the direction of the coroner (with the results subsequently given in evidence at an inquest), or with the permission of the deceased or his family and, where necessary, the coroner.[31]

38 Medical officers at UKAEA sites were less proactive in seeking out organs from deceased employees for analysis than those at Sellafield, Springfields and Capenhurst. UKAEA staff were aware of the desirability of obtaining organs for analysis for both scientific and legal reasons but they tended to react to organs being made available to them rather than actively seeking them. It does not appear that the close links with the local coroners and pathologists arranged by Dr Schofield in West Cumbria were replicated elsewhere.

39 The Inquiry has found no evidence of analysis by the UKAEA of human organs from former employees of the other sites which remained under its control.[32]

Secrecy

40 While the analytical results were not published in peer-reviewed scientific literature, the process was not secret. In three of the cases the deceased before death, and the family after death, consented to the removal of organs for analysis. The results from all but one of the employees referred to above[33] were either given in evidence at inquest or provided directly to the representatives of the family.

31 With the exception of EE (see paragraph 32), where the position is unclear

32 Culcheth, Culham, Risley

33 The exception is EE (see paragraph 32), where the position is unclear

Non-employees: individual cases

41 In addition to those obtained from former employees, the UKAEA analysed organs from a few individuals whom it had never employed.

42 On one occasion, the UKAEA undertook analysis after a request from Germany. There appears to have been suspicion that the deceased's death may have been the result of exposure to radiation in Greenland. In this instance the Harwell laboratory acted purely as an analytical service. Documentation suggests that the UKAEA intended to charge for this particular analysis. The Inquiry has seen nothing to suggest that the UKAEA received payment for other analyses referred to in this chapter.

43 The UKAEA also analysed organs from a former employee of the Atomic Weapons Establishment (AWE) in the early 1980s, after permission had been obtained from the family of the deceased.[34]

Non-employees: other research

44 The strontium research was by far the largest study involving analysis of human organs in which the UKAEA Research Group participated, but other research papers based to some extent on analysis of organs or smaller pieces of tissue or bone were produced from time to time. The Inquiry has identified fewer than 20 studies carried out by the UKAEA at Harwell and Woolwich which involved human organs (some of which led to publication of more than one paper) between 1956 and 1992. In contrast, over 15,000 research papers were published between 1954 and 1992 on topics which did not involve human organs. The infrequency of the publications involving analysis of organs suggests that such research was not a priority.

45 The UKAEA has been unable to provide the Inquiry with documentation, other than laboratory records, such as internal memoranda, correspondence, protocols or study designs relating to the research studies identified below. There are various explanations for the absence of such documentation:

- the documents might have been destroyed over the years in accordance with the UKAEA's statutory responsibilities, there having been no historical or business justification to retain them;

34 See chapter 9, "The Atomic Weapons Establishment"

- records might have been destroyed when laboratories closed, because they were no longer thought to be of use or interest, particularly if the papers had been written up into formal reports;
- archiving of generic categories of records together means that focused searches are impossible;
- some records may have been retained by individuals who took them when they left or retired from the UKAEA;
- some documents (such as protocols and study designs) which might have been expected to have been produced may in fact never have existed.

1950s

46 In the late 1950s, a series of papers[35] was produced in which levels of trace elements in human tissue were discussed. Responsibility for the work was shared by the MRC and the UKAEA. It is apparent from the papers that human tissue and bone were obtained directly from pathologists. The subjects appear to have been drawn from the general population rather than from the nuclear industry and are described as "accident cases", suggesting that the samples derived from coronial rather than hospital post mortem examinations. The purpose of the study was to measure levels of trace elements in the general population and in no case, therefore, did the results bear upon the cause of death.

47 The samples gathered for the papers referred to in the previous paragraph were used in further work, which led to a paper[36] published in 1960 by researchers from the Chemistry Division at the UKAEA.

48 The papers do not indicate whether permission for the removal of organs or bones had been obtained but the Inquiry's understanding of practice at the time suggests that it is unlikely to have been sought. Nevertheless, there was then (before the Human Tissue Act 1961 was in force) no statutory requirement for such consent. The papers were published in scientific journals available, at least in theory, to the public.

35 Stitch SR, Trace elements in human tissue. 1: A semi-quantitative spectrographic survey, *Biochemical Journal*, 1957, 67(1): 97–103; Sowden EM and Stitch SR, Trace elements in human tissue. 2: Estimation of the concentrations of stable strontium and barium in human bone, *Biochemical Journal*, 1957, 67(1): 104–9; Sowden EM, Trace elements in human tissue. 3: Strontium and barium in non-skeletal tissues, *Biochemical Journal*, 1958, 70(4): 712–15; Sowden EM and Pirie A, Barium and strontium concentrations in eye tissue, *Biochemical Journal*, 1958, 70(4): 716–17

36 Loveridge BA, Webster RK, Morgan JW, Thomas AM and Smales AA, The determination of strontium in rocks and biological materials, *Analytical Chimica Acta* (Netherlands), 1960, 23: 154–71

1960s

49 Various papers[37] were published in the 1960s describing levels of radioactive substances in bone which had been gathered for the UK strontium-90 research.[38] The analysis was performed at the UKAEA Chemistry Division's outstation at Woolwich, where the strontium analysis was then undertaken. The papers were published by Her Majesty's Stationery Office (HMSO). They do not indicate that consent had been obtained from either the family of the deceased or the coroner for removal of the bone. For reasons discussed elsewhere in this Report,[39] the Inquiry concludes that it is unlikely that such consent was obtained.

50 In 1968, a paper[40] was published from UKAEA Harwell which described chemical analysis of bone from young children. The purpose of the study was to enhance the accuracy of assessment of overall radiation dose to bone. The paper refers to vertebral bone supplied by pathologists at the Royal Victoria Infirmary, Newcastle, and St George's Hospital, London. Other documents seen by the Inquiry indicate that one of the authors, Dr E D Dyson, also received vertebrae for the study from Dr G M Ardran, a radiologist at Harwell who also had a clinical practice at the John Radcliffe Hospital, Oxford. Dr Dyson also received ribs but the source was not identified.

1970s onwards

51 Research into the detection and measurement of radionuclides in bone and tissue continued sporadically. The Inquiry has identified six sets of studies published between 1970 and 1992. Material for these studies was received from a variety of sources:

- tissue and bone from two individuals were obtained from hospitals for comparison with analytical results from an employee;[41]
- a vertebra from an adult male was supplied by Dr Ardran;[42]

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37 For example: Henderson EH, Parker A and Webb MSW, *Barium in bone and foodstuffs*, AERE/R/4035 (AERE, 1962); Owers MJ, *Preliminary Survey of some Radioactivities in Bone*, AERE/M/986 (AERE, 1962); Owers MJ and Parker A, *Radioactivities in human and animal bones,* AERE/R/4466 (AERE, 1964)

38 See chapter 11, "Strontium and the Medical Research Council"

39 Ibid

40 Dyson ED and Whitehouse WJ, Composition of trabecular bone in children and its relation to radiation dosimetry, *Nature*, 10 February 1968, 217: 576

41 Referred to in more detail at paragraph 30 and note 26, above

42 Whitehouse WJ, Dyson ED and Jackson CK, The scanning electron microscope in studies of trabecular bone from a human vertebral body, *Journal of Anatomy*, 1971, 108(3): 481–96

- ribs from five people were received from the MRC's Social Medicine Unit for assay of lead;[43]
- 46 bone samples from an unidentified number of people with Paget's disease were provided by pathology staff at Southampton General Hospital and analysed for the presence of trace elements: the results were compared with those of 46 control samples;[44]
- lung samples were received from 30 people (not UKAEA employees) who had been occupationally exposed to crocidolite, a form of asbestos used in the manufacture of gas masks;[45]
- bone from two US citizens who had donated their tissue through the United States Transuranium and Uranium Registries[46] (USTUR) was analysed for the presence of americium and thorium.[47]

Consent

52 The Inquiry has seen no evidence that consent was obtained in the UK for removal of organs or bone for the UKAEA's research, nor that the UKAEA required that researchers should use only material supplied in accordance with the provisions of the Human Tissue Act 1961. It is likely that the removal was done without the knowledge of the families of the deceased: although common practice at the time, this was contrary to the provisions of the Act. The Inquiry has seen no evidence that the UKAEA was directly involved in the removal of human tissue; any such breach was perpetrated by pathologists rather than by its employees.

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43 Hislop JS, Parker A, Spicer GS and Webb MSW, *Determination of Lead in Human rib bone*, AERE/R/7321 (AERE, 1973)

44 Hislop JS, Morton AG and Pickford CJ, *Determination of Trace Elements in Bone Affected by Paget's Disease*, AERE/G/1434 (AERE, 1979); Pickford CJ, Morton AG and Hislop JS, Determination of trace elements in bone affected by Paget's disease. Use of a Rank-Hilgar E1000 direct-reading spectrometer (undated)

45 Morgan A and Holmes A, Concentrations and characteristics of amphibole fibres in the lungs of workers exposed to crocidolite in the British gas-mask factories, and elsewhere, during the second world war, *British Journal of Industrial Medicine*, 1982, 39(1): 62–9

46 See chapter 10, "Registries"

47 Priest ND, Freemont A, Humphreys JA and Kathren RL, Histopathology and 241Am microdistribution in skeletal USTAR Case 246, *Health Physics*, 1995, 69(3): 330–7; Priest ND, Haines JW, Humphreys JA, Metivier H and Kathren RL, The bone volume effect on the dosimetry of plutonium-239 and americium-241 in the skeleton of man and baboon, *Journal of Radioanalytical and Nuclear Chemistry*, 1992, 156: 33–53; Priest ND, Studies on the deposition and redistribution patterns of α-emitting radionuclides in the skeleton of man and monkeys, AEA-EE-0172 (AEA, 1991); Priest ND, Humphreys JA and Kathren RL, The distribution of Thorotrast in the red bone marrow: a study using human and monkey tissues, in van Kaick G and Kellerer AM, eds, *Health Effects of Internally Deposited Radionuclides: Emphasis on Radium and Thorium: Proceedings of an International Seminar Held in Heidelberg* (World Scientific, 1995), pp 69–74; Humphreys JA, Priest ND, Ishikawa I, Townsend KMS and McInroy JF, Studies on the distribution of Thorotrast in bone, in ibid, pp 75–80; Ishikawa I, Humphreys JA, Priest ND, Mori T and Cato Y, Thorium deposition in the bone marrow of Thorotrast patients, in ibid, pp 81–6; Priest ND, Humphreys JA, Kathren RL and Mays CW, The distribution of Thorotrast in human bone marrow: a case report, *Health Physics*, 1992, 63(1): 46–53

53 In contrast, the bone obtained from the USTUR had been taken after fully informed consent before death. Professor Nicholas Priest, a specialist in autoradiography who undertook the studies in the 1990s on that bone, told the Inquiry that he had satisfied himself that its procedures for obtaining consent were robust.

Secrecy

54 Most of the papers described were published either by HMSO or in peer-reviewed scientific journals[48] and were therefore available to scientists, doctors and ultimately the general public. It is apparent from the periodic reviews of research at Harwell that not all research was published, even internally, but those reviews were themselves available through HMSO. The Inquiry has not identified any attempt to keep research using human organs secret. As the UKAEA indicated to the Inquiry, the research reviewed in this section:

> *was for scientific purposes … to advance science research and medical health relating to radioactivity, and* [was] *in the wider sense for the public good, and would have been seen by those producing* [it] *in that sense. There is no sense in any of the reports that the individuals felt that they were doing anything that was inappropriate or wrong.*

Unpublished research

55 Searches have been conducted of the UKAEA's manuscript and electronic databases to identify research relevant to the Inquiry's Terms of Reference. Unpublished studies involving human tissue include research:

- in the 1960s and 1970s, using thyroid and lymph glands obtained from the Royal Hospital, Sheffield, and from Liverpool;
- in 1971, in which 18 lungs were received from the Safety in Mines Research Establishment, Sheffield, for irradiation measurement of molybdenum;
- in 1973, with London Hospital Medical College on the presence of metals in the synovial tissue of patients with prosthetic knees;
- in 1974, with the Home Office on analysis of femora to determine time of death;

48 Save for the work on trace elements in Paget's disease in the late 1970s and early 1980s

- in 1974, with the MRC's Social Medicine Unit involving analysis of kidneys;
- in 1975, with John Radcliffe Hospital, Oxford, on the timing of intracranial bleeding in premature babies using chromium-50;
- in 1975, with London Hospital Medical College on the presence of gold in synovial tissue.

56 The Inquiry is satisfied that it has established the scale of research involving post mortem tissue which was carried out at Harwell even though, due to the passage of time, documentation is incomplete.

Other work on material obtained at post mortem

57 Those involved in the analysis of environmental and bioassay samples were concerned that the results of different laboratories should be accurate, consistent and comparable. The Inquiry heard from Mr Morrison that as part of exercises aimed at achieving consistency between laboratories, Harwell would:

> *receive subsamples from other laboratories from time to time and on occasions there would be "round robin" exercises across the various laboratories involved in the exercise.*

Who knew?

58 The research identified in this chapter fell within the wide powers of the UKAEA as set out by the Act which created it. Work involving analysis of organs from employees and general research on human tissue was referred to in management reports and progress reports produced primarily for the Health and Safety Branch Management Committee and the MOCC. It was also referred to in published papers. Knowledge reached Board level through Dr McLean, Director of Health and Safety, although he may not have been aware of the specific arrangements regarding the retention and analysis of organs in every case. It is apparent that arrangements to obtain organs from former employees usually involved senior medical staff at the UKAEA.

The legal and ethical position

59 In the rare cases discussed above where the UKAEA was directly involved in arranging for the removal of organs, it appears that the organs were removed in accordance with the law.

60 Human organs could be removed at the request of the coroner only when they might be relevant to the cause of death. Where the organs were removed for some other purpose the relatives' consent was necessary in addition to the coroner's. While there is limited documentation available, evidence heard by the Inquiry as to common pathology practice at the time leads it to conclude that consent would not have been sought from the families of the deceased for the removal of organs or bone for research. The pathologists who supplied material to the UKAEA probably acted contrary to the provisions of the Human Tissue Act 1961. The Inquiry considers it reasonable that the UKAEA should have relied upon the pathologists to have acted lawfully in obtaining the material which was provided.

61 The Inquiry has not seen any evidence that pathologists or anyone else brought to the attention of the UKAEA any concerns about the lawfulness of the provision of organs for research. Indeed, in 1970, Dr Hill, CMO, circulated to other medical officers independent legal advice obtained in 1969 as to the relevant law which is likely to have reassured the medical officers as to the legality of their occasional efforts to obtain organs following the deaths of employees. The Inquiry has not been able to determine whether that advice was circulated to the groups undertaking research work on individuals not employed by the UKAEA. In each employee case removal and analysis of tissue was performed in accordance with the law.

62 The Inquiry is satisfied that when the UKAEA was providing only an analytical service, there was no duty upon it to investigate the circumstances in which the organs had been obtained if they came from a reputable source and apparently in accordance with the law.

63 The UKAEA's work was not carried out secretly. For the most part it was published either by HMSO or in medical or scientific journals. It was carried out with a view either to gaining increased understanding of the relevance of exposure to radiation in relation to the cause of death of an individual or to increasing knowledge about the effects of radiation exposure more generally. The Inquiry does not criticise the ethics of the UKAEA's actions in respect of the work identified in this chapter.

The UKAEA's current involvement in tissue retention

64 The UKAEA assured the Inquiry that it complies with the provisions of the Human Tissue Act 2004. No human tissue is stored on UKAEA premises. The UKAEA has not undertaken analytical work on human organs or bone since the early 1990s; the last report referring to analysis of human material was published in 1995; and the UKAEA sold the relevant laboratories in 1996.

Remaining ashed samples

65 The UKAEA continues to hold three ashed, acellular samples of human material. Since they contain no cells, the samples are not subject to the provisions of the Human Tissue Act 2004. Two of them derive from one individual (CC). The third cannot be identified but appears to arise from analytical work carried out by the Woolwich laboratory as part of the survey of strontium levels in the Australian population.[49] The next of kin of those deceased have not approached the Inquiry and best practice demands that the Inquiry does not make contact with them.[50] The Inquiry has agreed with the UKAEA that the ashed specimens will be retained for a short time to enable the next of kin, should they come forward, to be involved in decisions as to disposal. The UKAEA has assured the Inquiry that if no such approach is made within 12 months of publication of the Inquiry's Report the samples will be disposed of in an appropriate manner.

49 See chapter 11, "Strontium and the Medical Research Council"

50 Brazier M, Organ retention and return: problems of consent, *Journal of Medical Ethics*, 2003, 29: 30–3. "*A final question was raised about how to return organs which were taken a long time ago and which the family had no idea had been retained. The* [Retained Organs] *Commission advises that unless families contact you, the best policy is to remain silent. Some hospitals and coroners have not done this and have proactively and independently contacted families. The result has been a lot of heartache.*"

The Trade Unions and the Compensation Scheme

Chapter 7

The Trade Unions and the Compensation Scheme

Chapter 7

Contents

Trade unions in the nuclear industry

1 The workforce in the nuclear industry in the UK has always been heavily unionised. On its creation in 1971, British Nuclear Fuels Limited (BNFL), in accordance with its statutory obligations,[1] agreed formally with the eight unions which represented its employees[2] to promote *"the best possible relations between the company and its industrial employees"*.

2 The fortunes of the workforce were of course tied to those of the industry. Mr John Edmonds, who from 1977 was national officer for the Energy Section of the General and Municipal Workers' Union (GMWU),[3] told the Inquiry:

> *a trade union has to deal with potential conflicts and divided loyalties. Every workforce will want its employment to continue but the workforce will also want good working conditions and terms of employment … those issues would perhaps have been more acute in West Cumbria given the fact that Sellafield was the dominant employer … we supported the nuclear industry and its growth and that was our commitment to the continued employment of our members, but we also recognised that this was a particularly dangerous industry and our support for it was conditional upon decent health and safety standards.*

3 Mr Leo Goldsworthy, who had worked at Sellafield for many years before becoming a full-time official in the Amalgamated Engineering Union (AEU), described a developing relationship:

> *In general terms* [BNFL] *and union side were miles apart when I started in the 1960s but by the time I finished in January 1994 the situation was different.* [We] *… had realised that we had issues in common and that a co-operative approach was helpful.*

4 The unions' role was not confined to representing their members in negotiations with the employers. They were also able to provide help with legal representation, for example in obtaining compensation for injuries sustained at work. It was usual for the unions to arrange representation for families at inquests, particularly if the death was thought to be radiation-related.

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1 Atomic Energy Authority Act 1971, s9(1)

2 After the various mergers between the unions which have taken place over the years, none of the eight original unions still exists

3 The GMWU is now part of the GMB. Mr Edmonds became its General Secretary

Union participation in the coronial process

5 If the relatives of a deceased worker tell the coroner that they wish to attend the post mortem, he must[4] inform them when it is to take place and allow them, if they wish, to be represented by a doctor. The coroner is under no obligation to inform the deceased's union or his employer. However, he has a general discretion to allow anyone to attend a coronial post mortem examination.

6 The Coroners Rules also allow any properly interested party to question witnesses at the inquest. The deceased's family obviously falls into this category. If the death could have been the result of an industrial disease, the deceased's union would be deemed to be a properly interested party, as would his employer, whose acts might have been responsible for the death.

Union funding of claims

7 Union funding for legal fees covered any matter connected with employment, including claims in respect of injury or disease alleged to have been caused through employment and claims on behalf of families of deceased members.

8 Such claims were not pursued by the union itself; it would appoint solicitors, typically a firm chosen from a panel it had approved, to act on behalf of the employee or family. From the 1960s, claims alleging injury caused by radiation were investigated, with union funding, from time to time.

Rules for obtaining legal assistance

9 In the 1970s and 1980s, two of the largest unions represented at Sellafield were the GMWU and the Amalgamated Union of Engineering Workers (AUEW).[5]

4 By the Coroners Rules: see chapter 3, "Law and Guidance"

5 Known for part of the relevant period as the Amalgamated Engineering Union (AEU); now part of Unite

The GMWU

10 From 1970, a member of the GMWU seeking legal assistance had initially to complete and sign a claim form, which would be countersigned by the branch secretary and sent to the regional office. The regional secretary was able to authorise assistance; he would send the form to solicitors, who would then make contact with the member or his family.

The AUEW

11 AUEW rules simply required the member to make an application to his branch. No specific form was mentioned but it is likely that, in practice, the procedure was similar to that of the GMWU.

Who was the client?

12 Although his fees were paid by the union, the solicitor's client was the union member or the relative. The solicitor sought authority from the union periodically for certain expenditure as the claim progressed, particularly the instruction of expert witnesses, and the union was able to withdraw funding if it considered the case was unlikely to succeed. However, during the course of the claim the solicitor would expect to receive instructions directly from the union member, as his client, rather than from union officials.

Why analyse organs?

13 Although radiation is known to cause cancer, it is extremely difficult to prove that a particular cancer has been caused by radiation. Cancer is common; it has many causes; it may, and indeed usually does, arise spontaneously, without any known cause. There is no feature of any cancer which indicates that it has been caused by radiation although some cancers, such as leukaemia, are more closely associated with exposure to radiation than others.

14 The chance that a particular individual's cancer has been caused by radiation is related to the amount of radiation to which he has been exposed. Dose records and the results of monitoring of urine and faecal samples were therefore of assistance in estimating that chance, since they allowed the dose of radiation to a particular organ to be calculated. However, the

accuracy of that calculation was uncertain. The method of calculation and approved radiation levels changed over time and dose figures were sometimes disputed. It was generally accepted that estimates derived from urinalysis tended to be too high[6] and hence that radiochemical analysis of organs obtained after death could be of value.

Two early cases

15 In two early claims, appropriate instructions appear to have been obtained from the relatives of the deceased for organs to be removed at post mortem and subjected to radiochemical analysis.

16 The first successful claim in which death was alleged to have been caused by radiation was brought by a man who died towards the end of 1960. He had been employed by the United Kingdom Atomic Energy Authority (UKAEA) at Sellafield and was a member of the Transport and General Workers' Union (TGWU).[7] Solicitors were instructed, through his union, while he was alive. After his death, they arranged with the pathologist and the coroner *"on behalf of the family"* for organs to be retained at the post mortem for analysis by experts instructed by the family and by the employers. Dr Geoffrey Schofield[8] attended the post mortem on behalf of the UKAEA. The results of the analysis were not given at the inquest, which the family attended, but the removal of organs for analysis was mentioned. The claim was settled some years later.

17 The next case followed the death in the early 1970s of a former employee of the UKAEA.[9] The year before his death he had instructed solicitors, probably via his union, the AUEW, to investigate whether his cancer had been caused by occupational exposure to radiation. Documents seen by the Inquiry suggest that the solicitors obtained his widow's agreement to organs being removed, as required by the Human Tissue Act 1961.

6 See chapter 2, "Science"

7 Now part of Unite

8 Then medical officer with the UKAEA; later BNFL Company Chief Medical Officer

9 See chapter 6, "The United Kingdom Atomic Energy Authority" (CC) for further details

The GMWU's involvement

18 The GMWU was the most active of the Sellafield unions which pursued claims in the 1970s and early 1980s. Sellafield lay within the GMWU's Northern Region, whose offices were in Newcastle. The regional secretary was Mr Bill Rickelton and, later, Mr Tom Burlison.[10] The BNFL branches of the union were large and were allowed a degree of autonomy. Local union officials included Mr John Noctor (Whitehaven branch secretary), Mr Thompson Reed (Whitehaven regional organiser) and Mr Bill Maxwell (Sellafield convenor).

19 The unions at Sellafield competed for members. Mr Ian Robertson, formerly a partner at Crutes, a firm of solicitors which was often instructed to act for members of the GMWU, told the Inquiry:

> [The GMWU] *was in direct competition for members with other unions and wanted to do something which distinguished itself from those other unions. More importantly it felt it essential to have a precedent so that other cases could be brought in the future … in about 1971 Bill Rickelton came to see me and explained that the* [GMWU] *were concerned that the union had never been able to commence proceedings against BNFL/UKAEA on the basis that exposure to radiation had caused illness/disease/death, and that the rival union at BNFL, the AEU … had cases ongoing … in the High Court.*

Mr Ian Robertson

20 In the 1970s and early 1980s, Mr Robertson acted on behalf of families in several cases in which damages were recovered in respect of the deaths from cancer of radiation workers. In each, radiochemical analysis was performed on organs removed at post mortem and a settlement was agreed shortly before trial. Mr Robertson also undertook preliminary investigations in similar cases which were not successful. He said that before he became involved, in 1971, the GMWU had funded similar cases, which had been conducted by Mr Alan Crute, another partner at the firm. Mr Crute had obtained advice from Mr Michael Morland[11] that on the evidence available

10 Later Lord Burlison of Rowlands Gill

11 Later the Honourable Mr Justice Morland

those claims would fail. The Inquiry has seen no evidence that organs were removed or analysed in those cases.

21 Mr Robertson said that, by 1971, Mr Rickelton wished *"to show his members that the union had done its best, even if the cases were lost"*. Union officials were therefore keen to investigate any potential claim on behalf of a member exposed to radiation who later developed cancer, particularly leukaemia. Mr Robertson gained the impression that he had *carte blanche* to pursue test cases through to trial, almost irrespective of cost.

22 On receiving that mandate, Mr Robertson sought assistance from Mr William Ross, consultant radiotherapist at Newcastle General Hospital who later became President of the Royal College of Radiologists. Mr Ross became Mr Robertson's first port of call for medical advice and he put Mr Robertson in touch with various other medical experts.

Six cases

The law

23 A full discussion of the relevant law appears elsewhere in this Report.[12] In summary, however, organs could be removed at coronial post mortem and analysed only if the analysis would assist the pathologist and the coroner in determining the cause of death or if the coroner and the relatives of the deceased agreed. By the time of the deaths considered below, the relevant legislation had been in place, unchanged, for a decade.[13]

The individuals

Malcolm Pattinson

24 Malcolm Pattinson, a former Sellafield worker, died at the age of 36 on 28 May 1971.[14] The coroner, Mr Hubert Gough, informed Mr Robertson of the death by telephone on the same day. At this stage Mr Robertson's instructions had been confined to the general mandate from the GMWU: he had had no contact with Mr Pattinson or his family. The union would

12 See chapter 3, "Law and Guidance"

13 Coroners Act 1887, Coroners (Amendment) Act 1926, Coroners Rules 1953 and Human Tissue Act 1961

14 Mr Pattinson's story is set out in full in chapter 13, "The Families"

obviously have been keen to offer any possible assistance, given that Mr Pattinson had left a widow and three children. In addition, as Mr Robertson observed:

> *I think it is fair to say* [the GMWU] *would have recognised this as a possible test case to pursue … he was a relatively young man dying from leukaemia and leaving a young family.*

25 Mr Robertson immediately spoke to Mr Robert Baptist,[15] obtaining, according to his contemporaneous note, authority to represent and get a medical report. He also arranged for Mr Ross to attend the post mortem, which was to be performed by Dr Philip Whitehead[16] the following day. There is no evidence that anyone obtained instructions from Mr Pattinson's family at this stage. Mrs Bridget Pattinson has since died, but her eldest daughter, Ms Angela Christie, told the Inquiry that she was sure that her mother, who was unwell and in hospital, was not consulted.

26 Mr Robertson's papers suggest that he did not know whether the family wished to bring a legal claim. A month after Mr Pattinson's death, on 30 June 1971, he wrote to Mr Reed:

> *Would you please look into the matter and see whether the relatives do wish to attempt to make a claim and if they do, to complete the claim form as quickly as possible so that it can ultimately be sent to us.*

27 It was not until 6 July 1971 that Mrs Pattinson signed a form requesting assistance *"by the Union's Legal and Medical Representatives at the resumed inquest"*. After passing through the GMWU's Newcastle office, the form was sent to Crutes on 12 July 1971. Under the union's rules, no funding for legal assistance could have been granted until the form had been completed. Mr Robertson sought to explain why he acted without instructions from the family:

> *the union would have automatically done everything which it felt necessary to look after the family, anticipating what the family might ultimately want to do.*

28 A post mortem examination took place on 29 May 1971. It is not clear whether Dr Schofield attended but he did receive organs taken at the time. Mr Ross did attend; he received no organs but he was sent slides for microscopic examination. Mr Robertson said that Mr Ross had been asked to attend:

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15 An official at the GMWU Northern Regional Office

16 Consultant pathologist at West Cumberland Hospital

> *to see the body opened up, to put it bluntly, to see if there was anything to see, because after all, a medical man might immediately see something ... When they started the post mortem and opened up the body they wouldn't know exactly what they were going to see but they would have to decide what sample should be taken for what, and I'd always assumed that it would be done with the microscope or something more advanced than that, and I think there was every need to have him there.*

29 Three days after the post mortem, Mr Ross wrote to Mr Robertson:

> *At your request I attended on Saturday the post mortem examination … I have arranged to receive from Dr Whitehead a copy of his report and specimens which have been preserved for microscopic examination. It will of course be necessary for me to obtain through you … in due course the results of the estimations of radiation contained in various tissues which Dr Schofield … received.*

30 The organs were analysed at Sellafield but the coroner showed no interest in the results, holding his inquest into Mr Pattinson's death without waiting for them to become available.

HH

31 The next similar case in which Mr Robertson was involved was that of HH, a union member who had instructed Mr Robertson to investigate a claim against BNFL, alleging that his cancer had been caused by radiation. He died in the early 1970s. Two days later, on being informed of the death by Mr Reed's secretary, Mr Robertson spoke to Mr Adrian Walker, the Coroner for West Cumbria, who *"agreed that there would be a Post Mortem and that we could have a representative, probably Mr Ross if he agrees, present. Unlikely to be an Inquest as such."*

32 It then became apparent that HH had not died in Whitehaven. Mr Robertson therefore telephoned the correct coroner to discover that the post mortem had already been performed and that Dr Schofield had attended and, with the coroner's permission, obtained organs for analysis. The final post mortem report referred to the results, which were given in evidence at the inquest.

33 Mr Robertson and Mr Ross did not initially understand that the analysis performed at Sellafield involved the complete destruction of the organs.[17] Mr Ross wrote to Mr Robertson:

> *I expect to have access to the material when the tests have been completed.*

After the inquest, Mr Robertson wrote to Mr Rickelton:

> *The Coroner has been requested for details of where the organs of the deceased which were kept for examination are being kept so that our specialists may have access to them.*

34 By the mid-1970s the situation was clearer, Mr Ross writing to Mr Robertson:

> *Tissues removed at autopsy were examined for their radioactive content by Dr. Schofield … but the methods available to him for these examinations were such as to prevent any residual matter being available for testing elsewhere … It is unlikely that any further information will be available … for the reasons stated above.*

35 The family and the coroner were therefore reliant on the results reported by BNFL, which of course was not an independent analyst: it had been the employer of the man whose employment was suspected of having caused his death. There was an obvious conflict of interest, involving both BNFL and Dr Schofield, who provided expertise in interpreting the analytical data.[18]

36 Mr Robertson was certainly aware of this problem. Writing to Mr Rickelton immediately after the inquest, he summarised Dr Schofield's evidence, which had denied that any ill-effect had been sustained by any worker as a result of exposure to plutonium, and commented:

> *We would dispute that there is no death known here from plutonium poisoning and refer you to the late member M. F. Pattinson. Dr Schofield is of course the Chief Medical Officer for British Nuclear Fuels and as such, although he will no doubt have prepared in his consideration an unbiased report, is a medical expert for the Defendants.*

37 In 1975, when describing arrangements by which in another case (described in the next paragraph) he had succeeded in obtaining organs, Mr Robertson commented ruefully:

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17 See chapter 2, "Science"

18 For a detailed discussion of this point, see chapter 5, "British Nuclear Fuels Limited"

> *You will remember that when the late member* [HH] *died we were informed too late to obtain such facilities.*

It would seem that if Mr Robertson had been informed of HH's death before the post mortem, he would have asked Mr Ross to obtain organs for analysis on behalf of the family. He was able to adopt that approach in the next two cases (Geoffrey Southward and II) in which he was involved.

Geoffrey Southward

38 Geoffrey Southward died of leukaemia on 8 January 1975.[19] He had been employed at Sellafield. Mr Noctor learned of the death the following day and informed Crutes that the post mortem was to take place later that morning. Mr Robertson wrote to Mr Rickelton that on his instructions:

> [a colleague] *asked … the Coroner … if the post mortem could be delayed to allow facilities to be given for Mr Ross to be present … and to have the opportunity to have such organs tested as he felt necessary … I was later able to speak to Mr Ross who had by then spoken to Dr Schofield … It was not possible for Mr Ross to be present at the post mortem but he was given an assurance that … certain organs will be retained … for tests ... This is in our view perfectly in order.*

This was the first occasion on which Mr Robertson had arranged for organs to be retained for analysis on behalf of the family.

39 Mr Southward's widow signed the claim form for legal assistance on 9 January 1975, the day of the post mortem. Her eldest son, Colin, believed, however, that she had not been aware that organs had been removed for analysis:

> *I made most of the funeral arrangements and looked after things. I do not recall being asked by the doctors … the coroner, the union or BNFL about the removal of organs for testing. I do not believe that the family was in touch with Crutes by this time but my mother would have taken advice from the union if they had raised it with her… I am confident, however, that the question was never put to her because she would have discussed it with me before giving any authorisation.*

40 The form was not sent to Crutes until nearly three weeks later. In the meantime, Mr Rickelton had authorised Mr Robertson *"to take the necessary*

19 Mr Southward's story is set out in full in chapter 13, "The Families"

steps to protect this widow's interests" and Mr Robertson had written to Mrs Southward:

> *We have been instructed by the General and Municipal Workers Union in respect of members' cases concerning plutonium poisoning and the Union have authorised us to represent you at the Inquest if you so wish and to make enquiries with a view to ascertaining whether the problems your husband had were caused by plutonium poisoning. We understand a Union representative is to call to see you.*

Mr Robertson clearly understood the need to obtain her instructions: a note he made of a conversation with a journalist the following day indicates that he was happy to discuss another case, in which he had full instructions, but could not comment on Mr Southward's case as he *"had only received instructions from his Trade Union … and … had yet to receive formal instructions from his widow".*

41 Despite the lack of formal instructions from Mrs Southward, Mr Robertson had, by the time he wrote that note, already asked Mr Ross to arrange with Dr Schofield that organs were removed for analysis. Dr Schofield attended the post mortem and was under the impression that Mr Ross, instructed by Mr Robertson, had authority to make decisions:

> *I discussed the removal of organs with* [the pathologist], [the coroner], *Mr W M Ross of Newcastle (for the Unions) and with Dr Dolphin of NRPB* [National Radiological Protection Board]. *The Coroner and Mr Ross agreed that I could remove the organs necessary for carrying out plutonium estimations. I also took duplicate specimens for similar analysis by Dr Dolphin's group in NRPB. Some specimens were also removed for Mr Ross who is intending to forward them for analysis to … the Middlesex hospital.*

42 As in Mr Pattinson's case, the coroner apparently expressed no interest in the results, although on this occasion the analysis had taken place by the time of the inquest.

II

43 II had instructed Mr Robertson to investigate a claim against BNFL, alleging that his cancer had been caused by radiation. Mr Robertson had been told by II's general practitioner that death was imminent; his note of a conference attended by barristers and by Mr Reed, but not by II himself, records:

> *We telephoned* [the GP's] *surgery to leave a message that should he die we needed to be represented at the Post Mortem.*

44 II died shortly afterwards. His general practitioner reported his death to the coroner, who within the hour had told both Mr Robertson and Dr Schofield when the pathologist intended to perform the post mortem.

45 The post mortem report records the presence of Mr Ross and Dr Schofield and that *"they retained certain specimens for further examination"*. Mr Ross wrote to Mr Robertson the following month:

> *I have attended the post mortem … and have delivered … specimens … which Mr Bryant*[20] *is to analyse for their radioactivity content.*

46 Again, the inquest was held before the removed organs had been subjected to radiochemical analysis, the coroner apparently expressing no interest in the results.

John Simpson

47 In early 1978, John Simpson had instructed Mr Robertson, via his union, to investigate a proposed claim against BNFL arising out of his pancreatic cancer. He died on 20 June 1978.[21] Mr Robertson instructed Mr Ross to attend the post mortem and spoke also to the coroner, the GMWU and BNFL's solicitors, the last with the intention of securing Dr Schofield's attendance at the post mortem. There is no record of his having obtained instructions from Mrs Simpson. The post mortem report records that Dr Schofield and Mr Ross attended and that organs were removed for analysis, which would take two to three months. The inquest, at which Mr Robertson appeared on behalf of Mrs Simpson, was held only two days after the post mortem, long before the analytical results were available.

48 The pathologist acted quite properly in removing the organs and providing them to Dr Schofield; it is clear from his post mortem report that he believed they were relevant to the cause of death. However, the coroner had no interest in the analysis which was to be performed. Dr Schofield's report, prepared for the litigation, stated that the samples had been analysed *"at Mr Ross's request"*.

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20 See paragraph 57

21 Mr Simpson's story is set out in full in chapter 13, "The Families"

49 Mr Simpson's daughter, Ms Judith Oldfield, told the Inquiry:

> *I have a vague memory of the union having told us that obtaining samples at post mortem would help the claim but if that did happen then I am sure that my mother would not have appreciated either the full extent of retention or the exact nature of the analytical process which was then undertaken.*

JJ

50 JJ was a plutonium worker at Sellafield. He had cancer. Mr Robertson advised him that the claim he wished to bring against BNFL would not be successful. His death, in the late 1970s, was reported to the coroner, who noted:

> *Used to work for B.N.F.L. Had claimed cancer caused by radiation. However any exposure to radiation occurred after the symptoms of cancer were apparent. Widow does not wish to proceed.*

51 The following day, the coroner informed Mr Robertson by telephone of the death. Mr Robertson wrote to Mr Burlison:

> *Acting on your authority … we have reopened the case by putting Mr Ross in possession of the facts although the Post Mortem was already carried out by the time we were informed of it. Mr Ross is to find out whether Dr Schofield of B.N.F.L. was present at the Post Mortem and he is also to talk to Dr Whitehead to ensure that such specimens as we need have been preserved … I have telephoned your Mr Reed of Whitehaven … to see if it can be ascertained whether the late member left a widow and, if he did, I shall write to her.*

52 The day after that, Dr Whitehead spoke to the coroner, who noted:

> *Ross has spoken to him and arranged to preserve specimens Ross is interested in. Schofield B.N.F.L. is to carry out plutonium test with Ross's concurrence.*

53 Mr Robertson appeared on behalf of JJ's widow at the inquest, which was held three months later. Although radiochemical analysis of the organs was by then completed, the results were not adduced in evidence. An open verdict was returned. A BNFL memorandum noted:

> *I Robertson of Crutes announced that there would be no legal action against BNFL because there was nothing to say that* [JJ's] *cancer had any connection with his work at Windscale. From visits by our Welfare Officer we were aware that the widow did not want to pursue any legal action and deplored the Trade Union activity in the matter.*

Settlements

54 The claims brought by Mrs Pattinson, Mrs Southward, Mrs Simpson and the relatives of HH and II were settled in the late 1970s and early 1980s. Although it paid compensation in each of those cases, BNFL admitted liability only for Mr Pattinson's death. The introduction of the Compensation Scheme for Radiation-Linked Diseases[22] obviated the need for any further litigation.

Mr William Ross

55 Mr Ross acted as an adviser and expert witness in a number of cases. At Mr Robertson's request, he attended the post mortem examinations of Mr Pattinson, II and Mr Simpson as an observer; he appears to have taken possession of some of the organs removed at the post mortem examinations of Mr Southward and II and to have delivered them for analysis to Mr Bryant.

56 In the circumstances, it would have been reasonable for Mr Ross to have believed that his instructions from Mr Robertson allowed him to agree on behalf of the family to organs being removed and analysed: this would explain his acquiescence in the cases of Mr Southward (paragraph 41) and JJ (paragraph 51). However, unless the relatives' agreement had already been obtained, he had in fact no authority to agree on their behalf.[23]

Mr T H E Bryant

57 Mr Bryant worked in the Department of Physics as Applied to Medicine at the Middlesex Hospital, London. Mr Ross sent him organs for analysis which had been taken at two post mortem examinations, on Mr Southward

22 See paragraphs 101 et seq

23 Human Tissue Act 1961, s1: see chapter 3, "Law and Guidance"

and II. Mr Bryant replied in respect of both individuals that he had been unable to obtain conclusive results:

> *This was because of the difficulty in determining the radioactive content of the tissues and the sensitivity of the methods and apparatus available … I regret therefore that we cannot give you any information on the activity of the tissues.*

Mr Ross did not send organs for analysis in any subsequent case.

Was Mr Robertson instructed by the families?

Instructions to act for the family

58 The GMB told the Inquiry:

> *Once funding* [for legal assistance] *had been agreed* [by the GMWU] *the papers were passed to Crutes, solicitors, who thereafter dealt directly with the widow/family in pursuing the claim and taking any appropriate action on behalf of the widow/family.*

59 Mr Robertson told the Inquiry that if urgent action were needed:

> *they weren't hidebound by the pro forma. So obviously instructions could be given to do something about it, and … we will confirm in writing later on.*

60 Nevertheless, his client was in each case the deceased's widow, not the union. His note-keeping, so far as the Inquiry can ascertain, was meticulous, and the absence of any record of contact with the widow or other relative leads ineluctably to the conclusion that he took steps on behalf of families without ascertaining whether the family wished him to act for them. He relied instead on his standing authority from the union to pursue any cases in which it could be said that the death had been caused by radiation and on his assumption that the family would wish to litigate in the circumstances.

61 Mr Robertson knew, when he was told of the death of a Sellafield radiation worker, that any post mortem examination would be held imminently and hence that any arrangements had to be made quickly. Nevertheless, his standing authority from the union did not obviate the need to determine whether the family wished him to act on their behalf. Even if Mr Robertson had been instructed by the union member before his death, he was required after the death to obtain fresh instructions from the man's family.

62 Mr Robertson's arranging for Mr Ross to attend post mortems, or to liaise with Dr Schofield or the pathologist regarding the removal and analysis of organs, also had the potential to give the misleading impression that the family had no objection to removal and analysis of organs.

Instructions on the removal of organs

63 Clearly, if Mr Robertson did not make contact with the family before the post mortem, he could obtain no instructions from them on consent to the removal of organs. The need for such instructions should have been apparent to him following his experience in Mr Pattinson's case. Mr Robertson knew there that organs had been taken, apparently for coronial purposes, but the analytical results had not been adduced in evidence at the inquest. He should have realised that the organs had been removed not for coronial purposes but for the litigation and hence that the family's consent had been required.

64 On the basis of that experience he should have realised that in subsequent cases he needed to ascertain from the relatives, before taking any action on their behalf, not only whether they wanted him to represent them but also whether they would consent to the removal of organs.

65 The Inquiry concludes that in four of the six cases discussed above the organs were removed and analysed to provide evidence in anticipated litigation.[24] Such removal required consent from the families; the Inquiry has seen no evidence that this was obtained. Mr Robertson continued to take initial steps on behalf of families on the basis of instructions from the union rather than from the relatives themselves. If on instruction from the deceased's relatives Mr Robertson had objected to organs being removed in such a case, it could not lawfully have been done.

Consequences of failing to take instructions

66 Mr Robertson's failure to ascertain the families' wishes is particularly unfortunate given the strong feelings aroused by the removal of organs at post mortem. It is easy to anticipate that families' views might vary: some may have expressed religious or ethical objection, while others might have

24 In Mr Simpson's case the removal, but not the analysis, was for coronial purposes; the removal and analysis in HH's case were both for coronial purposes

found it acceptable, particularly if done to further scientific research or to gather evidence for litigation. Unless they were asked, it was impossible to know. It was not appropriate to presume that a widow would wish everything to be done to allow her to pursue legal action after her husband's death: see, for example, the case of JJ, described at paragraphs 50–53.

Mr Robertson's evidence

67 Mr Robertson told the Inquiry *"it was the common view of all concerned at the time that the authority for the removal of specimens was vested in those who were responsible for arranging the post mortem examinations"*. He understood that the post mortem was going to proceed in any event and he instructed Mr Ross to attend:

> *to ensure that the family would have access to all the same information as BNFL. Had Crutes not acted in that fashion at the time then they would have failed in their professional duty as solicitors in circumstances where the arrangements for and the timing of post mortem examinations were simply not within their control.*

Mr Roberston argued that he was *"acting pursuant to a retainer of the Union on behalf of its members as the coroner knew"*. The Inquiry agrees that it was within the scope of that retainer for Mr Robertson to instruct Mr Ross to attend a post mortem as an observer. Mr Robertson could not, however, have given Mr Ross authority to agree to the removal of organs for non-coronial purposes without obtaining instructions from the deceased's relatives, whose consent was required before that could be done.

68 Mr Robertson said:

> *I do not remember that I ever addressed my mind to what may or may not have taken place at a post mortem and its correlation to the evidence presented at any inquest.*

Instead, he relied on the coroner to ensure *"that the conduct of any post mortem examination was within the law"*.

69 The Inquiry had sympathy with Mr Robertson's position. However, he should have appreciated that if organs were to be removed not for coronial purposes but to obtain evidence for litigation, the relatives' consent was necessary and that it was incumbent upon him to take instructions before acting. Mr Robertson conceded that he *"did not actively seek input from*

families" in connection with the removal of organs; the Inquiry notes that in some cases he failed even to make contact with the relatives before taking steps apparently on their behalf. That should not have happened.

70 The Inquiry recognises that Mr Robertson was in a difficult situation. His standing instructions from the union to find suitable cases for litigation and to pursue them meant that he had to act with expedition. The practical difficulties he faced are described in a note he made on JJ's file:

> *we had a very quick decision to make when we were informed that there had been a death … I have to immediately contact my consultant specialist so that no time is lost and that we have facilities for examining whatever material we need. If I went by the book and tried to find the next of kin, in what is a very trying and distressing time for her, I might well not succeed until the cremation has taken place and all the evidence is gone. It would not be very nice for the next of kin if the cremation was held up because we made it clear that we wanted to tamper with the body.*

71 Although he should not have taken steps preparatory to litigation without proper instruction, particularly on an issue as important as permission to *"tamper with the body"*, Mr Robertson's motives cannot be criticised: he acted in what he perceived to be the best interests of both the union and the families.

The GMWU's recommendation for post mortems

72 Mr Edmonds told the Inquiry that in 1977 Mr Reed had told him that the *"local position"* at Sellafield was that the union strongly recommended that a post mortem be performed on any radiation worker. This local policy became the union's formal policy in 1983:

> *The GMW Nuclear Conference agreed to recommend to radiation workers that their dependants request post mortems as a matter of routine. This follows worries that doctors do not always record contributory causes of death.*

Mr Edmonds emphasised that the union's recommendation for post mortem examinations had nothing to do with obtaining organs for analysis. There was a desire for better understanding of the effects of radiation, with the benefits that would accrue for their members, and to facilitate claims for compensation by establishing firmly the cause of death.

News of the death

73 Mr Robertson would usually be informed of a death very soon after it had occurred, by a telephone call from the coroner or a union official. Often, BNFL would already have been contacted by the coroner. The practice was neatly encapsulated in a note made by Mr Robertson in 1983, on being asked by a union official for advice on whether a post mortem should be sought in a particular case:

> *I said that in the usual course of events … I would have telephoned Mr Ross who would have contacted perhaps Dr Schofield of B.N.F.L. and the Pathologist and decide whether there was going to be a Post Mortem and whether he needed to be there or whether he could agree what samples could be kept for him … An alternative is that the son himself could request a Post Mortem without involving the Union but I said that this would be worth very little if Dr Schofield was not involved and Mr Ross was not involved because normally the Pathologist would not know what to keep for the purposes of further investigation in respect of plutonium etc.*

74 Later that day, Mr Walker, the coroner concerned, telephoned Mr Robertson:

> *He informed me that there would be a post mortem here but he did not think there was any necessity for an Inquest unless I did. I thanked him for ringing and said that I had, in fact, been on the point of ringing him to say that I had heard about this death because I knew that he would be good enough to ring me … I suggested that he might like to contact Dr Schofield of Windscale who always took an interest in such matters so that at least he could assist the Pathologist when it came to the Post Mortem and any question of taking specimens.*

75 Mr Robertson did not become directly involved in this case: because of the imminent agreement between BNFL and the unions on the introduction of a compensation scheme, he had been told by the GMWU no longer to pursue cases of radiation injury against BNFL.

76 There are other examples of close contact between Mr Gough or Mr Walker and Mr Robertson. In one, for example, Mr Walker, who did not know whether or not the deceased had been a member of the GMWU, telephoned Mr Robertson to inquire if he had any interest in the case and told him that he had not discussed organ removal with him before the post mortem because he had known that Mr Ross had not been available to attend.

While there is nothing inappropriate in this contact, it illustrates the close working relationship between Mr Robertson and the coroner.

What did the GMWU know?

77 Numerous letters from Mr Robertson to the regional office of the GMWU refer to the removal of organs at post mortem and there can be no doubt that senior union officials both locally, at Sellafield and Whitehaven, and at the regional office in Newcastle, knew of the practice. In one case, Mr Robertson wrote in 1978 to Mr Burlison:

> *a confidential telephone call from the West Cumberland Coroner, Mr Gough, to tell us that … a B.N.F.L. worker had died and that a post mortem had been performed. The Coroner said that specimens would be sent to Dr Schofield at Sellafield, as is now the established practice.*

78 In another case, the union was directly involved in discussing arrangements for organ removal. The day after a Sellafield worker died of cancer in 1985, Dr Schofield noted:

> *post mortem is to be held. Spoke to HMC Walker who indicated that* [the GP] *was not reporting the death but that the patient had specifically requested that a post mortem be carried out after his death. Bill Maxwell then contacted … indicated that* [the man] *had done this for the Union and could we send the results or a copy to Bill for the Union.*

It is not clear why being informed that a radiation worker had died from cancer failed to arouse Mr Walker's interest. It may be that on learning that there was to be a hospital post mortem he saw no need to become involved in the usual way, as Dr Schofield would have access to the organs in any event. A BNFL employee attended the post mortem and took the removed organs to Dr Schofield. The union intended to forward the analytical results to Mr Ross.

79 In evidence to the Inquiry, the GMB accepted:

> [The GMWU] *was aware that tissue samples were obtained and analysed as a result of reports from Crutes. However the Union had no involvement in or knowledge of the steps taken by Crutes and/or Bill Ross in obtaining these samples and would have expected that the correct procedures would have been adhered to with regard to consents/permissions as regards the widow/family with whom they were in direct contact.*

Having given instructions to experienced solicitors in relation to specific litigation claims, the union was entitled to assume that appropriate steps would be taken to ascertain what, if anything, the family of any particular man wished to be done. The Inquiry has seen no evidence that Mr Robertson advised the union of any requirement to obtain the family's agreement before organs could be removed for litigation purposes. The union did not pass on to its members its knowledge that organs were sometimes removed at post mortem: the union's responsibilities in this regard are discussed at paragraph 91.

Conflict of interest

80 Mr Robertson told the Inquiry that he had instructed Mr Ross to attend post mortems:

> *on the union's behalf, or the family's behalf. The same thing. You might say there was no conflict of interest as far as we were concerned.*

81 The Inquiry does not agree. A family might want no further action to be taken, particularly if it involved wholesale removal of organs from the body; the union might want a test case to be successfully pursued for the benefit of its members in general. The potential for conflict of interest was obvious.

Amounts of tissue

82 Mr Robertson denied to the Inquiry that he had known that whole organs, as opposed to small specimens such as would routinely be taken for histology, were removed. However, in each of the settled cases described above he had received at least one medical report giving the weights of the

organs removed, which were obviously far in excess of those which would be necessary only for histology. For example, the post mortem report on HH included the following list:

Organ	Weight (g)
Femur	350
Ribs, vertebrae, iliac crest	265
Lung	1,010
Liver	250
Brain	370
Mediastinum	675
Spleen	85

83 Mr Robertson was also aware from correspondence with Mr Ross on 13 March 1972 regarding Mr Pattinson that slides and blocks suitable for microscopic examination did not contain sufficient material for radiochemical analysis. On 31 August 1973, he referred in a letter to Mr Rickelton to *"the organs of the deceased which were being kept for examination … so that our experts may have access to them"*.

84 The Inquiry is satisfied that at the time that he was working on these cases, at least from 1973 onwards, Mr Robertson was aware that whole or large parts of organs were being removed at post mortem for radiochemical analysis.

Members of other unions

85 During the 1970s and early 1980s, most of the men whose organs were removed for radiochemical analysis for litigation purposes were members of the GMWU. The Inquiry has identified three Sellafield workers, not members of the GMWU, whose organs were removed at post mortem when the man's union or a solicitor was assisting the family.

86 One, a member of the AUEW, is discussed at paragraph 17 above. The others were Mr Stanley Higgins, a member of the Association of Government Supervisors and Radio Officers (AGSRO), and Mr Kenneth Roberts, a member of the Institute of Professional Civil Servants (IPCS).[25]

- In 1973, Mr Higgins had been heavily contaminated with radioactivity in an accident[26] at Sellafield. He died on 11 February 1979. His post mortem was conducted by Dr Whitehead and confirmed heart attack as the cause of death. The initial report recorded *"extensive specimens were taken at the time of the post mortem by Dr Schofield"*. The General Secretary of AGSRO, Mr Tom Casey, spoke about Mr Higgins to the coroner, Dr Whitehead and Dr Schofield and was aware that organs had been removed for analysis at Sellafield. The union was not aware before the post mortem that organs were to be removed.
- Kenneth Roberts developed cancer and, in early 1982, through the IPCS, instructed solicitors to pursue a claim that his cancer had been induced by radiation. Court proceedings were issued but he died the following year. Mr Walker spoke to Mr Roberts's solicitor before the post mortem, inviting him to attend; after taking instructions from the union, the solicitor declined but asked for copies of the report and analytical results, which were in due course given in evidence at the inquest. Mr Roberts's widow told the Inquiry that she does not recall any discussion of removal of organs from her husband's body but since it appears that the organs were removed and analysed for proper coronial purposes, her consent would not have been required.

87 Although it is clear from these histories that the relevant union was aware that organs were removed from the body after death, it is also plain that neither did anything untoward. The same conclusion applies to Mr Roberts's solicitors.

25 Both cases are described in chapter 13, "The Families"

26 Known as the "Head-End" incident

Workers from other nuclear sites

88 Unions also funded litigation on behalf of members and their families employed at nuclear facilities other than Sellafield. The Inquiry is aware of a few cases in which unions or solicitors appear to have discussed post mortem examination and the removal of organs in these cases: one is discussed at paragraph 17 above.

89 Several claims arising out of exposure to plutonium were investigated on behalf of employees of the Atomic Weapons Establishment (AWE). Four examples, which took place between 1975 and 1980, are detailed elsewhere in this Report.[27] The unions involved were the IPCS, the TGWU and the AUEW. In none of the four is there evidence that the unions or solicitors appointed by them acted inappropriately.

The unions' responsibilities

90 Documents seen by the Inquiry show that officials at various unions, particularly the GMWU but also the AUEW, the AGSRO, the IPCS and the TGWU, were aware that after the deaths of nuclear workers from cancer, organs were sometimes removed at post mortem. Nevertheless, they appear not to have mentioned it, either to members before death or their families afterwards.

91 Whether they should have done so is a moot point. They had no legal responsibility to engage in such a discussion, they had in most cases funded solicitors to advise on the law and they knew that the coroner was overseeing the whole process. Alternatively, they may have felt that to address such a sensitive issue openly was not desirable.

92 Whatever the motive, the result was that the news of the wholesale removal of organs came as a shock to families who contacted the Inquiry.

27 See chapter 9, "The Atomic Weapons Establishment", paragraphs 11–30

Union involvement in discussions on registries

93 In 1980, Dr Ron Owen, medical adviser to the Trades Union Congress (TUC), was involved in discussions with the nuclear industry and the Government over the possible introduction of a national post mortem registry in the UK. The design was to be similar to the United States Transuranium Registry (USTR) which had been in operation for some years, obtaining organs for analysis by consent of the donors before their deaths.[28]

94 Dr Owen was among those who attended a meeting on 18 December 1980 to discuss "Measurement of Radioactive Materials in Cadavers". The meeting, held at the Medical Research Council (MRC), was chaired by Dr Jack Vennart of the MRC Radiobiology Unit and its secretary was Dr Hylton Smith of the NRPB. Dr Schofield, Dr Murray Roberts,[29] Dr Alexander Stott,[30] Dr Andrew McLean[31] and Professor Patricia Lindop[32] were also present. Before the meeting, Dr Smith had circulated a note in which he listed the organs he considered to be required from each body:

> *both lungs, trachea and intact mediastinum; 2 ribs; sternum; 1 femur; 3 lumbar vertebrae (or vertebral bodies); liver; gonads, kidneys. Other tissues may be required depending upon the exposure history of the individual.*

95 Dr Smith's minute of the meeting records that Dr Schofield *"stated that unions approached BNFL to analyse tissues for medico-legal cases"*. This comment is likely to refer to Mr Ross, Mr Robertson or a union official agreeing to Dr Schofield's analysing organs, as described above, although Dr Schofield was occasionally also instructed to advise unions in claims by workers employed other than at Sellafield.

96 At the conclusion of the meeting, Dr Owen was asked to *"consider the implications of obtaining tissues in medico-legal cases"*. The Inquiry has seen no evidence of any work done by Dr Owen on this issue, nor of whether information gained at the meeting was returned to the TUC or to the representatives of individual unions. Nevertheless, it is unlikely to have come as a surprise to senior union officials representing workers at nuclear

28 See chapter 10, "Registries"

29 Chief Medical Officer, Atomic Weapons Research Establishment

30 Chief Medical Officer, UKAEA

31 Director, NRPB

32 St Bartholomew's Medical College; Professor Lindop was an adviser often instructed on behalf of union members in litigation

sites that the nuclear industry, and in particular BNFL, was analysing organs removed from nuclear workers.

The Compensation Scheme for Radiation-Linked Diseases

Announcement

97 Informal discussion about the possibility of a scheme to allow compensation for injury caused by radiation to be assessed and paid without recourse to litigation began in the 1970s. Mr Robertson said that the idea had been raised by the GMWU as claims for damages became more common:

> *We had also made it clear to both* [BNFL's solicitors] *and to the barrister in Whitehall in charge of BNFL's interests that the ultimate aim was to have a compensation scheme in place like the Coal Miners' Dust agreement. Clearly any scheme relating to nuclear workers would be more complicated because there was such a wide variety of diseases, tumours etc. from which they could suffer. At that point however, it was made clear to us that this was not something which the Defendants wanted.*

98 Nevertheless, the first discussions of a possible compensation scheme took place within BNFL in 1975. In November 1977, immediately after Mr Robertson had secured the first settlements, BNFL confirmed publicly that it would enter into negotiations with the unions with a view to agreeing a compensation scheme for its employees.

99 On 18 November 1977, Mr Maxwell wrote to Mr Jack Biggins, GMWU National Officer for the nuclear industry:

> *On the day of the hearing … I received a verbal commitment from B.N.F.L. Executives that the Company were prepared to enter into negotiation with the Trade Unions to agree an automatic compensation agreement for its employees … I asked that a public announcement be immediately made in order to prove goodwill and intent. This was cordially agreed to and Mr H Bolter for the Company and myself on behalf of Windscale G.M.W.U. made the announcement to the T.V. and press. Whilst acknowledging that such an agreement could probably take 3 years or more to fertilize there was mutual understanding that talks should quickly begin.*

100 The matter was discussed again by BNFL and its staff and union representatives at the next Joint Health and Safety Committee meeting, on 12 December 1977. The minutes record that Mr Arthur Scott, BNFL's Company Secretary, said:

> *they were interested in devising a scheme to deal with possible compensation claims which could avoid the need for possibly long and expensive legal cases, but there were many problems to be resolved and it could be many months before proposals could be presented. Unlike Compensation Schemes in some industries there was no conclusive evidence that certain diseases were caused by radiation, and arguments could only centre around the degree of probability … The aim of any scheme would be to ensure that, having regard for the probability of a disease being caused by radiation received at work, a basis of settlement could be agreed, without going to the courts, but on a level which would compare with the payments which could be expected to be produced by the courts … there could be no interference with the ultimate right of people … to take their case to the courts but if a less costly and more civilised way of dealing with such cases could be devised it would have obvious attractions.*

The unions indicated that they would await proposals.

The introduction of the Compensation Scheme

101 After extensive discussion over the next four years, the Compensation Scheme for Radiation-Linked Diseases was introduced in November 1982, by agreement between BNFL and its recognised unions. The limited documents available to the Inquiry indicate that BNFL and the unions jointly obtained advice from the NRPB on the underlying scientific and medical knowledge of health risks from low-level radiation. The unions also received expert advice on the rules of the Compensation Scheme. While the agreement signed in 1982 set out the procedures in general terms, certain matters, particularly relating to the assessment of radiation dose, remained to be finalised. They were developed over time and are contained in agreed schedules and protocols. In its initial form, the Compensation Scheme provided compensation only for death.

102 The proposed scheme did not initially cover employees of other organisations such as the UKAEA or the AWE, although both organisations were provided with advance information. The AWE considered it at the time to be overly generous to employees, but noted:

in retrospect, BNFL consider that, of the 5 cases which they have settled, 2 would have got nothing under the scheme and a third one would have got a significantly lower award.

103 The UKAEA joined the Compensation Scheme in 1987 and most other employers in the nuclear industry followed suit, including the Ministry of Defence and the AWE in 1994.

104 The Compensation Scheme provided for compensation to be paid to the relatives of BNFL radiation workers who had died from specified cancers and who had been members of the signatory unions. It was not compulsory: families could choose to pursue their cases in court if they wished but agreement not to pursue legal action in the future was a condition of payment from the Compensation Scheme and the unions agreed not to support legal action after an application had been made to the Compensation Scheme. The initial agreement provided for the Compensation Scheme to run for a trial period of two years; it remains in operation today and now covers the vast majority of nuclear workers.

105 In 1987, the Compensation Scheme was extended to allow payments to be made to workers who had contracted cancer but had not yet died. By December 2008, over 1,400 applications had been made to the Compensation Scheme and 117 successful applicants had received £6.2 million compensation, under both parts of the Compensation Scheme. The remainder of this chapter will discuss only that part of the Compensation Scheme which provided compensation after death.

Compensation Scheme bodies

106 The Compensation Scheme is administered by the Executive Secretary, based at Sellafield. Its administrative costs are borne by the participating employers.

107 In the early years of the Compensation Scheme, the main forum in which BNFL and the unions discussed rules and procedures was the Joint Working Party (JWP). It comprised the Executive Secretary and representatives from BNFL and the unions. The first Chairman was Dr Donald Avery.[33] Other BNFL representatives were Mr Peter Mummery[34] and Dr Schofield. The various unions were represented by senior officials.

33 Deputy Managing Director, BNFL

34 Director of Health and Safety, BNFL

108 The JWP has now been replaced by the Compensation Scheme Council, which comprises the Executive Secretary and a representative from each employer and each union. Management boards, again comprising the Executive Secretary and employer and union representatives, oversee the operation of the Compensation Scheme as it applies to the various employers.

109 The Compensation Scheme Council receives, as did the JWP, scientific advice on the rules and procedures to be adopted by the Compensation Scheme from a Technical Working Party (TWP) comprising experts in radiation biology appointed by the employers and by the unions.

Compensation Scheme procedures

110 The procedure has remained essentially unchanged since 1982, involving several sequential steps.

Assessment of eligibility

111 Families are able to apply to the Compensation Scheme only if the deceased had been a member of a participating union, had a radiation dose record with a participating employer and had contracted a disease listed in the Compensation Scheme documentation as being linked to radiation. This list includes almost all forms of cancer.[35]

Assessment of probability of causation

112 In eligible cases, the employer assesses the dose of radiation received by the deceased during employment. Radiation dose has been measured or estimated in various ways, using indicators of external dose such as film badges and indicators of internal dose such as urinalysis and analysis of organs obtained at post mortem.[36] The assessment of dose may not be straightforward: data, sometimes derived from different methods of monitoring, may be old or inconsistent and have usually been gathered for radiation protection purposes rather than for precise estimation of dose.

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35 The cancers currently thought not to be linked to radiation and therefore not covered by the scheme are chronic lymphatic leukaemia, hairy cell leukaemia, malignant melanoma, malignant mesothelioma and Hodgkin's disease

36 See chapter 2, "Science"

113 Once radiation dose has been estimated, the employer applies a formula defined in the Compensation Scheme's rules to determine the probability that the individual's death was caused by radiation. The resulting percentage is known as the probability of causation (PC).[37] Initially, the assessment was based on modified versions of the risk models presented by the International Commission on Radiological Protection (ICRP) in 1977.[38] In 1991, the methods of calculation were updated in light of revised risk models produced by the US National Academy of Sciences' Committee on the Biological Effects of Ionizing Radiation (BEIR) in 1990[39] and a further update is pending.[40] Cancers are grouped into "Disease Schedules" which contain the formulae to be used for the calculation of PC. The variables used in the assessment of PC include:

- the type of cancer;
- the radiation dose, the period over which it was received and the time since exposure;
- the sex and age of the individual;
- exposure of the employee to other carcinogens (for example, from other employment, smoking or medical sources).

The Compensation Scheme's rules include various assumptions favourable to the applicant.

114 In the early days of the Compensation Scheme, it was possible to calculate PC on an agreed mathematical basis in relatively few cases. These tended to involve cancers such as leukaemia, whose potential causation by radiation was well known, where there was no other significant risk factor and where the exposure level was not significantly higher than recommended limits. If those criteria were not satisfied, the application was assessed by an expert panel whose membership was agreed by BNFL and the unions.

115 As the Compensation Scheme has matured, the schedules have become more comprehensive and the number of cases referred to the expert panel has decreased. PC is now determined by the application of agreed formulae in the vast majority of cases and referral is permitted in only a few types of case.

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37 Although the term was not actually used until 1992

38 ICRP, Recommendations of the International Commission on Radiological Protection, *Annals of the ICRP*, 1977, 1(3): 1–53

39 Committee on the Biological Effects of Ionizing Radiation, *Health Effects of Exposure to Low Levels of Ionizing Radiation*, BEIR V, National Academies Press, 1990

40 Based on Committee on the Biological Effects of Ionizing Radiation, *Health Risks from Exposure to Low Levels of Ionizing Radiation*, BEIR VII, National Academies Press, 2005

Information provided to the union

116 Information about how the dose has been calculated and PC assessed is sent by the employer to the Compensation Scheme and by the Compensation Scheme to the relevant union along with the result of the application. Responsibility for advising the applicant about the Compensation Scheme assessment rests with his union.

Calculation of compensation

117 Compensation is payable, on a sliding scale, if the PC is greater than 20%:

Probability of causation (%)	Fraction of full compensation
20 – 29.9	¼
30 – 39.9	½
40 – 49.9	¾
50 – 100	1

"Full compensation" is defined as *"the sum likely to be awarded by a court for the benefit of the eligible person's dependants and/or his estate in the event that legal liability in respect of the death was established"*.

118 The calculation of full compensation is the only stage at which lawyers become involved, the previous stages being handled by the applicant and his union.

119 The ability to obtain compensation, albeit reduced, when the probability that the death was caused by occupational exposure to radiation is less than 50% is a significant benefit to applicants: such claims would fail in court.

Use of post mortem data

120 When the Compensation Scheme was initiated, the detailed assessment of internal dose remained the subject of negotiation between BNFL management, advised by its own scientific and technical staff, and the unions, advised by retained specialists. The main forum for discussion was the JWP. Minutes of a meeting on 20 December 1982 record that Mr Mummery *"proposed to use autopsy data, if it were available, and personal monitoring results otherwise"*. The meeting was attended by three senior union officials and the minutes were circulated to four more union representatives.

121 Further discussion about assessment of internal dose took place within BNFL. On 12 May 1983, Dr Schofield reported to the company's Senior Medical Officers:

> *Examination of 35 cases has shown that in-vivo measurements give a dose of five to ten times higher than that obtained from autopsy data, so the autopsy route is the most favourable to BNFL.*

122 Mr Mummery detailed his proposals, which included the use of data derived from post mortem analysis of organs, to the JWP on 20 June 1983, whose minutes record:

> [a union representative] *initiated a discussion on the value of autopsy data where intake and disease are such that dose is still being received at the time of death … Mr Mummery reported that quantities measured at autopsy tended to be less than those inferred from personal monitoring. Accordingly, cases referred to the panel on a basis excluding autopsy data would be more likely to fail than those including autopsy data.*

It is obvious that the words *"including"* and *"excluding"* have been transposed: clearly, if post mortem data were included, claims would be more likely to fail.

123 The union representatives present at the meeting agreed to the proposals, the arrangements were approved by the expert panel and the Compensation Scheme's rules were drafted to allow post mortem data to be used when available.

124 In 1984, BNFL presented a "Protocol for Autopsy Sampling" to the JWP:

> *This note describes the protocol for the sampling and assay requirements in the event of autopsy specimens being made available ... The objectives are:*
>
> *(a) To provide information to assist in the better understanding of the metabolic behaviour of radionuclides in the body.*
> *(b) To provide additional data for the assessment of radiation dose in the case of deceased employees qualifying under the terms of the Compensation Scheme for Radiation Linked Diseases.*

125 The document set out minimum sampling requirements for objective (a), which for plutonium were liver, bone, lung, the "relevant organ" (that is, the organ in which the cancer originated) and *"other organs as available from the pathologist"* and for objective (b), which were the relevant organ and a "relevant tracer organ".[41]

126 Compensation Scheme rules included a hierarchy of information on which assessment of internal dose from plutonium would potentially be based, providing formulae to be used for various cancers:

> *Where the alpha activity of material deposited in the* [relevant organ] *had been assayed at autopsy ...*
>
> *Where the alpha activity of material deposited in the* [relevant organ] *had not been assayed at autopsy but that deposited in liver has been assayed …*
>
> *Where … the activity of material deposited in the body (excluding lungs) has been assessed by personal monitoring …*

Documents setting out this approach were provided to the members of the JWP.

127 It is therefore clear that where both were available, data derived from post mortem material were preferred to data from personal monitoring.

128 It is clear also that the union representatives on the JWP were aware that post mortem data were to be used. The Inquiry has been unable to determine the extent to which this information was disseminated within individual unions, but it would be extremely surprising if the union representatives on the JWP had not discussed it with senior union colleagues.

41 Noted as being defined in another Compensation Scheme document which the Inquiry has not seen

Dr Barrie Lambert

129 The Inquiry heard evidence from Dr Barrie Lambert,[42] who had become involved very early in the genesis of the Compensation Scheme as an expert adviser first to the GMWU and later to all of the unions. He also assisted the unions in reviewing BNFL's assessments of applications to the Compensation Scheme. He is now a member of both the Compensation Scheme Council and the TWP.

130 Despite his close involvement in the Compensation Scheme for very many years, Dr Lambert maintained that its rules had never included any provision for the use of data derived from post mortem, save in *"a very, very unlikely situation where there is no other data available"*. The Inquiry was unable to reconcile Dr Lambert's evidence with Compensation Scheme documents setting out how post mortem data were to be used. Dr Lambert suggested that he might not previously have seen some of the documents but it was hard to understand how, as the unions' expert adviser on the technical basis for the Compensation Scheme, he could have been other than fully aware of the mechanisms for assessment of internal dose.

The new technical basis

131 It had always been envisaged that the Compensation Scheme's rules would be updated from time to time as scientific knowledge advanced. In November 1990, Mr David Coulston,[43] on behalf of BNFL and the UKAEA, presented a proposal for a new method of determining internal radiation dose.

132 At a JWP meeting on 18 June 1991, Dr Lambert, on behalf of the unions, objected to the continued use of autopsy data:

> *On the question of autopsy data, the unions did not wish to see claimants adversely affected under the scheme, due to the use of autopsy data for specific cases. Dr Slovak*[44] *noted that there were in fact two separate points for consideration. The first concerned the use of actual autopsy data for a specific case internal dose assessment. The second related to the use of scientific inferences drawn from studies of autopsy data in general.*

42 Holder of a doctorate in radiation biology and a former employee of the MRC, the NRPB and St Bartholomew's Hospital Medical College

43 Of BNFL's Health and Safety Directorate

44 Chief Medical Officer, BNFL

133 The unions' concerns were rooted in the knowledge that estimates of internal dose based on analysis of organs were significantly lower than those based on urinalysis. It is puzzling that these concerns were raised at this stage: the Compensation Scheme had by then been using post mortem data for nine years.

134 On 2 September 1991, BNFL and the UKAEA agreed to change their approach: post mortem data would be used within the Compensation Scheme only if they would produce a dose estimate more favourable to the claimant than use of his personal monitoring results.

135 The companies' change of heart was disclosed at a TWP meeting on 5 December 1991, attended by, among others, Dr Lambert. It was agreed that assessment of dose would use personal monitoring data when possible. Post mortem data could continue to be used if necessary, but only if their use produced a result more beneficial to the claimant than the use of personal monitoring data: in practice it was acknowledged that such an eventuality was very unlikely to occur. The provision for use of post mortem data remains within the Compensation Scheme rules to this day.

136 The new arrangements for the use of post mortem data were only a small part of the change in the technical basis of the Compensation Scheme: the most significant changes derived from increased understanding of the causation of cancer by radiation.[45]

Retrospection

137 When the new technical basis for the Compensation Scheme was introduced, all cases that had already been assessed under the old rules were reassessed, a process known as *"retrospection"*. In several cases the PC increased: compensation was awarded in some cases which had previously been rejected and in others the percentage of full compensation rose. It is important to note that the change in the use of post mortem data – largely excluding it – had only a relatively minor effect.

Use of post mortem data

138 The Inquiry investigated the extent to which post mortem data had been used and the extent to which that use had influenced the outcome of applications to the Compensation Scheme. Such applications were made

45 See paragraph 113

by relatives of 25 of the Sellafield, Springfields and Capenhurst employees from whom organs had been taken at post mortem.[46] Of those:

- two were not covered by the Compensation Scheme;
- 13 were assessed using post mortem data;
- ten were assessed without using post mortem data, although in many of those cases the data were mentioned in the Compensation Scheme file.

139 Those assessed using post mortem data include two cases in which the data were taken into account both in the original assessment under the old technical basis and, at retrospection, because personal monitoring data were either non-existent or insufficient. In each, BNFL's use of post mortem data was specifically mentioned in the documentation sent by the Compensation Scheme to the union, the AUEW.

140 Two of the ten cases in which post mortem data were not used were considered only on the new technical basis. In the remainder there had been no recorded internal dose and there had therefore been no assessment of internal dose.

141 The use of post mortem data, which would be expected to produce a lower assessment of PC, affected the outcome of only one application, that of Mr Robert McLean. Data derived from post mortem analysis were used when the application was rejected in 1988. Sellafield Limited told the Inquiry that had urinalysis results been used to calculate internal dose and post mortem data excluded, Mr McLean's relatives would have received 25% of full compensation.[47]

142 When Mr McLean's claim was reassessed at retrospection, urinalysis data were used and post mortem data excluded. Combined with the various other changes introduced by the new technical basis, this resulted in the family receiving 75% of full compensation.

Were organs analysed for the Compensation Scheme?

143 The rules of the Compensation Scheme have never required data derived from the analysis of organs: even the original methodology provided merely for such data to be used if available, and so in the vast majority of cases internal dose was assessed using only personal monitoring data.

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46 Twenty from Sellafield, four from Springfields and one from Capenhurst

47 Mr McLean's case is further complicated by errors in the post mortem data used in the first application to the Compensation Scheme: see chapter 5, "British Nuclear Fuels Limited", paragraph 210. Had the correct post mortem data been used, a 25% award would have been received after the first application. See also chapter 13, "The Families"

144 However, consideration was given at one point to encouraging employees to allow their organs to be analysed for Compensation Scheme purposes. At a JWP meeting on 14 March 1984, attended as usual by union representatives and Dr Schofield, it was reported:

> [the expert panel] *had suggested encouraging employees to make their bodies available on death for autopsy and radioassay both to increase the scientific knowledge about the metabolism of radionuclides and to assist the determination of particular cases … The meeting discussed the suggestion about encouraging employees and all were agreed that it was not appropriate at the present time.*

The proposal does not appear to have been mentioned again.

145 In the last of the Sellafield cases, an application had been made under the part of the Compensation Scheme allowing payments to workers who had not yet died. The man's death, a few months later, was reported to the coroner, Mr John Taylor, who decided after the post mortem not to hold an inquest. Nevertheless, Mr Taylor asked Sellafield for *"normal tests to be carried out in any case in view of pending action by family against the Company"*.

146 The only *"pending action"* was the Compensation Scheme application. However, there is no suggestion that either the Compensation Scheme or the union had suggested that organs should be analysed. The request reflects Mr Taylor's misunderstanding both of the limits of his role as coroner and of the rules of the Compensation Scheme. The case was assessed only under the new technical basis and post mortem data were not used, although they are mentioned in the Compensation Scheme's file.

147 Save for this case, the Inquiry has seen no evidence to suggest that organs were removed or analysed for the purpose of the Compensation Scheme.

The National Radiological Protection Board

Chapter 8

The National Radiological Protection Board

Chapter 8

Contents

Introduction

1 Following the Windscale (Sellafield) fire of 10 October 1957, a leading industrialist, Mr (later Sir) Alexander Fleck, was asked by the Prime Minister, the Rt Hon Harold Macmillan MP, to recommend measures to remedy deficiencies in health and safety at the United Kingdom Atomic Energy Authority (UKAEA). In 1958, he produced his report.[1] One of his recommendations was that the UKAEA should take responsibility for building up a national supply of health and safety specialists and should establish a national training centre. A report[2] by Sir Douglas Veale in 1960 developed this idea by recommending the establishment of a national radiological advisory service.

2 In April 1966, it was agreed in principle by Sir Harold Himsworth, the Secretary of the Medical Research Council (MRC), Sir William Penney, Chairman of the UKAEA, and Sir Brian Windeyer, Chairman of the Radioactive Substances Advisory Committee, that a national organisation should be created to oversee radiological protection.

3 Over the next few years, Dr Andrew McLean, Director of the UKAEA, and Mr John Dunster, Deputy Head of the Radiological Protection Division (RPD) of the Health and Safety Branch of the UKAEA, based at Harwell, led a working party to develop this plan. The National Radiological Protection Board (NRPB) was created in 1970[3] by amalgamation of the Radiological Protection Service (RPS), an MRC body based in Surrey, and the RPD.

4 The NRPB was a non-departmental public body with statutory functions:

> *There shall be a public authority … whose function it shall be –*
>
> *(a) by means of research and otherwise, to advance the acquisition of knowledge about the protection of mankind from radiation hazards; and*
>
> *(b) to provide information and advice to persons (including government departments) with responsibilities in the United Kingdom in relation to the protection from radiation hazards either of the community as a whole or of particular sections of the community.*[4]

1 *Report of the Fleck Committee on the Organisation for the Control of Health and Safety in the United Kingdom Atomic Energy Authority*, Cmnd 342 (HMSO, 1958)

2 Veale D, *Training in Radiological Health and Safety*, Report of a committee appointed by the United Kingdom Atomic Energy Authority (HMSO, 1960)

3 Radiological Protection Act 1970

4 Radiological Protection Act 1970, s1(1)

5 The NRPB initially operated from laboratories and offices in Harwell and Sutton but moved into purpose-built accommodation in Chilton, near Didcot, on the Harwell site in 1974. Dr McLean was appointed its first Director and Mr Dunster an Assistant Director.

6 The NRPB's remit extended to all types of ionising radiation, including, but not limited to, those from the nuclear industries. Its staff had considerable expertise on naturally-occurring radionuclides and the use of radiation in the non-nuclear sectors, for example, medicine, research and engineering. From 1974, the NRPB assumed responsibility for advising on exposure to non-ionising radiation.

7 The NRPB was sponsored by what is now the English Department of Health with formal links to Scotland, Wales and Northern Ireland. From time to time it was consulted by other government departments. It never operated or regulated nuclear facilities. Initially, most of its funding was from the Department of Health but over time the proportion of its income derived from contract research (funded by UK or European research grants) and commercial services (mostly from contracts with customers outside the nuclear industries) increased to over 50%.

8 The NRPB had no financial or commercial links to the nuclear industry, with the exception of occasional minor research contracts. Its remit was purely scientific and advisory and its role was not dependent on the existence of a nuclear industry.

9 The Health Protection Agency (HPA) was created in 2003 as a Special Health Authority by the merger of the Public Health Laboratory Services and the Microbiological Research Authority.[5] It was reconstituted as a non-departmental public body in 2004.[6] On 1 April 2005 the NRPB became the Radiological Protection Division of the HPA (HPA-RPD).

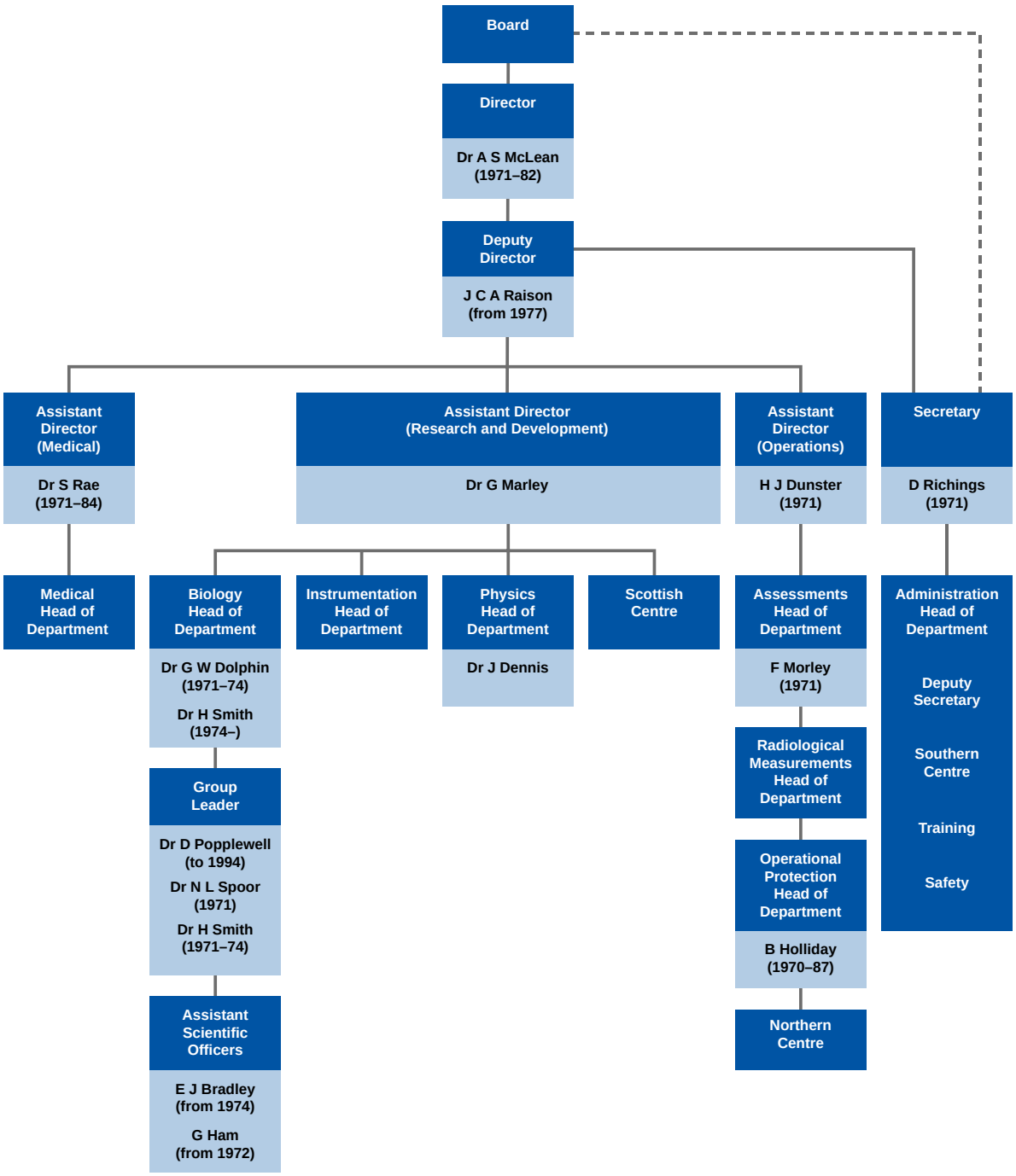
5 Health Protection Agency (Establishment) Order 2003

6 Health Protection Agency Act 2004

NRPB management and accountability

10 The initial structure[7] of the NRPB is shown in figure 8.1.

Figure 8.1: Structure of the National Radiological Protection Board



7 Information taken from O'Riordan M, *Radiation Protection – A Memoir of the National Radiological Protection Board* (HPA, 2007). Dr Michael O'Riordan joined the RPS in 1952, transferring to the NRPB in 1971 and ending his time there as Board Secretary from 1993 to 1997

11 As a statutory body, the NRPB was accountable for the exercise of its delegated functions to the Permanent Secretary at the Department of Health and Social Security (DHSS). Its chairman was Sir Brian Windeyer and its members included Dr Edward Pochin (later Sir Edward) and representatives from the MRC and the UKAEA.

12 As Director, Dr McLean was directly accountable to the Chairman and Board for implementation of the Board's policy and work programme. There were three Assistant Directors:

- Dr Greg Marley was responsible for Research and Development, which included the Biology Department and which became the focus for NRPB work involving analysis of post mortem material;
- Mr Dunster led Operations which included the related work of radiological measurements;
- Dr Stewart Rae led the Medical Department.

Mr David Richings was the Board Secretary and directly accountable to the Director with responsibilities including administration, finance and personnel.

13 Until 1977, the Assistant Director for either Research and Development or Operations acted as Deputy Director, with duties including *"line management responsibility"*. In 1977, Dr John Raison was appointed Deputy Director. The Directorate, comprising the Director and the three Assistant Directors, approved the NRPB's annual work programme, considered all policy matters and acted as a corporate management body when approving and monitoring progress of the annual programme. Individual projects within the programme were supervised and controlled by a project officer (often the Head of Department) and associated line management.

14 A Management Committee comprising the Directorate, Heads of Departments and three members of staff nominated by trade unions met every two months. It was a consultative body whose minutes were circulated to Board members.

15 The information above is derived from an undated NRPB document which reviewed the structure of the organisation in 1983 and cast light on it as it had existed from 1971. The document described how projects were managed and who was responsible for them:

> *The Board's annual technical programme is developed on a subject basis, from the continuing long term projects already in hand and the new needs foreseen by Assistant Directors. It is reviewed by the Management Committee and, more significantly, by the Directorate. This* [is one of] *the two principal areas in which the Directorate does act in a corporate manner. The programme is submitted to the Technical Committee of the Board for comment ... and becomes the formal programme of the Board. It contains all the planned research and development work ... Subsequently, Board members are kept informed of progress during the year by seeing the departmental six-monthly progress reports. The work is supervised and controlled by line management ... Each project officer will be accountable for the whole project to a single nominated line manager.*

Recognition of the value of post mortem work

16 Dr McLean and the Head of the Biology Department, Dr Geoffrey Dolphin, had both worked in the Health and Safety Branch of the UKAEA, the former as Director of Health and Safety. Both understood the value of the work undertaken by Dr Geoffrey Schofield[8] on organs obtained at post mortem. In 1964, Dr Dolphin had urged that:

> *every effort should be made to obtain measurements of the organ content at autopsy on the body of any worker who was exposed to a plutonium inhalation hazard and who had given fairly frequent urine samples for plutonium measurement.*[9]

In May 1970, shortly before taking up his position at the NRPB, he had written:[10]

8 Then Senior Medical Officer at Sellafield

9 Dolphin GW, Estimation of body content following inhalation of insoluble plutonium, *Assessment of Radioactivity in Man*, vol II, Proceedings of the IAEA Symposium, Heidelberg, 1964: 589–602

10 Dolphin GW, The biological problems in the radiological protection of workers exposed to plutonium, *Health Physics*, 1971, 20: 549–57

> *There are some data about the distribution of plutonium in man following occupational exposure from the analysis of tissue obtained at post mortem. These data are of limited value because only a small fraction of the human body is available for analysis … More data are required on the distribution of Pu among organs in the human body. These data are being collected slowly by analysis of tissues obtained at post mortem.*

17 On 7 April 1971, Mr John Donoghue[11] reminded Dr Dolphin in graphic terms of the need for post mortem work:

> *Without actually pushing people under buses we should, I am sure, take every opportunity to get post-mortem specimens for analysis. This is, I know, repugnant to some senior managements but it is in everybody's interest (including that of the workers themselves) that no opportunity should be missed to collect such data.*

18 Mr Donoghue clearly considered the analysis of organs taken at post mortem a good way to obtain knowledge which would inform the approach to be adopted in respect of *in vivo* monitoring and directly benefit other workers. That view was shared by Dr Dolphin and Dr McLean.[12]

NRPB analysis of nuclear workers' organs

19 In July 1972, Dr Donald Popplewell joined the NRPB as a Group Leader in the Biology Department and Principal Scientific Officer. He had previously undertaken highly specialised radiochemical analysis on weapon debris while based at the Atomic Weapons Research Establishment (AWRE) in Aldermaston and had also developed expertise in the subject of plutonium in blood. He had known Dr Dolphin for some years.

20 Before he moved to the NRPB, Dr Popplewell had not analysed human tissue. He told the Inquiry that in 1972 he had been asked by Dr Dolphin and Dr McLean to analyse organs which had been taken at post mortem from a former nuclear worker and sent to the NRPB by Dr Schofield. No log book or other documentation remains by which the Inquiry could definitively identify the individual, but it would seem likely that he had worked at Sellafield and that Dr Schofield was seeking a second opinion in order to

11 BNFL Health and Safety Manager

12 Both Dr Dolphin and Dr McLean became involved in discussions concerning a UK national post mortem registry: see chapter 10, "Registries"

verify analysis already undertaken there. Dr Popplewell duly performed the analysis but did not know what, if any, use Dr Schofield made of the results.

21 In 1974, Dr Dolphin and Dr Schofield published a paper[13] reporting on Sellafield's assays of plutonium in organs taken at post mortem:

> *from 10 workers at Windscale … the investigations were carried out on one whole lung, half the liver, about 0.5 kg of bone (vertebral bodies, sternum, ribs and long bone), the whole mediastinum, the spleen and one kidney … since the lung is such an important organ of deposition, the regional lymph nodes in the mediastinum have also been analysed for plutonium content. In 5 cases as many as possible of the tracheo-bronchial lymph nodes were dissected out.*

It is probable that the organs analysed by Dr Popplewell in 1972 came from one of the *"10 workers at Windscale"*: the deceased may have been Malcolm Pattinson, whose case is discussed in chapter 13, "The Families".

22 By the time of publication, Dr Dolphin had been promoted to Assistant Director and Dr Hylton Smith had succeeded him as Head of the Biology Department. Dr Schofield continued to send organs for analysis to Dr Popplewell from time to time. Some organs were taken from Geoffrey Southward, a former Sellafield worker who died of myeloid leukaemia in 1975 and whose death was reported to the Coroner for South Cumbria because of concern that the illness might have been caused by radiation.[14] Dr Schofield attended the post mortem and, with the coroner's authority, obtained organs for analysis, half of which he sent to the NRPB. From details provided in a paper[15] published by Dr Popplewell in 1975 referring to this and another similar case, it is evident that samples of the organs were brought to Harwell by Dr Schofield and initially given to Dr Hylton Smith. The organs (femur, vertebrae, rib, sternum, liver, kidney, lung and testes) were then passed to Dr Popplewell for radiochemical analysis. The Inquiry has seen no evidence that the coroner was aware of the collaboration between Dr Schofield and the NRPB in this case.

23 The NRPB also, properly and in accordance with its statutory duties, accepted contract work. From time to time it was asked directly by coroners to analyse organs taken at post mortem and to report formally in cases where exposure to radionuclides was thought to be a potential contributing

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13 Schofield GB and Dolphin GW, UK experience on the medical aspects of radiological protection of workers handling plutonium, *Annals of Occupational Hygiene*, 1974, 17(2): 73–83

14 See chapter 13, "The Families"

15 Popplewell DS, *Determination of the Plutonium Content of Post Mortem Tissues from Two Workers who were Exposed to Plutonium*, NRPB Report, NRPB-R38, September 1975

factor to death. Those cases were diverse geographically and included workers from Aldermaston, Calder Hall and Winfrith. By 1976, Dr Popplewell had reported[16] on radiochemical analysis of organs (said to consist usually of one whole lung, a kidney, about half the liver, two ribs, a femur, half the sternum, several vertebrae and, occasionally, gonadal tissue) in six cases. The NRPB's contract work was described in its report covering 1977–80:

> [the NRPB] *is sometimes asked by Coroners to make measurements when it is suspected that a radiation dose might be a … cause of death.*

The population studies

An initial false start

24 In the late 1970s, the NRPB began to consider assaying plutonium in organs taken from people, from Cumbria and elsewhere in the UK, who had not worked in the nuclear industry. Such data would allow comparison with levels in those from nuclear workers. This project became known informally as the population studies.

25 The earliest reference to this work which the Inquiry has seen is a minute of a meeting that took place at West Cumberland Hospital on 12 April 1978 *"to discuss the possibility of obtaining tissue samples at post mortems for radiochemical analysis in NRPB laboratories"*. It was attended by Dr David Smith and Dr Philip Whitehead, consultant pathologists who shared responsibility for the post mortem work at West Cumberland Hospital; Dr Dolphin and Dr John Reissland[17] of the NRPB; and, for less immediately obvious reasons, Dr Schofield.

26 Dr Dolphin explained the purpose of the studies. He said that following the recommendation of the Windscale Inquiry Report[18] that more monitoring should be carried out in the environment around the plant, the NRPB wished to ascertain levels of radionuclides in people who had lived near Sellafield. The intention was to obtain, at post mortem, organs from people living within about ten miles of the plant: the NRPB hoped to obtain about six or seven sets per year. It was agreed to take organs only from coroners'

16 Popplewell DS, *Plutonium in Tissues Obtained at Autopsy*, NRPB Annual Report, 1976

17 Head of the Physics Department and therefore of equivalent grade to Dr Hylton Smith

18 *The Windscale Inquiry* (HMSO, 1978): the Inquiry, chaired by the Honourable Mr Justice Parker, looked at the implications of building a thermal oxide reprocessing plant (THORP) at Windscale

cases. Dr Schofield would see the coroner to explain the reasons for the sampling and to seek his co-operation. The organs to be taken would be a lung with mediastinum (including respiratory lymph nodes), the liver, samples of bone including two or three ribs, sternum and vertebral bodies, thyroid, kidney and, where appropriate, testes. Dr Schofield would arrange for the samples to be collected and held at Sellafield pending transfer to the NRPB.

27 It is not clear why Dr Schofield should have attended the meeting. As Company Chief Medical Officer for British Nuclear Fuels Limited[19] (BNFL), he would have been interested in the results of any work undertaken by the NRPB. However, the subjects of the study would not have worked within the nuclear industry and Dr Schofield was to play no part whatsoever in the project when it formally commenced in the 1980s. Dr Popplewell speculated in evidence to the Inquiry that Dr Schofield's presence could be explained by *"his close relationship with Dr Dolphin and knowledge of the people in authority in the West Cumbria area"*. It is also possible that the NRPB considered his assistance would be invaluable in view of the arrangements already in place between him and West Cumberland Hospital.

Concerns at Sellafield

28 The NRPB's proposal caused concern at BNFL. On 5 May 1978, Mr Arthur Scott, the Company Secretary, wrote to Dr McLean stating that Dr Schofield had drawn his attention to the proposed arrangements for the collection of the organs:

> *It is a potentially very emotive business removing substantial parts of the anatomy of persons who were not employed in the nuclear industry and whose deaths were not in any way associated with radiation exposure and sending them to NRPB for analysis. I can see the danger, especially if Schofield's people are involved or Windscale is used as a staging post, that this will become another cause of resentment at the consequences of having a Windscale on one's doorstep. It would be potentially disastrous if knowledge that it was going on were to leak out without anything having been said locally and especially without any preliminary discussion at the Local Liaison Committee.*[20]

19 Dr Schofield had been appointed Company Senior Medical Officer when BNFL was incorporated in 1971 and promoted to Company Chief Medical Officer in 1975

20 A body which allowed exchange of information between Sellafield and the local community: see chapter 12, "West Cumberland Hospital", paragraph 55

Mr Scott also asked whether the consent of next of kin would be sought and whether any preliminary public announcement was contemplated.

29 Dr Dolphin responded on Dr McLean's behalf on 6 September 1978:

> *I have written to the coroner at Whitehaven, Mr* [Hubert] *Gough, asking for his permission to obtain post-mortem samples from cases under his jurisdiction in West Cumbria. We require samples from cases of accidental death … The question of consent of next of kin will I think be a matter for the coroner but I believe is not necessary in certain cases which come within his control. No public announcement is contemplated.*

Dr Dolphin's legal analysis was incorrect. The Human Tissue Act 1961 required[21] that the relatives' lack of objection to the removal of organs for research be established; the agreement of the coroner was necessary[22] but not sufficient. It does not appear that Mr Gough ever responded either in writing or orally to Dr Dolphin's letter.

30 Mr Scott replied to Dr McLean on 15 September 1978. Presciently, he speculated that the material in Dr Dolphin's letter would prove:

> *useful background if one of these fine days the … Whitehaven News dig out the fact that vital bits of accident victims are being removed and sent to NRPB and want to make a big story of it.*

31 Despite the plans formulated at the April meeting, no organs were obtained for analysis. It is not clear whether this was because of Mr Gough's failure to deal with the NRPB's correspondence or whether a genuine drive to advance the project had not yet developed.

Proposals revisited

32 Although the project did not get off the ground in 1978, it had not been forgotten. Dr Popplewell continued to undertake work involving radiochemical analysis of organs from nuclear workers who had been exposed to plutonium. He was aware that the results of that analysis would be compared with data relating to the general public and that the only extant data relating to the general public were from the US. He also knew that civil claims for compensation might be brought as a result of exposure to radiation at work. Although he felt there was unlikely to be a great deal

21 Human Tissue Act 1961, s1(2)

22 Ibid, s1(5)

of difference between results derived from US and UK cohorts, it struck him that any proper consideration of the merits of those civil claims would be on a stronger footing if British data were available with which data from nuclear workers could be compared. He told the Inquiry that he therefore suggested, at one of the NRPB's annual budget meetings, that it would be sensible to begin a post mortem programme looking at plutonium levels in the general public. He said that a formal protocol for the population studies was prepared and submitted to the Director, Dr McLean, but could not recall exactly when. Given the substantial investment of time, expertise and money in the studies, they must have received formal approval but the Inquiry has seen no documents to indicate by whom[23] or when.

Control areas

33 On 30 March 1979, Dr Hylton Smith wrote in a memorandum to Dr Popplewell:

> *In discussions with Dr Dolphin, it appears that he suggested to you some months ago that you should initiate a programme on autopsy tissue analysis for actinides in the Oxford area. Dr Dolphin asked you to approach Dr Rae and through him arrange the collection of tissues, presumably directly with a pathologist or a Coroner.*

34 Dr Hylton Smith's reference to *"the Oxford area"* reflected the need for organs to be taken from areas other than West Cumbria. The population studies enabled plutonium levels in nuclear workers to be compared with those in the general population, but there remained the possibility that levels in those living close to Sellafield would be higher than in those living remote from any nuclear site. Therefore, while obtaining organs from the neighbourhood of Sellafield was a priority, it was necessary also to have organs from other areas to act as control groups against which the West Cumbrian cohort could be compared. Initially three additional areas were selected. Mr George Ham, an Assistant Scientific Officer at the NRPB who was involved with the population studies, explained to the Inquiry that Oxford was chosen as it was in the south, local to the NRPB and therefore convenient; Newcastle because it was on the opposite side of the country to Cumbria; and Edinburgh because its rainfall, a factor relevant to natural background radiation, was fairly similar to that in Cumbria. Dr Popplewell's evidence to the Inquiry was that the selection of the relevant areas was

23 Presumably they would have been approved by the Directorate: see paragraph 13

primarily based upon the presence of personal contacts in those areas, who might facilitate the supply of organs.

Further discussions

35 Despite Dr Hylton Smith's memorandum, there is no evidence of organs actually being obtained for the population studies in 1979, presumably because the appropriate arrangements for collection were still being put into place. A minute of a meeting on 9 April 1980 between Sir Edward Pochin, Dr McLean, Dr John Dennis[24] and Dr Hylton Smith records:

> *Smith summarised progress to date. He has contacted Professor J. O'D. McGee (Oxford), Professor Sir Alistair Currie (Edinburgh) and Dr. G. B. Schofield (BNFL, Windscale) to obtain tissues from non-occupationally exposed people who had died. The minimum requirement is one lung with the major birfurcation* [sic] *and associated mediastinum, up to half the liver and two ribs. A femur, a block of lumbar vertebrae and testes would be invaluable if they could be included ... Popplewell and his team should be able to cope with about thirty samples per year ...*
>
> *The availability of these tissues from deceased occupationally exposed people was discussed. Both McLean and Sir Edward emphasised the importance of this ... It was felt that the Board should be involved wherever possible.*
>
> *Sources of supply of tissue from the occupationally exposed group were discussed. McLean felt that he should speak to Schofield on his next visit to Harwell, and Rae and Smith should approach Murray Roberts*[25] *to seek his opinion on setting up a Transuranics Registry.*[26]
>
> *It was agreed that Smith should convene a meeting quarterly and include Rae in order to progress the development of this project.*

The minute was signed by Dr Hylton Smith, who added a note:

> *10th April 1980 NB Sir Edward thought that it would be more appropriate to obtain tissues from people who had died accidentally.*

24 Assistant Director of the NRPB

25 Senior Medical Officer, AWRE

26 See chapter 10, "Registries"

36 It is of note that although what was required was organs obtained at post mortem, only Professor McGee and Professor Currie were pathologists; Dr Schofield was an occupational health physician. It is not obvious why the meeting should have considered Dr Schofield's assistance would be of value in obtaining tissue from people who had not been exposed to radiation in the course of their employment.

The need for consent

37 One major potential difficulty with the population studies was apparently not discussed. Although a coroner could order a post mortem without the relatives' consent, that examination was limited to determining the cause of death; organs could not be removed for research without the relatives' consent. For the population studies Dr Popplewell required organs untouched by disease. By definition, therefore, analysis of those organs was irrelevant to the cause of death, so they could be removed at post mortem only if it had been ascertained that the next of kin did not object.[27] Ultimately, the need for such consent and the difficulties in obtaining it were to bring the population studies to an end. Initially, however, the problem was either not recognised or, if it was recognised, simply ignored.

The studies begin

38 In May 1980, the first batches of organs were received. They had been taken from coronial post mortems in Oxford. Twelve sets of organs were provided the following month by pathologists in Edinburgh: all came from hospital post mortem examinations, indicating that consent to the post mortem, although not necessarily to the organ removal, had been obtained.[28]

Renewed attempts in West Cumbria

39 On 30 May 1980, Dr Raison, Deputy Director of the NRPB, noted that attempts to secure post mortem material in 1978 had failed and that Dr Hylton Smith had recently tried to reactivate the arrangements by speaking to Dr Schofield at Sellafield and to the Coroner for West Cumbria, Mr Adrian Walker.[29] Dr Raison's note indicated that there had been further

27 Human Tissue Act 1961, s1(2)

28 There is no coronial system in Scotland, where sudden deaths are investigated by the Procurator Fiscal

29 Mr Gough had retired in October 1979 and was succeeded by Mr Walker, his Deputy

discussions with Dr David Smith and that arrangements were in place with pathologists in Oxford and Edinburgh. It is clear that legal and ethical considerations were of concern to Dr Raison, who wondered:

> *whether there are special circumstances apropos Cumbria/Windscale which would make it helpful to shelter under the umbrella of the coroner's protection by receiving only the coroner's cases … the legal questions, of possession of the body and authorisation, are not the ones which should dictate the choice between coroners' and non-coroners' cases for the answers are clear about that. Rather the choice depends upon interpretation of medical ethics and views in certain postulated circumstances.*

Dr Raison suggested that Dr Schofield be asked to clarify whether he preferred coronial or non-coronial material. The coroner should be involved only if coronial material were sought; otherwise the approach should be to Dr David Smith.

40 On the same day, Dr Raison prepared letters to Dr David Smith and to Mr Walker, the former asking for about 12 sets of tissue samples each year from people living within about 15 miles of Windscale, the latter explaining the nature of the programme and asking for approval. They were not sent: perhaps it was intended that Dr Schofield's preferred source of material would be established first.

41 It is unclear why Dr Schofield should have been considered to have been of any relevance to the actual implementation of the proposed project, still less why his preference as to the source of material should have been of interest to the NRPB. The Inquiry has seen no evidence that Dr Schofield actually participated in the population studies.

42 On 30 June 1980, Dr Raison reported to Dr Hylton Smith:

> *Dr. Schofield is not concerned whether material you receive from Cumbria is from Coroners' cases or otherwise. He did not think that we need be concerned by Dr. Smith's wishes to have the Coroner support him. He telephoned Mr. Adrian Walker … who not only sees no objection but does not wish to have any letter from us about these cases. If the material does not arise for one of his autopsies he has no locus and if it were to do so he would know as a result of his direct contact with the examining pathologist. You can, therefore, go ahead making arrangements with Dr* [David] *Smith telling him that Geoff Schofield spoke with the coroner on 26 June and received this reassurance.*

43 On 19 September 1980, Dr Hylton Smith met Dr David Smith in Cumbria to outline the NRPB programme: the pathologist had by then assisted Dr Schofield with his own research by providing organs taken at post mortem from eight men who had previously worked at Sellafield. Dr David Smith agreed to assist:

> *The tissues would include one lung, the major bifurcation and a portion of trachea complete with mediastinal lymph nodes; two ribs; three or four vertebral bodies from the lumbar region, one femur, approximately half the liver (1 kg) and one testis. The subjects would be aged between 30 and 50 and those dying of malignant disease would be excluded.*

The subjects would have lived within a 15-mile radius of the Sellafield plant or the Ravenglass estuary.[30] Dr David Smith's colleague Dr Thomas Bird was not present at the meeting but was said to be willing to collect samples.

44 The list of organs agreed at the meeting proved to be merely a guide: once the studies began, sternum, kidney and spleen were also taken in some cases and testis in only a few. The deceased from whom organs were taken were often significantly older than 50.

Publication of initial results

45 In 1981, Dr Popplewell began to receive organs taken from post mortems at West Cumberland Hospital and later that year he published his initial results and conclusions. The first reference to the population studies in an official NRPB publication appears in a note[31] in the NRPB Report covering 1979–81:

> *From time to time, NRPB has measured the plutonium content of tissues taken at autopsy from people who had worked in the nuclear fuel reprocessing industry at Sellafield. During that work it became apparent that the results would be more enlightening if they could be compared with the baseline levels of plutonium in the general populace … Autopsy tissues were obtained from the South Midlands of England and Central Scotland.*[32] *The subjects were aged at least 35 years and had died from acute injury in 1980 or 1981.*

30 These residence conditions were relaxed by Dr Hylton Smith in April 1981

31 Popplewell DS, Ham GJ and Johnson TE, Plutonium body burdens of members of the public in different regions of the United Kingdom, *The Work of the NRPB 1979–81*

32 Clearly, Oxford and Edinburgh

Tables in the paper referred to the analysis of 15 vertebrae, 15 livers, 14 lungs, 13 tracheobronchial lymph nodes, ten sets of ribs and eight femora. Organs from North East England and Cumbria were *"still to be analysed"*.

46 By *"North East England"*, the authors were referring to Newcastle. Towards the end of 1981, Professor Bernard Tomlinson, Head of Pathology at Newcastle General Hospital, had agreed that pathologists in his department would attempt to gather tissue for analysis. He suggested that the hospital's mortuary technician should receive a small honorarium for his extra work in *"re-fixing defects in the lumbar vertebrae and replacing femurs by a wooden support"* [33] and this was agreed. Similar honoraria, between £5 and £15 per set of samples, were paid to mortuary technicians at other hospitals. Professor Tomlinson indicated that he would have considered the proposed study, organised by a government body, to have been, *"serious and important"*. He did not himself supply organs for the studies.

47 Dr Popplewell continued to receive organs from West Cumbria and other areas and an update appeared in *The Work of the NRPB 1981–83*:

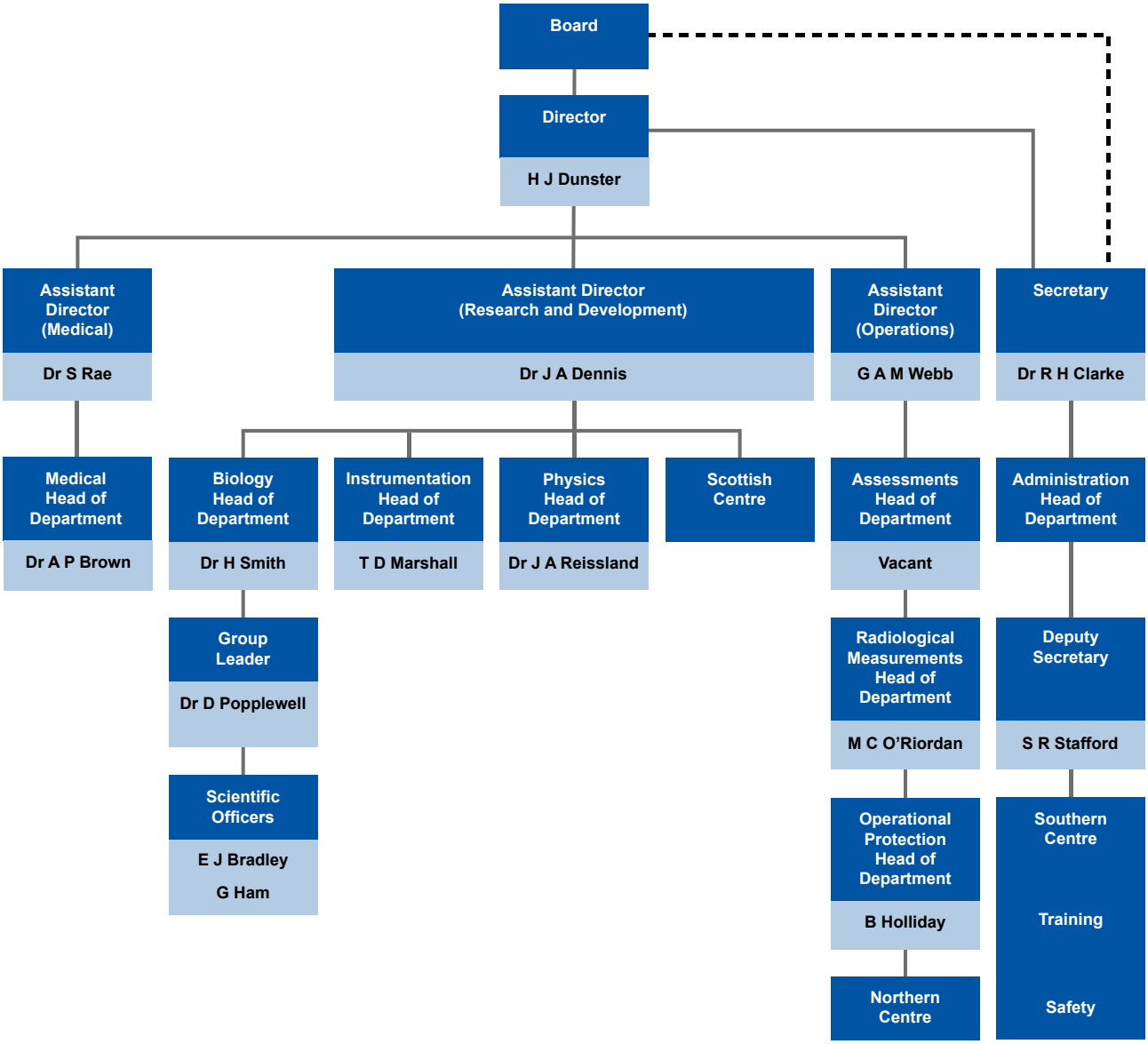
> *Work continues on the measurement of plutonium in tissues taken at autopsy from people who have lived in various regions of the UK … thirty sets of tissues, including a few from the Ravenglass area, have now been analysed.*

NRPB organisational changes

48 In 1983, various organisational changes were made in the NRPB. The most significant was the abolition of the post of Deputy Director: the Secretary and Assistant Directors became directly accountable to the Director. An NRPB document dated 1 April 1983 summarised the organisation: see figure 8.2.

33 For more detail as to the process of reconstruction of the bodies, see paragraph 90

Figure 8.2: The National Radiological Protection Board, 1983



The Black report

49 In 1983, a television programme[34] reported an apparently increased incidence of leukaemia in children living in and around the village of Seascale, close to Sellafield, and suggested a connection to the nuclear site. Sir Douglas Black[35] was asked by the Minister of Health to chair an

34 Yorkshire TV, *Windscale: the Nuclear Laundry*, transmitted 1 November 1983

35 Past President of the Royal College of Physicians

independent inquiry and the population studies, which had investigated levels of plutonium in the general public, became of particular interest. On 12 December 1983, Dr Hylton Smith sent data on 28 cases to the medical secretary to Professor Black's inquiry, Dr Eileen Rubery.[36] Dr Rubery also received a copy of a paper published by Dr Schofield in 1980,[37] describing his post mortem work at Sellafield.

50 The Black Inquiry acknowledged the importance of post mortem work. Consideration was given to *"the possibility of doing studies on tissue levels of isotopes in a young person from Seascale who might die in Whitehaven Infirmary"*.[38] Dr Rubery spoke to Dr David Smith at West Cumberland Hospital, noting on 12 March 1984 that she had expressed a hope to *"get material from a young accident case"*. However, there is no evidence that any such work was undertaken at the direct request of the Black Inquiry.

51 Sir Douglas Black's investigations found no clear link between Sellafield and the increased local incidence of childhood leukaemia but he considered further epidemiological research to be necessary. He noted:

> *Post mortem assessments of tissue levels would be a possible source of information on human exposure. The limited data made available to us by NRPB, did not suggest that levels of Plutonium in members of the public in Cumbria were significantly different from levels in members of the public in the rest of the UK, but the data available were very limited.*

Paediatric studies

52 The Black report[39] recommended that attention be given to the levels of radiation received by members of the public in West Cumbria. Dr Alan Craft, Professor of Child Health in Newcastle, and his colleague Dr Jennifer Kernahan treated all children from the northern region who had leukaemia and so were the treating clinicians for the children who formed part of the Seascale cluster. On 13 August 1984, Professor Craft wrote to Dr Rubery suggesting that it might be possible to compare post mortem levels of

36 Senior Medical Officer at the Department of Health

37 Schofield GB, Biological control in a plutonium production facility, *British Journal of Radiology*, 1980, 53: 398–409

38 Black Advisory Group minutes, 5 March 1984

39 Black, Sir Douglas, *Investigation of the Possible Increased Incidence of Cancer in West Cumbria. Report of the Independent Advisory Group*, Cmnd 667 (122) (HMSO, 1984)

actinides in the bones of children from West Cumbria with those in a similar group from the east coast. Dr Rubery replied on 28 August 1984 that this was exactly the sort of work which Sir Douglas Black had been anxious to see undertaken. Accordingly, on 18 September 1984, Professor Craft wrote to Dr Bird, consultant haematologist at West Cumberland Hospital and partly responsible for the post mortem work there, asking for specimens to be collected from *"stillbirths, neonates, or older children depending on availability"*. On the same day he also wrote to Dr Hylton Smith at the NRPB informing him that he intended to take *"lung, liver, long bones and vertebrae or ribs"*. Organs would also be obtained from Newcastle. The NRPB would then undertake the analysis.

53 On 22 October 1984, before Professor Craft's project began, a meeting took place to discuss how the Black recommendations could be implemented.[40] Dr Rubery noted that *"the Black Advisory Group had already asked the local pathologist to try to obtain post-mortem tissue for analysis by Dr Hylton Smith at NRPB"* and the minute records:

> *Dr Smith said that the NRPB had been collecting and analysing human tissue samples from Cumbria and several other parts of the country for some time … They had also been in contact with Dr A Craft and had obtained tissues from children dying in road accidents, and were trying to obtain fetal tissues and placentae. He said that some of this data would become available within the next few years.*

It is unclear how the implication that Dr Hylton Smith had already obtained tissue from children who had died in road accidents is compatible with the reported dates of collection in the paediatric studies, which post-date this meeting: the HPA was unable to assist. Professor Craft told the Inquiry that he had had no access to organs of children who had died suddenly other than from leukaemia; the NRPB's log books contain no mention of such tissue; and the Inquiry has seen no other documentation to suggest that Dr Hylton Smith's reported remarks were accurate.

54 The meeting also considered other potential projects. The DHSS was said to be anxious that all data collected should eventually be published and hence that the ethical aspects of the studies needed to be considered. It was agreed that it would probably be necessary to obtain the relatives' permission to use post mortem tissues. Dr John Terrell, the District Medical Officer for West Cumbria, said that this point had been raised locally. He expected to find the Seascale population co-operative, but well-informed and likely to ask

40 The meeting was chaired by Dr Rubery from DHSS and attended by, inter alia, Dr Dennis, Dr Hylton Smith and Dr Fry from the NRPB. Professor Craft had been due to attend but was unwell

penetrating questions, making it important that the studies had a firm foundation. He agreed to ask the local ethics committee for its opinion on the appropriateness of using post mortem material and the need to obtain the relatives' consent.

Ethical approval

55 On 8 November 1984, the West Cumbria Health Authority Ethics of Research Committee considered issues of consent arising from proposed research described by Dr Terrell[41] and commented:

> *it might be usefully promulgated in the West Cumbria community that certain tissue specimens, as they became available, would be routinely examined for radioactivity, as they may be for other pathological or biochemical analysis without detailed specific consents for each test; and that reliance should then be placed on any person or relatives who so wished, to opt out. It was felt by the Committee that this should be given serious consideration. It was also agreed that maximum community goodwill and co-operation was desirable.*

56 On 5 December 1984, Dr Helen Sutton, the Senior Medical Officer at the Office of the Chief Scientist within the DHSS, wrote to Dr Terrell:

41 Set out in a paper entitled "Research associated with the report of the Black Advisory Group on cancer incidence in West Cumbria"

The nature and extent of the consent needed for the examination of post-mortem and placental tissues will vary with the circumstances. A coroner's post-mortem allows for the examination of tissue bearing on the cause of death and relatives' consent is not required. However the Human Tissue Act 1961 … covers consent for post-mortem tissue examination. The DHSS approved declaration form (HC(77)28) covers consent to post-mortem examination and I am also sending you a copy of this. There is no statutory requirement to replace tissue removed and you will, I am sure, be guided by sensitivities and the prevention of outrage. Commonsense would indicate that only the small amount of tissue required for diagnostic or research purposes should be removed. The use of fetuses and fetal material for research was considered by an Advisory Group in 1970, again I am sending you a copy of their report together with their recommended code of practice. Because of the sensitivities involved again commonsense dictates that any research contemplated should be discussed, at an appropriate time, with the mother/father and their consent assured. How you intend to conduct such research together with the handling of issues of ethics/confidentiality, and proposed approaches to relatives should be included in your protocol for consideration by the local ethical committee.

57 In January 1985, Professor Craft met Dr Hylton Smith and then prepared a draft protocol, which envisaged taking only the liver from ten children in West Cumbria and ten in Tyneside and included a requirement for the consent of the next of kin. The proposal was put before the ethics committees of West Cumbria, Newcastle and North Tyneside. West Cumbria considered the protocol on 14 February 1985 and withheld its approval pending sight of comments by the other ethics committees. Newcastle formally approved the project on 26 February 1985, North Tyneside two days later and West Cumbria shortly thereafter. It is clear, therefore, that Professor Craft acted entirely properly in making arrangements to obtain ethical approval for his research and the consent of the next of kin: contrast the NRPB's approach in respect of the population studies.

Preparation

58 On 7 March 1985, Dr Rubery sent her comments on the draft protocol to Professor Craft. She noted that the members of the Black Advisory Group felt that it would be desirable to measure the levels of actinides in bone and marrow as well as in liver and pointed out that the NRPB had indicated that the bone of choice was likely to be the femur, possibly with several ribs

and vertebral spines. Professor Craft responded on 13 March 1985, agreeing that while this would be ideal:

> *as a pilot exercise it might be better just to stick to the liver … it is very much easier to get samples of liver than bones and indeed I have only sought ethical permission for the liver. To obtain specimens of rib, vertebra and femur in sufficient quantity from very small children would be an enormous undertaking as babies would be left with virtually no bones at all and this becomes almost unacceptable … my own feeling is that it would be better to do the livers as a pilot exercise and then once we have the cooperation of the pathologists for this then we can perhaps extend it later to include other tissues if it seems a worthwhile exercise from the pilot study.*

59 Nevertheless, on 31 July 1985, Professor Craft wrote to Dr David Scott, consultant pathologist in Newcastle, asking if he had yet had an opportunity to collect livers and *"if it were also easy to get 100g of bone, e.g. from the anterior vertebral column then we would also be very grateful for this"*. The Inquiry has seen no evidence to suggest that Professor Craft sought to extend the ethical approval for the study, which was limited to livers as he had noted on 13 March. It is not clear that such an extension would have been necessary: the ethics of the study were not affected by the specific tissue under consideration. The consent obtained from the relatives to the post mortem was sufficient to cover the removal of bone as well as liver.

60 Before the project could get properly off the ground, a difficulty was encountered. On 30 July 1985, Dr Terrell wrote to Professor Craft indicating that Dr David Smith had drawn his attention to the fact that consent for post mortem was not required on coroners' cases *"and, therefore, unless it were to be specially organised there would not be on record in cases of accidental child death consent for the organ analysis for radionuclides"*. Dr Terrell suggested that it might be prudent to obtain consent for the research work *"even in coroners' cases"* and wondered who might obtain it. Professor Craft responded on 13 August 1985:

> *As I understand it the body actually belongs to the coroner and you are not allowed to do anything at all without his permission. I wonder, therefore, whether it would be possible for you to discuss this informally with your local coroner to see what he would feel about us removing the appropriate specimens for our study from coroners' post mortems without having the parents' permission.*

He also indicated that he would look into the position with his local coroners, with whom he had not previously discussed the question.

Professor Knight's wake-up call

61 On 20 August 1985, Dr Terrell advised Professor Craft that Dr David Smith intended to discuss matters further with the Coroner for West Cumbria. However, within the next few weeks came what ultimately proved to be a fatal blow to the adult population studies. An article by Bernard Knight, Professor of Pathology at the Royal Infirmary, Cardiff, was published in the *Bulletin of the Royal College of Pathologists*,[42] summarising the legal position on consent:

> *The retention of tissues for teaching and research is not covered by the coroner's permission and the coroner cannot grant such permission, as it is not within his remit to do so. He can forbid the use of any tissues for such purposes, but positive permission must be obtained under the terms of the Human Tissue Act, 1961 … One of the most obvious examples of this, is the retention of pituitary glands for hormone extraction. In spite of frequent claims to the contrary, the coroner has no authority to give permission for such removal. A significant proportion of the contents of pathology museums are undoubtedly from coroner's cases and are, in the strict terms of the law, illegally retained.*

62 The article, although merely re-stating the law, caused consternation among pathologists. One who immediately changed his practice was Dr David Smith at West Cumberland Hospital, who stopped providing organs to the NRPB pending advice from Mr Walker.

63 Professor Craft sent a copy of Professor Knight's article to Dr Terrell, commenting:

> *It is obviously very clear that we cannot proceed with the removal of organs or other tissues for the measure of plutonium levels without getting the written permission of the next of kin. I think that this is going to be very difficult in many instances but I think that because of the very emotive nature of the subject we are dealing with we will have to comply with the regulations. Our local coroner in Newcastle has made it clear that he would wish us to abide by these rules.*

He indicated that he intended to speak to the paediatricians at West Cumberland Hospital to see if they could obtain the necessary consent in coroners' cases: he presumed that if written permission were obtained, the coroner would allow the tissue to be removed. There is in fact nothing

42 Knight B, Legal considerations in the retention of post-mortem material, *Bulletin of the Royal College of Pathologists*, September 1985

in Professor Knight's article, the Human Tissue Act 1961 or any official guidance to suggest that written, as opposed to oral, consent was required.

64 On 20 September 1985, Professor Craft raised the issue with the paediatricians at West Cumberland Hospital, Dr John Platt and Dr Ronayne Roberts, copying his letter to Dr David Smith. On 24 September 1985, Mr Walker wrote to Dr Smith:

> *Where tissue, therefore, has been taken for the purpose of examination for the Coroner, I am of the opinion that such tissue may not be used for the purposes set out in the Human Tissue Act unless that specified consent has been obtained from those persons I have mentioned i.e. the person lawfully in possession of the body who will have made reasonable enquiry from the surviving spouse or other surviving relatives. If I am correct in this then it would appear that a Coroner has no power to override the Human Tissue Act as amended and give consent for specimens to be taken for therapeutic purposes or research.*

Dr Smith sent copies of the letter to the paediatricians the following day.

65 Mr Walker's advice was expressed so clearly that Dr Smith also wrote to a researcher to whom he had previously provided thyroid glands advising him that if any more thyroid tissue was required, it would have to be taken from hospital post mortems.[43] One may contrast the unequivocal nature of Mr Walker's advice at this point, probably having seen Professor Knight's article, with the view he had reportedly held in 1980:[44] the law had not changed in the interim.

66 Dr Smith took the advice to heart and refused to provide any more organs for the studies. An undated note in the NRPB files, headed *"Supply of Autopsy Tissues"*, records:

> *Since the unfortunate intervention of Professor Knight, Dr David Smith … has been unwilling to supply tissues unless he has permission from the deceased's next of kin. The stumbling block has been that no-one has been willing to go through the trauma of seeking out the relatives and asking for signatures on consent forms in order to secure the tissues.*

67 On 6 December 1985, Professor Craft reported to Dr Rubery the legal problems which had been encountered:

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43 See chapter 5, "British Nuclear Fuels Limited"

44 See paragraph 42

> *The problem that we have run up against is that legally we are not allowed to remove any material from a body which is undergoing a coroner's autopsy. As most of the children who die do so suddenly and unexpectedly either as a result of an accident or the sudden infant death syndrome, we really are very limited in the number of specimens which we are likely to get … Perhaps it would be possible to get the Home Office to give us special dispensation to waive the coroners rules in appropriate cases to allow us to obtain this vital information which will not be available from any other source.*

Professor Craft was misinformed. The problem was a failure to obtain parental consent,[45] which would not have been addressed by any "special dispensation" which might allow the Coroners Rules to be waived.

68 On 10 March 1986, Dr Roberts eventually responded to Professor Craft's letter of six months earlier, indicating that the paediatricians would in theory be content to obtain consent but:

> *if we are to remove a large amount of tissue, or whole organs, we need to have clear and informed permission from the parents over and above the usual blanket permission on the standard P.M. form. Such parental permission will be difficult though not impossible … It is questionable however whether we should impose the extra burden of such requests on a family at such a stressful time … An alternative … is that, in view of the widespread public concern over the nuclear industry in West Cumbria, our Coroner might consider a blanket instruction in all these cases of Coroners' P.M.s.*

Of course, no such "blanket instruction" was legally possible. Both the proposed paediatric project and the adult population studies remained stalled.

End of the population studies

69 After Professor Knight's article, only a very few further sets of organs were made available for the adult population studies. Although strenuous efforts, discussed below, were made to overcome the difficulties in securing consent, they proved insurmountable and, after November 1985, organs in only one further case were obtained. Dr Popplewell's final paper on the population

45 Human Tissue Act 1961, s1(2)

studies,[46] published in 1988, dealt only with the analysis of organs up to 1985.

Continuing search for consent

70 The problems in securing consent attracted some attention. On 14 August 1986, an article in *New Scientist* noted:

> *Popplewell reports*[47] *"legal difficulties in obtaining autopsy material". In fact, it is strictly illegal to examine autopsy tissue except to ascertain the cause of death. In the past, some coroners have turned a blind eye to the practice, but there is increasing concern over the ethical issues among pathologists and this is severely hampering Popplewell's work. The National Radiological Protection Board has approached the Department of Health and Social Security to see what can be done.*

71 In September 1986, Dr Hylton Smith also explained the problem in a report[48] to the Committee on Medical Aspects of Radiation in the Environment (COMARE), the body charged with implementing the Black recommendations:

> *We have received no tissues from adults since the summer of 1985 following an article … questioning the legality of removing tissues at autopsy for purposes other than diagnosing the cause of death. Written permission from the relatives is necessary to remove substantial amounts of tissue for scientific purposes, a situation which is untenable to busy pathologists and/or junior hospital doctors ... It is apparent that we need more samples from both adults and children to make statistical analyses feasible but the problem of obtaining samples remains. The advice of COMARE is sought on how best we might proceed in the future.*

There was, of course, no solution to the problem posed by Dr Smith save for grasping the nettle of obtaining consent.

72 The NRPB explored various avenues by which consent might be secured. On 15 October 1987, Dr Kenneth Duncan, Assistant Director (Medical),

46 Popplewell DS, Ham GJ, Dodd NJ and Shuttler SD, Plutonium and Cs-137 in autopsy tissues in Great Britain, *The Science of the Total Environment*, 1988, 70: 321–34

47 Popplewell DS, Plutonium in autopsy tissues in Great Britain, *Radiological Protection Bulletin*, 1986, 74: 10–12, see paragraph 105

48 *State of the NRPB Autopsy Tissue Analyses Program*

asked for assistance with the population studies from the Chief Constable of Cumbria:

> *Currently this work is held up, through a greater appreciation of the legal aspects of taking human autopsy tissues for purposes other than those required for ascertaining the cause of death. I would like to ask you if it would be possible to enlist the help of the Coroner's Officer … in securing from the family of the deceased a written consent for the pathologist to take samples for radiochemical analysis in addition to those normally taken to ascertain the cause of death.*

73 Although senior police agreed to help, individual police officers reported unease to their union. On 24 June 1988, Mr Walker advised Dr Terrell that the police were not prepared to assist as *"officers find it extremely harrowing to request such consent from the bereaved relatives in the circumstances"*.

74 By this time a document[49] had been circulated within the NRPB which set out the legal position in the UK:

> *Where a pathologist is directed by a coroner to perform an autopsy, the pathologist is obliged to retain any tissues which upon further examination may assist in the ascertainment of the cause of death. Statutory permission to retain organs from coroner's autopsies strictly applies only to those tissues where further examination has relevance in arriving at the cause of death. The use of human tissue for other purposes, such as research, is governed by the Human Tissue Act 1961 as amended by the Anatomy Act 1984. Permission for the autopsy analysis is obtained either by the ante-mortem request of the patient or by the consent of the person lawfully in possession of the body who will have made reasonable enquiry from the deceased's relatives … Anyone wishing to undertake autopsy analyses on members of the public must be aware of the legal and ethical considerations outlined above.*

There was no reason why this full and accurate legal analysis could not have been undertaken some years earlier. The paper noted that *"in spite of such difficulties, a number of studies have been conducted"*. It would appear that the studies mentioned, which included the NRPB's own population studies, had been performed without consent.

75 The need to obtain further organs remained. The pathologists in Whitehaven had confirmed their willingness to assist: Dr David Smith had advised Professor Craft on 8 January 1988 that he and his consultant colleague

49 Its author is not given but it was thought by the HPA probably to have been prepared by Dr Frances Fry, then Head of Environmental Measurements Department, later NRPB Assistant Director

Dr George Ghazala[50] would be happy to supply post mortem specimens once the issue of consent had been resolved. In 1988, an NRPB paper[51] emphasised the need for further post mortem sampling and the disadvantage of having only a small number of cases from Seascale and the surrounding area:

> *More data on the levels of plutonium in tissues obtained at autopsy from persons of different ages are needed to improve estimates of radiation doses to the local community as a result of the Sellafield operations.*

76 Because the police were unwilling to assist, the impasse relating to the provision of organs remained. On 22 December 1988, Dr Terrell wrote to all general practitioners in West Cumbria asking if, when contacted by a coroner's officer, they would be willing to *"get in touch with the parent or next of kin and seek to have the enclosed consent form completed and forwarded to the Pathologist at West Cumberland Hospital"*. These proposals also failed to bear fruit.

77 On 18 February 1989, Dr Roger Clarke, Director of the NRPB, was quoted in *New Scientist* as having observed, when giving evidence to a public inquiry:[52]

> *There do seem to be some legal obstacles and this is the reason why for some years now we have been unable to get any further samples for analysis ... it is not unwillingness on our part. It is problems with the profession.*

The comment drew a sharp response from Professor Dillwyn Williams, President of the Royal College of Pathologists, which was published in *New Scientist* on 9 March 1989:

50 Dr Ghazala had been appointed consultant pathologist at West Cumberland Hospital in 1983

51 Stather JW, Clarke RH and Duncan KP, *The Risk of Childhood Leukaemia near Nuclear Installations*, NRPB-R215, 1988

52 Into plans for a nuclear reactor at Hinkley Point, Somerset

> *pathologists involved in performing autopsies … regard the autopsy primarily as a serious and important investigation into the diseases associated with the death of a patient. They do not regard the dead body as simply a source of tissue samples, and there are indeed legal and ethical problems involved. The Human Tissues* [sic] *Act is usually interpreted as preventing the taking of samples of autopsy tissue for research purposes without permission from a close relative. That poses little problem if the autopsy is carried out with the consent of a relative, but makes it very difficult to provide samples if the autopsy is carried out … at the request of the coroner. Many pathologists are actively concerned with research into radiation and cancer, and co-operative studies are under way between pathologists and physicists on the radionuclide content of human tissues. The director of the National Radiological Protection Board might find it helpful to discuss the problem with the Royal College of Pathologists.*

78 This public exchange led to correspondence between Professor Williams and the NRPB. On 17 May 1989, Professor Williams highlighted the difficulties in obtaining samples of the size required by the NRPB:

> *Firstly, the consent form normally used for "non-coroners" autopsies uses the phrase "limited amounts of tissue" so to ask for the whole liver is difficult. Secondly, the mortuary technicians must ensure that the body is decently returned for burial so that if the whole of both lungs and the liver are removed, then the thoracic and abdominal cavities will be required to be packed. If the ribs and the complete sternum are removed, then a replacement protection will be required. If several vertebrae are removed, the physical continuity of the spinal column will have to be artificially replaced. Similarly, if the whole femur is removed it will require replacement to prevent the leg simply dangling. It may have been possible to achieve samples of this size twenty or thirty years ago, but I do not believe that this is now a practicable list and suggest that smaller samples would greatly increase the likelihood of obtaining tissue.*

79 On 14 June 1989, Dr Barbara MacGibbon, Dr Duncan's successor at the NRPB, responded, betraying a misunderstanding of the law:

> *NRPB had no problem in obtaining the kinds of tissue sample I described (from autopsies carried out at the request of the coroner) until the introduction of the Human Tissues* [sic] *Act a few years ago.*

The Human Tissue Act 1961 had by then been in force for nearly 28 years. There had been no more recent relevant legislation.

80 On 7 September 1989, Dr MacGibbon wrote to Professor Ray Guillery, Professor of Anatomy at Oxford University, noting that the *"introduction of the Human Tissues* [sic] *Act made it impossible for us to obtain post mortem samples for radionuclide analysis during recent years"* and asking for permission to use samples from dissected cadavers. Organs from one such body were subsequently provided to the NRPB by the Oxford University Department of Anatomy in 1990.

81 On 18 January 1990, Dr Adam Lawson, who had succeeded Dr Schofield as BNFL Company Chief Medical Officer at Sellafield but was due to retire that March, agreed to act as a paid "local agent" to obtain consent. Dr Joan Munro,[53] Mr Walker and Dr David Smith were told of the proposed arrangements. It was agreed that Dr Smith would notify Dr Lawson when a person who had lived in the catchment area died and that Dr Lawson would then approach the deceased's general practitioner and, with the general practitioner's approval, the family. Dr Smith would record in his report that *"samples have been taken for analysis by the NRPB"*.

82 While the agreement of the deceased's family was a prerequisite to organs being removed at coronial post mortem for research, the coroner's consent was also required.[54] On 29 October 1990, Mr Walker granted a blanket approval for such removal, writing to Dr Lawson that he had *"certainly no objection at all to specimens being taken for research with the written consent of the next of kin. I think it is also an excellent idea for William Chapman*[55] *to notify you"*.

83 However, this scheme also came to naught. On 13 September 1991, Dr Frances Fry[56] wrote to Dr Lawson noting that no tissue had been received since ethics committee approval had been granted[57] a year earlier. Presumably in the hope of easing the problem, she extended the catchment area to the whole area served by West Cumberland Hospital.

84 This made no difference: the dearth of material continued. In October 1992, at Dr Lawson's suggestion, Dr Roger Bursey, an occupational health physician at West Cumberland Hospital, took over from him as local agent, although Dr Lawson's contract with the NRPB remained in force.

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53 Dr Terrell's successor, with the new title of Director of Public Health

54 Human Tissue Act 1961, s1(5)

55 Mortuary technician at West Cumberland Hospital

56 By now Assistant Director, NRPB

57 On 22 May 1990: see paragraph 115

Dr Lawson considered Dr Bursey would be better placed than he to ensure that Mr Chapman reported the arrival of suitable cases at the mortuary.

85 Dr Bursey's appointment did not solve the problem. In August 1993, he reported that pathologists undertaking coronial post mortem had often refused, fearful of delay, to wait for consent to be obtained. He said that it was clear that the pathologists did not want to be involved and suggested that the mortuary technician could remove the tissues himself after the post mortem and once cause of death had been established:

> *It would not take long to re-open the abdominal cavity to remove the necessary organs. A femur could be removed at the same time. This would permit more time for obtaining consent. However, I feel sure that I would require the permission of the Coroner in addition to that of the next of kin … I rather feel that it would be dishonest and unethical for me to merely request permission for samples to be removed when, in actual fact, whole organs are being taken and a thigh bone replaced by a length of broom-stick. It is indeed a very difficult and sensitive area as you state.*

The course of action proposed by Dr Bursey would not have been lawful: only a doctor could remove organs from a body for research.[58] Dr Fry responded that there should be no dishonesty in relation to requesting consent: *"However, you might consider what degree of detail of the actual procedures would be appropriate."*

86 Yet more options were considered. Dr Andrej Slovak[59] told Ms Lesley Prosser[60] that he had many contacts in West Cumbria; she noted that "[he] *felt he may be of some use in obtaining tissues. He agreed to pursue these contacts."*

87 Despite this offer and Dr Bursey's efforts, no adult tissues were obtained. In December 1993, Dr Popplewell reported to West Cumbria Health Authority:

> *There seems to be an insurmountable difficulty in securing next of kin approval in the short time available between death and autopsy examination. The last samples received on a regular basis were in 1985, before the current arrangements came into force. Our last publication, in 1989, dealt with some outstanding matters relating to the pre 1985 samples.*

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58 Human Tissue Act 1961, s1(4)

59 Dr Lawson's successor as BNFL Company Chief Medical Officer

60 Scientific Officer at the NRPB

88 No further organs were ever obtained. Dr Lawson's contract with the NRPB was consensually terminated in October 1994 and the population studies came to an end.

Organ collection

89 Organs harvested at post mortem were collected from mortuaries by employees of the NRPB, initially Dr Hylton Smith and later Mr Ham, who would return to Chilton with the frozen organs in a coolbox in the boot of the Board's Ford Escort. Mr Ham dealt with the mortuary technicians rather than with the pathologists and he tried to make the process as simple as possible. The NRPB provided freezers for both West Cumberland and Newcastle General Hospitals, in which organs were stored pending collection. The mortuary technician would generally wait until he had two or three sets of samples before notifying Mr Ham by telephone that they were available for collection. Mr Ham would drive to the hospital to collect the samples, which were stored in clear, labelled polythene bags. He would pay the mortuary technician his honorarium, often by personal cheque, claiming the money back from petty cash. At the NRPB the organs would be stored if there was no immediate capacity for analysis but specimens were not kept for any significant length of time.

Reconstruction of bodies

90 The extent of the organ retention required for the population studies was dramatic. The removal of the femur would leave an obviously limp leg, requiring reconstruction. The mortuary technicians would use a broom handle to replace the missing bone and give the appearance of normality. The mortuary technicians' skill – and the way in which undertakers presented the body, often under a shroud stapled to the sides of the coffin – meant that most families did not notice that the body had been stripped of organs. Although the technicians received a small payment in recognition of their work, the Inquiry has seen no evidence to suggest that any payments were made to any other individuals.

91 Had the families discovered, at the time or even years later, that their relatives' bodies had been treated in this fashion, many would have been shocked, distressed and justifiably outraged. Most families would not even

have wondered whether their relative might have been the subject of such research. To this day, nearly all remain ignorant of the fact that the studies included analysis of their relative's organs. The Inquiry has, in accordance with recommended practice,[61] taken no steps to notify any relative and has merely responded to requests for information.

Organ analysis

92 Mr Ham explained that the first step of the analytical process, once the organs had been transported to the NRPB, was to identify each organ. It was sometimes necessary, particularly when lymph nodes in the lungs were being studied, to spend some time dissecting out the tissue of interest. After initial preparatory work the organ was ashed in a furnace at 500°C. The ash was then dissolved in acid. A recovery tracer was added to allow the efficiency of the process to be determined. There then followed precipitation, purification and ion exchange separation, resulting in two separate solutions, one containing the purified plutonium. The final step involved electroplating onto a 1-inch stainless steel disc so that plutonium content could be determined.

93 The analytical process thus involved the total destruction of the organ. Any residual solid material, which contained no cells, was disposed of as waste. Unused solution was poured down the sink after neutralisation. The stainless steel discs were held for a few years before being incinerated.

Residual material

94 The Alder Hey[62] and Bristol[63] inquiries and the introduction of the Human Tissue Act 2004 prompted the NRPB to check that no human organs or tissue samples had been inadvertently stored in its laboratory freezers and overlooked. After the relevant provisions of the Human Tissue Act 2004

61 Brazier M, Organ retention and return: problems of consent, *Journal of Medical Ethics*, 2003, 29: 30–3. *"A final question was raised about how to return organs which were taken a long time ago and which the family had no idea had been retained. The* [Retained Organs] *Commission advises that unless families contact you, the best policy is to remain silent. Some hospitals and coroners have not done this and have proactively and independently contacted families. The result has been a lot of heartache."*

62 *The Royal Liverpool Children's Inquiry Report*, HC12-II (TSO, 2001)

63 *Learning from Bristol: The Report of the Public Inquiry into Children's Heart Surgery at the Bristol Royal Infirmary 1984–1995*, Cmd 5207 (TSO, 2001)

came into force in May 2006, the HPA-RPD (which by then incorporated the NRPB) made an initial preliminary registration with the Human Tissue Authority. In June/July 2006 a survey of human tissue holdings reconfirmed that the HPA held no post mortem tissues from nuclear industry workers or others. The Inquiry is accordingly satisfied that no organ received by the NRPB for the population studies remains in existence. The analytical process was wholly destructive and acellular material was not retained.

95 The Inquiry identified a number of cases in which organs were offered or indeed actually given to the NRPB but not analysed. Sometimes, the reason was that the organs had been taken at post mortem on the authority of the coroner; he had asked the NRPB to undertake analysis but it had then been decided that this would serve no useful purpose. Sometimes, the organs received were too small to be of value; the NRPB's log books also record that on occasion *"some muscle* [was] *bagged and stored"*. It is unclear what happened to these organs but it is likely that they were disposed of as waste. The HPA no longer has them.

96 On a search of the Animal House[64] at West Cumberland Hospital, the Inquiry discovered in a display cabinet part of a brain which it identified as being from a man some of whose other organs had been analysed by the NRPB. There is no evidence that the NRPB itself at any point had possession of that brain, which was removed in the ordinary course of a post mortem.[65]

Log books

97 From 1980, every specimen received by the NRPB was recorded in a log book. The record was considered to be robust: Mr Ham was confident that it was *"100% accurate"*. The Inquiry undertook a thorough cross-check, searching in particular the archives of the Coroner for West Cumbria, and was able to identify one case not recorded in the log book where, unusually, there was clear evidence from the post mortem report that organs had been taken and preserved for the NRPB.[66] Either the organs were received by the NRPB but not recorded in the log book, or for some reason the harvested

64 A part of West Cumberland Hospital which historically housed animals for testing, now used as a pathology department store for archived histopathology blocks and cytology slides, post mortem and histopathology reports and mortuary log books

65 The Trust had advised the Retained Organs Commission (ROC) of the retention in its formal return in 2001 and continued to hold the organ in accordance with guidelines issued by the Human Tissue Authority

66 See the first of the two cases referred to in paragraph 162

organs were not sent to the NRPB. Since retention was often not recorded in the post mortem report, the Inquiry cannot be certain that the log books do record every single instance. However, the numbers referred to in the published reports are broadly consistent with the log books and the Inquiry therefore accepts that in general the log books are accurate. On this basis the population studies comprised 100 cases.[67]

98 Paediatric specimens were recorded in a separate log book, which is discussed below.

Publications

Paediatric studies

99 The results of the paediatric studies were published only in two internal NRPB papers. The first[68] is dated October 1985 and describes radiochemical measurements on five cases: the first set of organs for the studies was collected on 5 June 1985. The second paper,[69] dated March 1986, repeated those results and added a further six (giving 11 in all), remarking that a further two sets had been received but had proved too small for analysis.

100 In all, the NRBP's paediatric log book records 16 sets of organs. Nearly all were taken from children who had been under Professor Craft's care at the Royal Victoria Infirmary, Newcastle. All were taken from children who underwent hospital post mortem for which consent had been obtained. After the records of the thirteenth set in the book there is a note confirming that *"the two reports of previous child autopsy samples"* deal with the results to that stage. The final three sets of organs were not analysed until April 1986.

101 The organs recorded as taken in the paediatric log book were mostly vertebrae and liver, although in some cases the retention was more extensive and also included, for example, ribs, sternum, lung and kidney. The Inquiry was able to identify 13 of the 16 paediatric cases referred to in the log book.

67 These were 31 from West Cumbria, 23 from Edinburgh, 20 from Newcastle, 19 from Oxford and 7 from South Cumbria

68 Popplewell DS, Ham GJ and Shuttler SD, *Radiochemical measurements on placentae and tissues removed at autopsies of children*, NRPB Report, October 1985

69 Popplewell DS and Ham GJ, *Radiochemical measurements on tissues removed at autopsies of children*, NRPB Report, March 1986

102 Publication of the paediatric studies was limited to the two internal NRPB papers; unlike the population studies, they did not reach a wider audience. The Inquiry was told that because the levels of plutonium detected were extremely low – at or around the limit of detection – the results were not considered worthy of open publication.

Population studies

103 A note included in *The Work of the NRPB 1981–83* has been mentioned above.[70] An update appeared in *The Work of the NRPB 1984–86*, by which time approximately 60 cases had been analysed.

104 In August 1985, Dr Popplewell published a paper[71] describing the population studies. He wrote:

> *we commenced a series of plutonium analyses on the tissues removed at autopsy from members of the general public … The subjects were at least 50 years old at the time of death. The cause of death in most cases was from cardiovascular disease … Experience gained in the analysis of tissues from occupationally exposed workers indicated that the major sites of deposition for plutonium are bone, lung and liver. Therefore these were the organs selected for analysis.*

The paper concluded:

> *The concentrations are generally higher for Cumbria with significant differences for femur, liver and lung. Clearly more autopsy cases from western Cumbria are needed to augment the rather meagre data available at present. Work is continuing on this programme, though the sparsity of the population in western Cumbria is a limiting factor.*

There is no mention of any consideration of the legal or ethical issues (coronial consent and the provisions of the Human Tissue Act 1961) involved in the provision of organs.

105 Of course, *"the sparsity of the population in western Cumbria"* was not the only problem which Dr Popplewell faced. The other was the need for the relatives' consent. Professor Knight's article highlighted the issue and initially the supply of organs simply dried up. In July 1986, as efforts were made to resolve the situation, Dr Popplewell published a further paper,

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70 See paragraph 47

71 Popplewell DS, Ham GJ, Johnson TE and Barry SF, Plutonium in autopsy tissues in Great Britain, *Health Physics*, 1985, 49(2): 304–9

summarising previous results and adding recent data.[72] He wrote that the material now included the *"tissues of some young people … victims of road traffic accidents"*. The paper ended:

> *However, there are legal difficulties in obtaining autopsy material. In addition, west Cumbria is not a densely populated region, and of that population a high proportion work, or have worked, at the Sellafield Works … it is hoped that some of these difficulties may be resolved in the near future.*

The reference to *"legal difficulties"* cited Professor Knight's article.

Inadvertent sampling of nuclear workers

106 The paper's conclusion highlighted another problem which had arisen in connection with the acquisition of organs, namely that a high proportion of the West Cumbrian population worked or had worked at Sellafield. The population studies required that the organs analysed came from people who had not worked in the nuclear industry, since they were intended to provide a reference against which levels in nuclear workers could be compared. Unexpectedly high levels of plutonium in a few of the samples prompted Dr Popplewell to wonder whether they might have been taken from nuclear workers. Having identified the individuals, he wrote to Mr Walker, the local coroner, on 2 June 1987:

> *My work at NRPB involves the analysis of plutonium in post-mortem tissues, some from former workers in the nuclear energy industries, and some from people who have not worked in those industries. The latter group forms a background, or control, against which the former group can be compared. However, I have found it difficult in many post-mortem cases to obtain firm evidence as to which group the subject belonged.*

He asked Mr Walker whether any of nine individuals, whose names he supplied, had at some time worked in the nuclear industry.

107 Dr Popplewell's query should have rung alarm bells. Its clear indication that he was obtaining organs at post mortem solely to use as *"background, or control"* samples should have prompted Mr Walker to establish exactly

72 See note 47, above

what was going on, especially given the views expressed in his letter[73] to Dr David Smith just under two years earlier. In fact, Mr Walker did no such thing: either the implications were lost on him or Dr Popplewell had told him nothing of which he was not already aware. He responded on 13 July 1987 simply by advising that his records did not assist.

108 If Mr Walker had been ignorant of Dr Popplewell's activities, had given any proper consideration to the letter and had taken a look at his own files, he would inevitably have asked in what circumstances the organs had been supplied to Dr Popplewell; he would have found no evidence of consent and discovered that the cause of death could not possibly have been related to radiation. Instead, he took no action and so the opportunity to seek explanations from his pathologists and/or the NRPB was missed.

109 By dint of his own efforts at Somerset House,[74] Dr Popplewell established that some of the deceased in question had indeed worked at Sellafield. The inclusion of data from such individuals jeopardised the validity of the studies. Dr Popplewell published a further paper.[75] He reported that he had previously described three individuals whose organs had shown high plutonium levels whom he had later identified as having been employed at Sellafield and that since then a further three had been included in the study, giving six in all.[76]

110 One of the six was James Cavanagh.[77] He had never been employed by BNFL but had worked at Sellafield as a sub-contractor, undertaking labouring jobs in the 1950s and in particular had been working in the vicinity at the time of the 1957 fire. His death on 14 March 1985 was reported to the Coroner for West Cumbria, at that time Mr Walker, and found at post mortem to have been natural, due to acute cardiac failure. No inquest was held. There was unjustifiable and extensive retention of organs: liver, ribs, femur, vertebrae, lung, lymph nodes and sternum. His daughter told the Inquiry she had been *"devastated"* to discover that her father's body had been used in this way.

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73 See paragraph 64

74 At that time, birth, marriage and death certificates were stored at Somerset House in London

75 Popplewell DS, Ham GJ, McCarthy W and Morgan M, Isotopic composition of plutonium in human tissue samples determined by mass spectrometry, *Radiation Protection Dosimetry*, 1989, 26(1): 313–16

76 In fact, evidence seen by the Inquiry indicates that organs were taken for the population studies from seven former Sellafield workers (five direct employees and two Sellafield workers employed by contractors)

77 See chapter 13, "The Families"

Ethical considerations

111 No request for ethical approval was submitted to any local research ethics committee before the population studies started in 1980.[78] Dr Popplewell said in evidence to the Inquiry that he had seen no need for ethical approval. After the population studies had ended, the NRPB did establish an internal ethics committee but Dr Popplewell's evidence was that no-one within the NRPB had ever suggested that formal ethical approval should have been obtained.

112 Dr Popplewell's recollection is not supported by the NRPB's own files, which include a memorandum sent on 18 January 1985 by Dr Clarke[79] to Dr Duncan:

> *I gather … that Dr Terrell in the Cumbrian Health Authority keeps pressing DHSS for a local ethical committee approval for our autopsy work … I have agreed … that we will send a short statement … which can be passed to the Cumbrian authorities … perhaps you could let me have this to pass on to DHSS so that we can smooth the Cumbrian people.*

Notwithstanding that note, no approach was made to the ethics committee.

113 The Inquiry explored this issue further with the HPA. It asserted that it was only in 1991 that:

> *a formal and more structured ethics framework for the NHS* [was introduced]*, and for the first time it explicitly brought research involving deceased within the remit of the ethics committees, stating that a local research ethics committee must be consulted about any research proposal involving, amongst other things, fetal material and the recently dead in NHS premises.*

The assertion is correct. However, the lack of express guidance in relation to research involving the deceased did not preclude the obtaining of proper approval: the Inquiry notes that such approval was obtained for the later paediatric and fetal studies.[80]

78 An application was successfully made in May 1990 to the West Cumbrian Ethics Committee but this was some five years after the last organs were obtained. The application was coupled with a separate approach in respect of a fetal study: see paragraphs 115 et seq

79 NRPB Secretary at the time; later Director from 1987 to 2003

80 See paragraphs 57 and 115 respectively

Did the next of kin consent?

114 No attempt was made to obtain the consent of the relatives to the retention and analysis of organs for the population studies.

- Review of files from the coroners and the NRPB and of relevant hospital pathology records revealed no documentary evidence of consent.[81]
- All the pathologists who had supplied organs for the studies and from whom the Inquiry heard evidence said that they had not obtained any such consent.
- No member of any family from whom the Inquiry heard evidence recalled being asked for consent.
- The HPA did not suggest that any of the NRPB's employees would have been responsible for obtaining consent: indeed, it viewed that duty as falling within the remit of the person in lawful possession[82] of the body.
- When in 1985 the supply of organs dried up following publication of Professor Knight's article,[83] the NRPB was forced to address the issue directly; it was unable to devise a system to obtain consent and the population studies effectively came to an end.

The failure to attempt to obtain consent from the relatives was inexcusable.

Fetal studies

115 Between 1989 and 1997, the NRPB investigated the radionuclide content of second trimester fetal tissues. The studies were approved by ethics committees in Oxford (application 28 April 1989, approval 9 June 1989) and West Cumbria[84] (application 8 May 1990, approval 22 May 1990). Guidance was sought on obtaining maternal consent. The Central Oxford Research Ethics Committee (COREC) considered that maternal consent was not required:

81 In the English cases; the organs taken in Edinburgh were from hospital post mortems where consent would have been taken

82 The meaning of this phrase is discussed in chapter 3, "Law and Guidance"

83 See paragraph 61

84 This application also sought approval for further population studies

> *COREC has previously debated the vexed question of whether women's consent should be sought to the use for research purposes of fetal tissue derived from planned terminations, and concluded that – until such time as there are national rulings which might dictate otherwise – consent should not be sought.*

The West Cumbrian Health Authority Ethics of Research Committee differed, insisting that maternal consent be obtained. It may be relevant that the Oxford approval was granted before the publication in July 1989 of the Polkinghorne report[85] which advised that maternal written consent should be obtained before fetal tissue was used for research purposes.

116 The first fetus was obtained from the John Radcliffe Hospital, Oxford, on 20 March 1989, although ethical approval was not granted by COREC until that June. In due course, a further 54 fetus were received from Oxford. On 25 September 1990, Dr Stephen Gould was appointed consultant paediatric pathologist and provision of fetus ceased while he made further inquiries as to due process in the light of the Polkinghorne report. In a letter to Dr Popplewell he described the guidelines introduced by the report (which, as mere guidelines, had no legal force) as *"very clear"*:

> 1. *All research projects into fetal tissue would have to be subject to hospital Ethics Committee approval.*
> 2. *On all cases where tissue is taken the mother should be asked for written consent which should be informed.*

117 On 17 December 1991, Dr Gould wrote to Ms Prosser:

> *we should be able to help you to some extent but possibly on a more reduced level than has happened in the past. In short, we now are obtaining consent for use of foetal tissue for research in a limited number of cases. Thus in those situations we would be able to preserve some tissue. It would have to be a relatively limited amount of tissue because, following a recent N.H.S. directive relating to disposal of foetal tissue, we have to have all foetuses either buried or cremated.*

In fact, Oxford provided no further fetal material for the study.

118 On 2 October 1990, Mr Stephen Bober, consultant obstetrician and gynaecologist at West Cumberland Hospital, and Sister A Fisher met

85 Polkinghorne J, *Review of the Guidance on the Research Use of Fetuses and Fetal Material,* Cmd 762 (HMSO, 1989)

Dr Lawson and representatives of the NRPB[86] to discuss arrangements for the provision of fetal material. It was agreed that:

> *consent would be asked for the tissues to be used for "medical research" but if pressed for more information this would be expanded to "measurement of natural radioactivity" in the tissues.*

The first fetal sample from Cumbria was received on 8 October 1990 and a further 39 had followed by 1997.

119 Two papers[87] were published in 1994 which described analysis of 15 sets of fetal tissue from Oxford of 15–19 weeks' gestation and 13 from Cumbria of 14–19 weeks' gestation. The work, which was supported financially by, among others, BNFL, concluded that the enhanced levels of plutonium in the West Cumbrian environment, caused by discharges from Sellafield, did not appear to result in any measurable increase in plutonium concentrations in fetus from the area. A further paper was published in 1999.[88] In total, 95 fetus were analysed between 1989 and 1997.

120 In December 1989, the UK Co-ordinating Committee on Cancer Research (UKCCCR) agreed to fund a study investigating the influence of geographical location on concentrations of naturally-occurring radionuclides in human tissue. It was to be run jointly by the NRPB and Bristol University. Samples of bone, bone marrow, liver, fetus and placenta were to be obtained from Avon, Cumbria, Devon and Cornwall, with a maximum of 20 samples of each within a three-year period. Ethical approval from Cornwall was obtained on 18 November 1991, subject to maternal consent being obtained, although as it turned out, no specimens were taken from Cornwall. In August 1992, further funding beyond the agreed three-year period for the joint project was refused and the final report was submitted on 17 August 1994.[89]

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86 Dr Popplewell, Ms Bradley, Ms Prosser and Mr Ham

87 Bradley EJ and Ewers LW, The transfer and resulting radiation dose from polonium, thorium and other naturally occurring radionuclides to the human fetus, in van Kaick G, Karagolou A and Kellerer AM, eds, *Proceedings of International Conference on Health Effects of Internally Deposited Radionuclides. Heidelberg, 18–21 April 1994* (World Scientific, 1994); Prosser SL, McCarthy W and Lands C, The plutonium content of human fetal tissue and implications for fetal dose, *Radiation Protection Dosimetry*, 1994, 55(1): 49–55

88 Ham GJ, The measurement of the plutonium content of human fetal and placental tissue, in Newton GWA, ed., *Environmental Radiochemical Analysis* (Royal Society of Chemistry, 1999), pp81–7

89 Subsequently published by the NRPB: Bradley EJ, Ewers LW, Bailey MR and Fry F, *Influence of Geographical Location upon Concentrations of Naturally Occurring Radionuclides in Human Tissues*, NRPB-M501

Consent

121 In West Cumbria, appropriate procedures were in place to obtain maternal consent before the first fetal sample was taken. Each sample sent to the NRPB by the mortuary technician, Mr Chapman, was accompanied by a form, completed at the hospital, which began:

> *OBTAIN: Mother's consent for her fetus to be used for Medical Research (oral consent will do – this should be recorded in the notes). If she requires details she should be told that research is being done on the levels of natural radioactivity in fetuses.*

The form included fetal and maternal age at termination, date of termination, where the mother lived and for how long she had lived there, whether the mother smoked and, if she was an ex-smoker, when she had stopped. Mr Chapman received an honorarium of £15 for each fetus and provided receipts for the payments.

122 Mr Nigel Woodcock, Unit General Manager at West Cumberland Hospital, was aware that fetus were being supplied to the NRPB. On 3 February 1992, he wrote to Professor Liam Donaldson, then Regional Medical Officer for the Northern Region Health Authority, setting out the arrangements for the disposal of fetus:

> *For terminations between 12 and 20 weeks (social late terminations) the complete fetus and placenta are sent in separate containers to the mortuary. Both products are sent to the National Radiological Protection Board, Didcot, Oxford, for research. Both placenta and fetus are frozen and placed in three bags, each bag being sealed and allocated a number by the N.R.P.B. Both products are placed in a sealed metal container and sent off for delivery.*

123 No similar consent process was put in place at Oxford before Dr Gould's arrival because the local ethics committee had considered it unnecessary. That decision was not reviewed on publication of the Polkinghorne report until Dr Gould took the initiative on his appointment.

Analysis

124 The fetal material was analysed for plutonium in the same way as the adult organs taken for the population studies.[90] However, the fetus posed a

90 See paragraphs 92 and 93; the process was slightly different when polonium-210 or lead-210 were assayed: see also chapter 2, "Science"

particular problem because of its size, requiring several fetus to be pooled to provide sufficient plutonium for estimation in the Atomic Weapons Establishment's (AWE's) mass spectrometer, a piece of sensitive analytical equipment.

125 On occasion assistance was sought from overseas: in October 1993, Dr Popplewell sent two samples of fetal ash to Professor Narayani P Singh at the University of Utah School of Medicine, and in July 1996, Mr Ham asked the Battelle Pacific Northwest National Laboratory in Washington to analyse fetal material which had been sent to the NRPB:

> *The samples sent to Battelle are the evaporated final solution from Radiochemical separation by ion-exchange of the ashed tissue. As such it has been ashed at 500C for at least 36 hours and is just a faint stain on the bottom of a 10ml vial.*

The Inquiry found no other evidence of overseas involvement in analysis.

Contract and other work

126 The NRPB also carried out analysis of organs under contract. On a number of occasions, it was requested by coroners to undertake tests on organs removed at post mortem to assist them in determining the cause of death. In these cases, while the coroner might have asked the NRPB for advice on which organs to send, the final decision rested with him. The NRPB sent the analytical results to the requesting coroner.[91] With one exception,[92] data from these reports were not included in external publications. The work was undertaken at the request of the coroner to assist in determining the cause of death and so no issues of consent arose.

127 On one occasion, organs from a former employee of the AWE, analysed by the NRPB at coronial request, were shared with Professor Denis Henshaw at the University of Bristol. Professor Henshaw's method of assessing the radionuclide content of an organ did not involve its destruction and required only small amounts of tissue. He used the results in a published paper.[93] Dr Popplewell noted:

91 Or, in some cases involving the AWE, to the Treasury Solicitor

92 Popplewell DS and Ham GJ, Distribution of plutonium and americium in tissues from a human autopsy case, *Journal of Radiological Protection*, 1989, 9: 159–64

93 Henshaw DL, Hatzialekou U and Randle PH, Analysis of alpha particle autoradiographs of bone samples from adults and children in the UK at natural levels of exposure, *Radiation Protection Dosimetry*, 1988, 22: 231–42

> *Henshaw was shown Ward's letter … It was impressed on him that nothing must be said at this stage as otherwise Ward might be upset. Anonymity must be preserved and there must be no publication of results. Henshaw accepted these conditions.*

Mr John Ward worked for the Treasury Solicitor and represented the interests of the AWE. The Inquiry considers the NRPB's actions to have been unjustifiable: the organs had been provided to it by the coroner and he had given no permission for them to be passed to other researchers. When informed by the Inquiry of what had happened, Mr Ward agreed with that view.

128 A few analyses were initiated, mostly in the early 1990s, by nuclear test veterans[94] who wished to have their bodies tested for radionuclides. Results were sent directly to the deceased's relatives and were not included in external publications. No charge was made for these analyses, which were funded from a combination of the core Department of Health grant and NRPB commercial surpluses. Consent was explicit.

Sharing of tissue

129 On occasion, organs and/or the solutions which Mr Ham produced as part of his analysis were passed to others in the NRPB for analysis of a different nature. The practice reflected the NRPB's reasonable wish to make as much use as possible of a scarce scientific resource. For example, one paper[95] described assay of lead-210 in the remaining solutions. In the course of that research, organs were also taken at four further post mortem examinations in Oxford in 1985: one was a hospital post mortem and the other three were coronial cases following deaths in road traffic accidents. Again, there is no evidence in those three cases that consent to the removal of the organs, which would clearly have been necessary, was obtained from either the coroner or the relatives. The organs taken in each case included the spleen, liver, a kidney, a femur and two ribs.

130 Samples of three femora received by the NRPB for its population studies were sent to Professor Henshaw, to assist with his research. He also

94 Service personnel and civilians who observed the nuclear weapons tests in the Pacific and Australia in the 1950s and 1960s

95 Bradley EJ and Fry F, Lead-210 in diet and the human body, in Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP (Malvern, June 1989)* (Institute of Physics Publishing, 1989)

received seven samples which the NRPB had obtained for its paediatric studies but which proved too small for it to use. Professor Henshaw used his results in published papers; see paragraph 127.

131 From time to time the NRPB received organs from other researchers. On one occasion, Professor Henshaw provided three adult femora: the analysis resulted in a paper on the distribution of polonium in bone.[96] Professor Henshaw indicated to the Inquiry that the femora were obtained with appropriate consent.

The legality of the population studies

132 The population studies were potentially of considerable scientific significance. Nevertheless, the Inquiry is critical of the way in which they were conducted.

133 At coronial post mortem organs could lawfully be retained if the pathologist considered they might be relevant to the cause of death. Organs not relevant to the cause of death could be retained only if the relatives had been consulted and did not object and the coroner consented. An editorial[97] published in the *British Medical Journal* in 1978, before the population studies began, set out the position with clarity:

> *Major techniques such as kidney transplants are well regulated … but for many years the removal and the use of other tissues have been controlled by custom and tacit approval by the authorities rather than the Human Tissues* [sic] *Act.*

The editorial gave as an example the taking of pituitary glands for preparation of growth hormone and warned starkly of the need to comply with legislation by obtaining the relatives' consent:

96 Bradley EJ, The distribution of ^{210}Po in human bone, *The Science of the Total Environment*, 1993, 130–131: 85–93

97 Editorial, Postmortem tissue problems, *BMJ*, 1978(2): 382

> *All these innocent activities are illegal unless brought strictly within the terms of the Human Tissues* [sic] *Act … In many areas the practice of taking tissues in coroners' cases without any permission is continuing, with those concerned presumably relying on the ethical justification that the good that accrues from the use of such tissues will see them through any adverse comment. The climate of public opinion and the keen eye of the press make it imperative, however, that correct procedures be followed.*

The position of the NRPB

Compliance with the Human Tissue Act

134 A copy of the *British Medical Journal* editorial was found in an NRPB file. The file was first opened in 1980 in Dr Hylton Smith's name and then transferred in 1982 to Dr Popplewell. It appears therefore that the NRPB may have been aware before it embarked upon the population studies of the restrictions imposed by law on its activities.

135 The NRPB did take some steps to establish what the Human Tissue Act 1961 required and to ensure compliance. The HPA placed reliance on a note, dated 15 June 1982, by S R Stafford[98] as demonstrating concern in the NRPB over the legal basis of the population studies:

> *I telephoned V. J. Harley, DHSS, to find out the correct (ie, official) procedure for obtaining samples of human tissue for experimental purposes. He said that the NRPB should approach a local pathologist – or indeed any pathologist – and he should be able to supply tissues for scientific research purposes. If we found that this produced problems I should talk to him again – but in his view it was unlikely we would run into any difficulties. (I did not ask about repayment procedures.)*

By June 1982, the population studies had been running for over two years and the NRPB had received and analysed some 30 sets of human organs from all four centres (Oxford, West Cumbria, Edinburgh and Newcastle) including some received only the previous month. The reason for the conversation is therefore unclear.

136 The Inquiry has seen no evidence that the NRPB investigated any further or changed its procedures after this note was made. On its face, the note does

98 Deputy Secretary in the NRPB's Administration Department

not support the weight placed on it by the HPA: it inquires only after practicalities and does not attempt to address legal or ethical requirements.

137 The NRPB also consulted Her Majesty's Inspector of Anatomy. On 22 February 1984, Mr Dunster, then Director of the NRPB, asked the Deputy Secretary, Mr P Thatcher, to *"confirm that the Board had the necessary registration or licensing of premises for this type of work"* and Mr Thatcher duly wrote to the Inspector, Dr J H Andrew, on 7 June 1984:

> *Some 8 years ago, an Inspector visited the Board to ensure that appropriate arrangements were made for handling human tissue ... it was agreed that Dr. Stewart Rae … Assistant Director (Medical), should be the Responsible Person … Since that time, the situation has changed somewhat, in that the Biology Department receives from time to time samples of tissue for analysis obtained by NHS pathologists at necropsy. There are also occasions when H M Coroners ... seek our assistance in analysis. The amount of tissue used is generally small and is usually ashed: disposal has not, therefore, presented any difficulty. Dr. Rae, although not directly responsible for the work, has satisfied himself that the material has been dealt with in a suitable fashion. Dr. Rae has ceased to be a full-time member of the Board's staff but ... continues to be available on a part-time basis ... The purpose of my writing to you is to check that the procedures we have been employing are in conformity with the legislation and also to enquire what action should be taken for the future.*

138 On 25 June 1984, Dr Andrew responded:

> *The material you receive from NHS pathologists and Coroners is governed by the Human Tissue Act of 1961 and provided that there is a nominated person responsible for acceptance and proper disposal after examination of the tissues you receive and who keeps appropriate records, there will be no difficulty in conforming with the legislation.*

139 That advice was simply wrong and the ignorance of statutory provision it displays is alarming. The provisions of the Human Tissue Act 1961 related only to the removal of tissue from a body. They had no relevance to what was done with that tissue thereafter and did not stipulate that records were to be kept. However, since the Act did govern hospital post mortem examination and removal of organs from bodies at post mortem examination, it was the legislation upon which the NRPB should have sought advice if it felt it

needed guidance. The Anatomy Act 1832, then still in force[99] and with which Dr Andrew should have been highly familiar, set out a framework which governed only the use by medical schools of human bodies for dissection. It provided that a body subjected to anatomical examination be buried after the examination. Although that Act did provide for some records to be kept, it had not created the role of *"person responsible for acceptance and proper disposal"* mentioned in Mr Thatcher's letter. It had no relevance to post mortem examinations, whether coronial or hospital, or to research.

140 As a result of Dr Andrew's flawed advice, the NRPB laboured under the misconception that it had only to ensure that appropriate arrangements in respect of "registration" were in place. So when Dr Rubery, in the aftermath of the Black report, asked Dr Clarke *"about the official arrangements for handling autopsy samples"*, he replied on 14 January 1985:

> *the Board is registered with HM Inspector of Anatomy, Dr. Andrew … In fact, Dr. Hylton Smith is the nominated person and since we are registered under the Human Tissues Act, 1981* [sic]*, I hope this will satisfy the Health Authorities over sending samples to us.*

141 The letter confused the Anatomy Act 1832 with the Human Tissue Act 1961 and ignored the consent requirements of the latter by assuming registration of some kind was all that was required. The NRPB could not have been registered under the Anatomy Act, which applied only to anatomical education establishments, and an NRPB official could not have been registered under either Act as the "nominated person" responsible for proper disposal of material, since no such post existed.

The responsibility of the Board

142 The NRPB had authorised Dr Popplewell to undertake the population studies. The structure of the NRPB ensured that knowledge of individual research projects permeated the entire management structure:[100]

99 The Anatomy Act 1984 had received Royal Assent the previous month but did not come into force until February 1988

100 *National Radiological Protection Board and its Structure,* internal NRPB document, 21 January 1983

> *The Board's annual technical programme … is reviewed … by the Directorate. This, and the annual promotion review, are the two principal areas in which the Directorate does act in a corporate manner. The programme is submitted to the Technical Committee of the Board … and then becomes the formal programme of the Board. It contains all the planned research and development work … Board Members are kept informed of progress during the year by seeing the departmental six-monthly progress reports. The work is supervised and controlled by line management … The line management responsibility which runs through the relevant Assistant Director to the head of Centre, is supplemented by technical guidance along the functional links … Each project officer will be accountable for the whole project to a single nominated line manager.*

143 The NRPB's annual technical programme for 1983–84 made express reference to the post mortem work:

> *The Biology Department's programme of measuring plutonium, americium and strontium in tissues taken at autopsy from members of the public will continue. To date samples have been obtained from the Edinburgh, Newcastle, Oxford and Sellafield regions.*

144 It was for the NRPB to ensure that its employee Dr Popplewell was given adequate guidance on the legal and ethical foundation of the population studies. More than one former employee of the NRPB who gave evidence to the Inquiry stressed that *"the culture of the NRPB, at all levels, was always to ensure full compliance with any regulatory or statutory requirements"*. The Inquiry has seen little evidence to support that assertion so far as the population studies are concerned.

145 Although both Dr Hylton Smith and Dr Popplewell were highly respected scientists, neither would have been expected to have had an intimate knowledge of legislation. In evidence to the Inquiry, Dr Popplewell[101] was confused as to what he understood a coroner, and indeed a pathologist acting under the coroner's authority, could do. He thought the coroner had control of the body and therefore had authority to provide any organs he chose to an organisation such as the NRPB; yet he knew that the coroner's role was to establish the cause of death and that this might limit the organs which he could make available to those necessary to determine that cause. This inconsistency in his evidence was never resolved to the Inquiry's

101 Dr Hylton Smith died in 2001

satisfaction. Dr Smith and Dr Popplewell should have sought clarification from their employers.

The extent of NRPB duties under the law

146 The inevitable effect of the agreements into which the NRPB had entered with the pathologists it had contacted was that at coronial post mortems organs were retained which had absolutely no bearing on the cause of death. The consent of the relatives was therefore required, yet in most cases[102] families were not consulted or even informed.

147 The HPA submitted to the Inquiry that NRPB staff were never lawfully in possession of bodies and that therefore the NRPB was not directly responsible for authorising the removal of tissue or for making inquiries to ensure that the authorisation was lawful.[103] Hence, it argued, the Act did not impose any legal duties on the NRPB:

> *We are not, and have not at any stage been, suggesting that the NRPB did not have to address the issue of consent. What we are saying is that the 1961 Human Tissue Act imposes a clear legal obligation on the persons lawfully in control of the bodies to ensure that tissue, body parts, are only removed under the circumstances detailed in the Act. The records we have seen appear to indicate that the NRPB had a reasonable awareness of these obligations, and they appeared to have been aware of the duties the Act imposed on the persons lawfully in possession of the body. But at the same time we will state that, and it is contended that, the HPA* [NRPB] *was never lawfully in possession of any bodies in the meaning of the 1961 Act, and it was never NRPB's obligation to seek the consent directly, as referred to in the Act, or to seek consent or the lack of non-consent.*

148 The HPA also addressed the NRPB's relationship with the pathologists who supplied organs. It did not accept that the pathologist was acting as the NRPB's agent as the NRPB had no power to instruct him. As to any responsibility for the pathologists' actions, its Head of Legal Affairs said:

> *I think the NRPB had an obligation to consider whether those acting to collect samples for the NRPB acted within the law … and I think the NRPB had every reason to believe that they did so.*

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102 With the exception of 23 hospital post mortems in Edinburgh and one in South Cumbria, where consent to the examination was given

103 Under the Human Tissue Act 1961, s1(2)

149 The Inquiry considered well-founded the submission that since the NRPB was never lawfully in possession of the body, it was never itself under any legal duty to obtain the relatives' consent to retention of organs. The Inquiry has seen extensive internal NRPB documentation and correspondence between the NRPB and pathologists which indicates that while the nature of the population studies and their requirements for organs were discussed in some detail, there was no discussion of the necessity for consent to the retention of those organs. Nevertheless, the NRPB was entitled to assume that the consultant pathologists who were assisting it would act in accordance with the law which had governed their work for more than two decades.

The position of the DHSS

150 The NRPB's accountability to the Permanent Secretary at the DHSS appears to have been discharged by annual meetings with the DHSS and other government departments which commissioned work from it.

151 As Secretary to the Black Advisory Committee, Dr Rubery received information and data relating to the post mortem work undertaken both by the NRPB and at Sellafield.[104] She was the Senior Medical Officer at the DHSS and so through her the Department was aware of the existence and results, if not the detailed mechanisms, of both the occupational and non-occupational post mortem studies in West Cumbria. While DHSS officials can be expected to have known of the provisions of the Human Tissue Act 1961, the Inquiry does not consider that the Department had any responsibility to investigate retrospectively the ethical or legal basis of the studies, with which it had not been involved. Given its knowledge at the time, it was entitled to assume that the studies had been conducted, by respected medical professionals and researchers, in a lawful and ethical manner.

104 See paragraph 49

The position of the pathologists

"Silent" post mortem reports

152 Of the 77 reports on post mortem examinations in England at which organs were taken for the population studies, no fewer than 75 failed to mention that organs were removed. The report of one further post mortem does record removal of organs for the population studies but the NRPB's log books do not record that they were received: see paragraph 97 above.

153 Did this repeated failure to record organ retention indicate that the pathologists considered that in the absence of consent the retention was illegal and to be concealed? This suggestion was rejected by the pathologists who gave evidence. The majority considered that the silence simply reflected custom and practice at the time and should not be regarded with suspicion. However, they accepted that the absence of a proper note allowed the more sinister interpretation and was therefore regrettable. One pathologist said that while custom and practice at the time did demand the recording of retention, he had simply forgotten to make an appropriate note. Two said that they had made no note because they were unaware retention had taken place and that the mortuary technicians must have taken the organs without their knowledge: the technician for one of those pathologists denied the allegation and the Inquiry was unable to trace the other.

154 The Inquiry does not believe that the failure to record organ retention in the post mortem report constituted a deliberate attempt at concealment. The practice did, however, mean that the coroners remained unaware of their pathologists' actions and that even if families had managed to secure access to the post mortem reports, which was unusual at the time, they would have been none the wiser as to the condition of the body they buried.

Ignorance of the Human Tissue Act

155 All the pathologists who had provided organs to the NRPB and from whom the Inquiry heard evidence accepted that the organs taken for the population studies were not relevant to the cause of death. They could hardly contend otherwise: there could be no reason other than research to have taken, for example, a femur from someone who had died of a heart attack. Why did the pathologists act in this way?

156 To its surprise, the Inquiry found widespread ignorance among highly respected pathologists of the provisions of the Human Tissue Act 1961.

One eminent consultant confessed that he had not been aware even of its existence until it had been mentioned to him by his solicitor in preparation for his evidence to the Inquiry. The Inquiry found it little short of bizarre that a distinguished senior doctor had been unaware of the legislation which underpinned his work but his evidence was not inconsistent with that of most of the pathologists who appeared before the Inquiry. One was quite frank as to his fundamental misunderstanding of what he was authorised to do:

> *I must have thought I had the authority to do this by virtue of the fact that it was a Coroner's post mortem as I would not have removed the tissue samples if I had at the time thought such a step was of dubious legal or ethical validity. It would appear that I simply did not understand the law and/or the Coroner's rules at that particular time.*

He explained that he had been trained to approach coronial and hospital autopsies in the same way but:

> *Looking back on that now it would seem that this was not accurate advice and that tissue samples removed in a Coroner's post mortem should have been limited to those essential to determine the cause of death.*

There was a similar degree of ignorance as to the extent of the coroner's powers and duties and what he could properly authorise.[105]

157 The Inquiry heard that medical culture and practice at the time of the events it considered, some 30 years ago, was very different from that which now prevails. Little thought would be given to the propriety of retaining organs at post mortem: the benefits potentially arising from research and education were considered sufficient to keep what was being done from the relatives. Yet the requirements of the Act as to consent were clear and should have been widely known.

158 Time and again the Inquiry heard that the introduction of the Human Tissue Act 1961 had caused barely a ripple and that there had been little, if any, teaching or training related to the Act. Pathologists failed to realise that a coronial post mortem did not give them *carte blanche* for wholesale retention of organs and that consent from relatives was necessary, in addition to that of the coroner, before organs not relevant to the cause of death could be retained. The contrast between pathologists' insistence on written evidence of consent to hospital post mortem and their ignorance of

105 Although see the remarks of the Coroner for Oxfordshire, Mr Gardiner, paragraphs 164 and 165

the requirement for consent for removal at coronial post mortem of organs not relevant to the cause of death was striking.

The position of the coroners

159 Many individuals whose evidence might have been of value to the Inquiry are no longer alive and so it has been difficult to establish what if any steps were taken to involve the coroners. The then coroners for Newcastle (Mr P Cuff), South Cumbria (Mr William Ellison) and West Cumbria (Mr Walker) died long before the Inquiry was established. Mr Walker's successor in West Cumbria, Mr John Taylor, took early retirement in April 2009, shortly after giving evidence to the Inquiry. His retirement did not hinder the Inquiry's investigations.

160 Between March 1984 and June 1985, Mr Taylor presided, as Assistant Deputy or Deputy Coroner, over the investigations into the deaths of seven people from whom, the Inquiry established, a large number of organs[106] was taken at post mortem and provided to the NRPB. He conceded that the organs were not taken because of any possible bearing on the cause of death. However, he claimed to have known nothing of the retention of organs in those cases: his authority, he said, had not been sought. Mr Taylor confessed that he did not read the typed post mortem reports when they arrived in his office, because the pathologist would have telephoned immediately after the post mortem to advise him of the cause of death.[107] In fact, since the reports made no reference to retention, he would have been no better informed if he had taken the trouble to read them. He claimed that if he had become aware of the retention he would have sought assistance from Mr Walker, although given Mr Walker's views[108] it seems likely that he would have been (incorrectly) reassured.

161 Mr Taylor's failure to read post mortem reports, which were submitted for his attention, was a dereliction of duty. He claimed that his practice had changed when appointed Coroner in January 1995 *"out of a desire to do the job properly"*. As Deputy Coroner he had taken his lead from Mr Walker:

106 Liver, femur, ribs, lumbar vertebrae, sternum, lymph nodes, muscle and lung were taken from all seven; a kidney from two; and the spleen from one

107 He said that he did read the paper reports if he held an inquest into the death: there was no inquest into any of those seven deaths

108 As reported by Dr Schofield to the NRPB, see paragraph 42

he did not believe Mr Walker read the reports either, beyond *"probably look*[ing] *at the cause of death"*.

162 Although the vast majority of the post mortem reports in cases where organs were provided to the NRPB did not mention the fact, the Inquiry identified two reports in which the pathologist could not have been clearer. The first was from 1981:

> *This man had lived near to Windscale for several years. Specimens were obtained at the time of the post mortem examination and retained for examination at the request of Dr H Smith of the National Radiological Protection Board at Harwell.*

The second was from 1982:

> *samples of bone, liver and lung were retained and deep frozen in order that tissue analysis for radio nuclides could be carried out by the National Radiological Protection Board. The Board is anxious to do such assays on post-mortem material from people who have lived in the Ravenglass and Windscale areas for many years.*

These notes should have provoked questions from Mr Walker, to whom the post mortem reports were sent. He should have contacted his pathologist to determine exactly what had occurred, on whose authority and whether proper consent had been obtained from the next of kin: since both the men had died of heart disease, it was obvious from the report that the organ retention had been unjustifiable.

163 Had Mr Walker made adequate inquiry, he would have learned of the retention. He asked no questions and the Inquiry must therefore conclude either that he did not read the post mortem reports or that they conveyed nothing to him of which he was not already aware. The opportunity to intervene and stop such unauthorised activity within his jurisdiction was missed, at a relatively early point in the population studies, due to lax coronial practice.

164 Mr Taylor was not the only coroner who denied any knowledge of the NRPB's arrangements. Mr Nicholas Gardiner, Coroner for the Oxfordshire area, dealt with 19 cases in which organs were supplied to the NRPB for its population studies. All those cases, identified to him by the Inquiry, related either to natural deaths in elderly individuals or traumatic deaths in road traffic accidents. Retention of organs was not mentioned in any of the post mortem reports and, since there was no other paperwork to suggest that organs had been taken, he could not have known of it. He said that he knew nothing of the NRPB's desire to acquire organs: it had not asked for his

permission or assistance. He stressed that consent would have had to have come from the relatives and that if the NRPB or his pathologist had approached him for permission he would have insisted on the family's consent being obtained. There was no evidence of consent on any of the files in his archives.

165 Mr Gardiner was appalled to learn that organs had been removed from bodies in his custody without his knowledge and without proper consent. He observed that if any of the post mortem reports had mentioned retention he would immediately have taken the view that there was an issue to be addressed, although the power of his evidence was diminished by his concession that he too did not routinely read every report. He felt that consultant pathologists should have known exactly what his powers were and what he could or could not authorise:

> *They knew that generally I was supportive to research but it would be disingenuous to suggest that they did not know that their examination in a Coronial setting was limited to establishing the cause of death and did not extend to their being able to use specimens for more extensive purposes without appropriate consent being put in place. In particular, they would have known that they were acting under my direction and control.*

166 As the Coroners for Newcastle and South Cumbria were dead, the Inquiry sought clarification from a number of the pathologists from those areas as to whether their coroners had known and approved of the NRPB arrangements.

167 Those from Newcastle were unable to assist: none knew whether the coroner was aware of the retention or recalled any discussion with him. The Inquiry has seen no evidence that there was any direct contact between the NRPB and the Newcastle coroner and it is not possible to conclude that he was aware of the arrangement between the NRPB and the pathologists.

168 Dr Vijay Joglekar, a pathologist from Barrow, gave a slightly different account in respect of practice in South Cumbria. His (incorrect) understanding was that under the Human Tissue Act 1961 he was authorised to retain any organs or tissues for medical research or education if he had the coroner's permission. He remembered being asked by the NRPB to provide organs for research. He claimed to have spoken to the coroner, explained to him that the NRPB wanted to obtain organs from cases selected at random and been given blanket approval to retain organs in such cases as he wished. Dr Joglekar had not notified the coroner when

he did harvest organs for the NRPB and his post mortem reports made no reference to the retention of organs.

169 The Inquiry doubts that there had been contact with the coroner as Dr Joglekar recalled. Even if his recollection were correct, the coroner would not have been aware in any particular case that organs were to be provided to the NRPB.[109] While there was nothing to prevent a coroner from granting blanket permission for the removal of organs from bodies under his control, consent from the family was still required.[110] Dr Joglekar did not ensure that consent had been obtained and the coroner, unaware of what was proposed, could not.

170 Accordingly, the only documentary evidence to suggest that any coroner was ever consulted about the NRPB's population studies is the file note referred to at paragraph 42, describing Dr Schofield's conversation with Mr Walker. The Inquiry was surprised to find no other evidence on the NRPB's files of any coronial involvement or consent.

The position of the HPA

171 The HPA told the Inquiry that it was not now involved in any research studies involving material taken at post mortem and that if new studies were to be initiated:

> *the governance mechanisms within HPA would ensure that all relevant ethical and legislative requirements, including explicit consent and registration with the HTA* [Human Tissue Act]*, were addressed before the study could begin.*

172 The HPA is now subject to inspection by the Care Quality Commission. It has robust governance processes covering research, clinical work, health protection and internal audit. Its confidential information security is to NHS "Caldicott" standards.[111]

109 As required by the Human Tissue Act 1961, s1(5)

110 As required by the Human Tissue Act 1961, s1(2)

111 The Caldicott Committee, chaired by Dame Fiona Caldicott, made recommendations in 1997 on the protection of personally identifiable information within health services. New, rigorous standards were implemented throughout the NHS from 1998

Summary

173 Of all the NRPB's post mortem work which fell within the Inquiry's Terms of Reference, only the population studies give cause for concern. It is true that they had the potential to provide invaluable information on the uptake of background radionuclides by the general public and on whether living in proximity to Sellafield increased that uptake. However, no evidence was produced to the Inquiry to suggest that consideration had been given to the basic aspects of any such study, for example the numbers of sets of organs which would be needed to provide statistically valid answers to the questions being investigated.

174 Further, the Inquiry has seen no evidence that the legal and ethical issues raised by the retention of organs at post mortem were adequately considered. In particular, the requirement for the consent of the deceased's relatives was not adequately addressed. Discussions with coroners and relatives were not held. Instead, the NRPB relied on pathologists to act in accordance with the law: that reliance proved to be misplaced. It was not until after 1985, when Professor Knight's article led to pathologists revising their approach to the provision of organs for research and halted the supply, that the NRPB gave consideration to, and became involved in attempting to obtain, appropriate consent. As a result the bereaved families were unaware that the bodies of their loved ones, which they were burying ostensibly with dignity and respect, were little more than shells.

The Atomic Weapons Establishment

Chapter 9

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Contents

History

1 The development of a British atomic bomb began in June 1947 at Fort Halstead in Kent. The site proved too small for the facilities necessary to handle plutonium and so the Atomic Weapons Research Establishment (AWRE) was established in 1950 at an airfield near Aldermaston in Berkshire. The AWRE was originally part of the Ministry of Supply and was transferred to the United Kingdom Atomic Energy Authority (UKAEA) when that body was created[1] in 1954.

2 The Ministry of Defence (MoD) assumed responsibility for the AWRE in 1973. In 1987, the AWRE merged with the Royal Ordnance Factories at Burghfield and Cardiff, dropping the word "Research" from its title to become the AWE.[2] Since 1993, the AWE has been operated by private consortia under a "government-owned, contractor-operated" (GOCO) scheme. It remains responsible for the maintenance of the UK's nuclear deterrent.

3 The occupational health department of the AWE was originally in-house but is now operated by Trident Medical Services Limited (TMS), which is the custodian of all medical records relating to past and present employees of the AWE. TMS assisted the Inquiry by making available the medical records of various deceased former employees of the AWE.[3]

Monitoring

4 The work at Aldermaston involved handling and purification of radionuclides, principally plutonium. It therefore gave rise to the same need to monitor the exposure of the workers to radioactivity as existed at other nuclear installations such as Sellafield. The chosen methods of monitoring were urinalysis and the use of a whole body monitor (WBM) to assess lung burden.[4] The working environment was also monitored using static air samplers. Personal air samplers, battery-operated devices worn on radiation

1 By the Atomic Energy Authority Act 1954; see chapter 6, "The United Kingdom Atomic Energy Authority"

2 In this chapter, the organisation will be referred to as "the AWE" throughout its history

3 On an application by Dr Nicholas Lewis, a Director of TMS, the High Court (Mr Justice Foskett) declared disclosure by TMS (and by the Inquiry's other stakeholders) of the medical records of deceased former employees to be lawful because of the public interest in the Inquiry's investigations: *Lewis v Secretary of State for Health* [2008] EWHC 2196 (QB) [2008] LS Law Med 559. A copy of the order is at appendix D

4 Details of these methods, and a discussion of their drawbacks, can be found in chapter 2, "Science"

workers' clothing, were used *"in a limited and investigative way in, and since, 1968 but … only … in routine monitoring* [from] *September 1977"*.[5]

5 In 1978, WBM readings from three women who worked in the laundry at Aldermaston appeared to indicate that they had accumulated plutonium in the lung in excess of the level recommended by the International Commission on Radiological Protection (ICRP), and positive results requiring further scrutiny were also obtained from nine men working elsewhere at the site. An investigation was undertaken by Sir Edward Pochin,[6] whose report[7] was submitted in October 1978. Analysis of the results of repeat testing was reassuring, suggesting that in most cases the initial, single high reading probably did not indicate that a significant amount of plutonium was retained in the individual's lungs. Although the report emphasised *"the generally high quality of the industrial safety record, … and the good record also in the prevention of major radiation exposures"*, it noted deficiencies in both the construction of various buildings at Aldermaston and the management of health and safety, and made a number of recommendations.

6 Of 15 employees excluded from radiation work because of WBM readings in 1978, all but three (one of whom[8] had died) were allowed to return within a year.

7 One of the conclusions of the Pochin report was that the static air samplers were of limited use. They were commonly positioned away from and higher than the working position, so the air they sampled did not accurately represent the air that the workers were breathing. The AWE management appears to have agreed: by late 1980, minutes of a board meeting record that, at least in the context of litigation, the organisation *"should maintain the attitude that these records* [of readings taken from static air samplers] *could be misleading and unhelpful"*.

8 Personal air samplers too had drawbacks (as was observed by one witness who gave evidence to the Inquiry, *"by definition personal air samplers tell us what was **not** breathed in by the worker"*) but they were considered to provide more accurate information than static air samplers and had the

5 Pochin report (see note 7, below), paragraph 26

6 Physician, former chairman of the ICRP and founder member of the National Radiological Protection Board, of which he remained a member between 1970 and 1982

7 Pochin, Sir Edward, *Report of an Investigation into Radiological Health and Safety at the Ministry of Defence (Procurement Executive)* (AWRE, 1978)

8 LL: see paragraphs 14–16

advantage over urinalysis that results could be obtained quickly, allowing remedial action, if necessary, to be taken early.

The AWE's role in analysis

9 Urinalysis remained a mainstay of screening for exposure to radionuclides at the AWE and elsewhere. However, dosimetry experts at the AWE shared with those at other institutions longstanding concerns over the accuracy with which plutonium levels measured in urine could be used to estimate plutonium retained in the body.[9] They too were interested in the possibility of validating these estimates by analysis of the plutonium content of organs obtained at post mortem examination from employees for whom urinalysis data were available.

10 In written submissions to the Inquiry, the AWE described its role in analysis of human tissue as being:

> a. *to assist the Coroner and Treasury Solicitor (TSol) with Coroner's investigations following the deaths of individuals who had been in the employ of the AWE or who had been Nuclear Test Veterans. This work could also assist with defending claims against MOD and included, in some cases, arranging for the analysis of tissue/organs by other organisations (or sites when AWE was part of UKAEA) and providing interpretation of the results from the analysis of tissue/organs carried out by other organisations or sites;*
> b. *to participate in a limited amount of research associated with tissue samples taken at autopsy …*
> c. *to co-ordinate samples … for a strontium 90 research programme … on behalf of the UK and Australian Governments.*

First analysis: KK

11 KK died in 1975 of leukaemia. He had initiated a claim for damages against the AWE before his death. His post mortem was performed by Dr E Husband, consultant pathologist at Basingstoke Hospital, and was attended by Dr N Spoor from the AWE, a pathologist instructed by his

9 The reasons for these concerns are discussed in chapter 2, "Science"

widow's solicitors and three police officers. Various organs, including a femur, the liver, a lung, a testis, the sternum, some ribs, some vertebrae and some lymph nodes, were removed. Some were taken by Dr Spoor and sent to the National Radiological Protection Board (NRPB) for analysis; the remainder were collected a few days later by Ms Erica Irlam, secretary to Dr Geoffrey Schofield,[10] and taken back to Sellafield. Expert reports were obtained from Dr Geoffrey Dolphin[11] and Professor Patricia Lindop,[12] who differed starkly on whether the leukaemia was attributable to radiation. No inquest was held. The claim was discontinued in 1977.

12 The presence at the post mortem of a pathologist instructed by the widow's solicitors would imply that she had agreed to KK's organs being removed for analysis, but the Inquiry has seen no definite evidence to that effect.

Compensation claims after the Pochin report

13 Following the publication of the Pochin report in October 1978, some 70 claims for compensation as a result of illness from exposure to radiation were initiated against the AWE. Many alleged only psychological upset caused by concern over the possible consequences of exposure to radiation, but a few individuals claimed that more serious illnesses, including cancer, were the result of such exposure. Three of those claims were the subject of much discussion at the AWE.

LL

14 LL died in 1979 from a rare form of rectal cancer. The organs taken from his body at post mortem examination (one lung, the sternum, testes and liver, some ribs, some vertebrae, a femur, a kidney and various mediastinal tissues) were analysed at the request of the coroner by Dr Schofield, who had personally collected them from the pathologist. At the inquest Dr Schofield presented his findings, which were that the body had contained only 1.3% of the maximum amount of plutonium recommended by the ICRP. Dr Robin Mole[13] and Professor Lindop gave markedly differing expert

10 Chief Medical Officer, British Nuclear Fuels Limited (BNFL)

11 Head of the Biology Department, NRPB

12 Professor of Radiation Biology, University of London

13 Director of the Medical Research Council's Radiobiological Unit until 1977; at this time continuing to work as a member of the Council's external scientific staff

evidence on the interpretation of Dr Schofield's findings and on whether LL's cancer had been caused by radiation or had occurred naturally. The jury returned an open verdict, indicating that it had been unable, on the evidence it had heard from the experts, to determine the answer to that question.

15 LL had initiated legal action against the MoD before his death, claiming compensation for injury caused by radiation. The Inquiry has seen no evidence to indicate what happened to that action; it may be that the steps necessary to ensure that it continued after his death were not taken.

16 The Inquiry concludes that the organs were properly removed from LL's body for analysis because it was considered that the results might be relevant to the cause of death; Dr Schofield was one of the few people with access to a suitable laboratory and it would seem likely that that was why he was asked by the coroner to perform the analysis.

MM

17 MM's death in 1979 was caused by an abdominal cancer of uncertain type. A post mortem examination was performed after which the pathologist expressed the view that the death was natural and due to carcinomatosis. No inquest was held.

18 The post mortem report makes no mention of any organs from MM having been retained and the Inquiry has seen no evidence of any radiochemical analysis having been undertaken. Since no inquest was held, the coroner could not have requested such analysis.[14] MM had initiated legal action against the MoD before his death, claiming compensation for injury caused by radiation. The action was pursued after his death by his widow. In this context, it would be unsurprising if organs had been removed, but there is no reference to radiochemical analysis of organs in any of the papers seen by the Inquiry which relate to the litigation.

19 However, in 1988, nine years after MM had died, Dr Adam Lawson[15] was sent a summary of MM's health physics records by Mr Edgar Jones,[16] who asked for *"a copy of the post-mortem analysis … in the case of* [MM]*"*. He replied:

14 See chapter 3, "Law and Guidance", for a more detailed discussion of this point

15 Chief Medical Officer at BNFL

16 Superintendent, Personal Safety at the AWE

> *I was hoping you would be able to help to identify one of our few remaining sets of non-attributable data highlighted by our recent review of the autopsy files. All we in fact have is a cutting from the* Daily Telegraph *which indicates that Dr Schofield*[17] *was conducting radiobiological analysis … and I was hoping you could help … in retrospect it would appear that we are both victims of the secrecy which surrounded these examinations.*

20 Although it appears that, at least in 1988, the AWE was under the impression that there had been analysis of organs taken from MM, it is unclear, despite those press cuttings, whether in fact any organs were taken and, if they were, whether and by whom they were analysed. The AWE was unable to clarify the position.

21 The legal action against the MoD was discontinued in 1989.

NN

22 NN died in 1980 from a tumour in his chest wall. He had intimated a claim for damages against the MoD before his death and had instructed solicitors. A handwritten note by Dr Husband begins:

> *Coroner informed as there is a distinct possibility that the tumour is associated* [with] *exposure to plutonium. Professor Lindop of Barts*[18] *also contacted re plutonium levels on various organs as this is the only way in which a tie up between the tumour & level of plutonium in body is likely to be established. I have asked the houseman to put the relatives in the picture as the outcome of the Barts studies may be of financial importance to them.*

The formal typed post mortem report notes:

> *As a result of the conversation with Professor Lindop the right femur and the liver, spleen, left lung and mediastinal lymph nodes, as well as tumour tissue, were taken and were deep frozen in order that plutonium levels should be carried out on these tissues … Professor Lindop telephoned to say that the Treasury solicitor was asking for plutonium levels to be carried out on the entire body. Mrs* [NN] *and her son gave their permission for this to be carried out. The Coroner's office was informed.*

17 Dr Schofield had died in 1985

18 St Bartholomew's Hospital, London

Unless the coroner had formally released the body to the relatives, it was in fact necessary not merely to inform his office but to obtain his permission before such further examination.[19]

23 A handwritten note in NN's file at the AWE suggests that the reference to the Treasury Solicitor's request was accurate:

> *J Ward*[20] *discussed with Prof Lindop question of autopsy. She had already approached pathologist for organs, but Ward had suggested whole body. Lindop will probably approach family … Spoke SMO.*[21] *Died of cancer (not sure where). Unlikely to be caused by employment and GP inclined to agree.*

However, Mr Ward's own note suggests that the request for the whole body to be analysed had come from Professor Lindop.

24 It is clear that the sudden acquisition of a whole body took the various researchers by surprise and some debate followed concerning where and by whom the analysis could be done. A note from Mr J A Young[22] reads:

> *It was proposed that the whole corpse be analysed for radioactive contamination but it was learned that this would take about two months in Dr. Schofield's laboratory at BNFL* [British Nuclear Fuels Limited] *Windscale and take up all of Dr. Schofield's resources. Facilities for this kind of analysis are not widespread and exist elsewhere at Harwell and the UK. It was further suggested that if the analysis could not be done in the UK then the corpse could be flown to the USA for it to be done.*

19 Human Tissue Act 1961, s1(5)

20 Mr John Ward was a solicitor employed by the Treasury Solicitor's Department: see paragraphs 34 et seq

21 The SMO (Senior Medical Officer at the AWE) was Dr Murray Roberts

22 Mr Young worked for the AWE Claims Commission

25 Mr Ward wrote to NN's solicitors:

> *I further understand your client died recently and that his relatives have agreed to the release of the body to Professor Lindop for medical research and Professor Lindop is proposing that various tests and measurements are to be taken and I will do everything possible to assist her. It is clear that any tests and measurements which are made will be relevant to the claim and I have agreed with Professor Lindop that on the basis that the results of these tests and measurements are shared I would be prepared to share the costs of mutually agreed tests and measurements. To do this I would suggest a meeting be arranged … I understand the body is currently in St Bartholomew's Hospital and I agreed with Professor Lindop that I would bear the cost of the transport of the body to that hospital.*

26 The body was dissected at St Bartholomew's Hospital by Dr Alfred Stansfeld, consultant pathologist. The note of the procedure begins by recording *"(Additional unrelated brain and heart found)"*[23] and continues by setting out the various component parts of the body which had been separated. As to the destination of the body parts, the note records that:

- the tissues removed at the original post mortem examination had been *"sent to Dr Schofield for ashing and division between BNFL and AEA Harwell for chemical measurements of Pu, Am and Ur*[24] [sic]*"*;
- the larynx, trachea and some lymph nodes were to be sent to Professor Denis Henshaw at Bristol University;
- *"R side + head and vertebrae, testes; tongue etc. 2° tumour skin"* were to go to BNFL for deep-freeze storage;
- *"L side + calvarium and dura, sternum, pancreas, kidneys, other lymph nodes, retroperitoneal tissue and diaphragm"* were to go to the NRPB, also for deep-freeze storage.

27 Under the heading *"Lessons learned"*, Dr Stansfeld noted:

- deep-freeze storage capacity for a whole body was needed, particularly if it was to be used to calibrate the WBM;
- the post mortem examination should be carried out in conjunction with him and samples taken should be deep frozen;
- a decision was needed on basic tissues of interest in all cases, to include right lobe of liver, lung, femur, three abdominal vertebrae, three ribs,

---

23 That is, the brain and heart of another individual, who presumably had undergone post mortem examination in Dr Husband's mortuary at the same time as NN

24 Plutonium (chemical symbol Pu), americium (Am) and uranium (U)

spleen, pancreas, testis, skeletal muscle (40g), bone marrow, tracheobronchial lymph nodes, as well as on specific tissues of interest in particular cases.

It is apparent that Dr Stansfeld anticipated that further whole bodies might become available.

28 Extensive analysis of NN's body took place by BNFL at Sellafield and by the UKAEA at Harwell. One femur was analysed by the NRPB. The analysis would seem to have been done at least partly at the request of the coroner, but there was some argument later over who should bear the cost, NN's solicitors observing tartly that:

> *Mrs* [NN] *had been put into a position whereby great pressure was imposed upon her to agree to the release of her husband's body for purposes of medical research and it is something of a back hander to express gratitude in the form of a bill in excess of two thousand pounds.*

It is not apparent by whom this pressure could be said to have been applied: as observed above, the records are unclear as to whether it was Mr Ward or Professor Lindop who had been seeking analysis of the whole body.

29 At the inquest, evidence was heard from Dr Husband, Mr Jones, Professor Lindop, Dr Keith Britton[25] and Dr Mole. As at LL's inquest, Professor Lindop and Dr Mole disagreed starkly over the part played by radiation in the pathogenesis of the fatal tumour. The jury returned an open verdict.

30 Those of NN's organs which had not been analysed were disposed of after permission had been sought from the coroner: the method of disposal is not recorded. The litigation against the MoD which NN had started before his death was carried on by his widow but was eventually discontinued, along with that pursued by MM's widow, in 1989.

Fallout from Pochin

31 After LL and MM died in 1979, the AWE immediately realised that the deaths from cancer of two former radiation workers within a very short time of each other, even though coincidental, were likely to provoke a good deal of publicity. Within a couple of weeks of the deaths, it was observed in a note to the AWE's Board of Management that organs taken from LL had been

25 The physician who had prepared the report for the coroner with Professor Lindop

sent to BNFL for analysis and that Professor Lindop had been instructed (by LL's union). This memorandum emphasised the importance of the AWE's obtaining formal evidence on the interpretation of the results: *"we will need a big-name witness"*. It discussed briefly tactics at the forthcoming inquest and more generally:

> *The Board is invited to address the following points:*
>
> *a. Analysis of organs*
>
> *We should ensure satisfactory formal answers to the following:*
>
> *(i) the measurements and their confidence limits;*
>
> *(ii) a sufficient specification of procedure to ensure only plutonium alphas were measured;*
>
> *(iii) the standardisation of measurements;*
>
> *(iv) background corrections;*
>
> *(v) the levels found in other radiation workers and in non-exposed personnel.*

It concluded:

> *At the end of the day an open verdict seems most likely. This raises immediately the old question of whether cancer in radiation workers should be classed as an industrial injury or whether (following BNFL in* [name deleted]*) MOD should pay ex gratia.*
>
> *The Board is asked to note our belief that the ramifications of this case are serious; even were we to get a favourable decision, the matter will come up with increased force when inevitably an exposed person gets lung cancer.*

Litigation

32 The Treasury Solicitor's Department acts on behalf of government departments and thus became involved as solicitors for the MoD (of which the AWE was at the time a part) when claims against the MoD were intimated by employees and former employees of the AWE.

33 Minutes of a meeting held at the AWE in August 1980 show that there was concern over the way in which litigation was being defended, the effect this

was having on the morale of staff employed there and possible wider implications of the cases:

> *Mr Davies*[26] *also expressed concern at the apparent lack of a common policy and coordination between the UKAEA, BNFL and MOD in relation to claims for damages. The MOD's tactics and policy decisions appeared to be decided unilaterally by one T. Sol solicitor who was dealing with AWRE cases. Mr Davies suggested that the outcome of the claims for damages could be prejudicial to the UK nuclear programme (both civil and defence) and that the Board might wish to consider raising the question at a high level in HQ and that the need for close collaboration with UKAEA and BNFL should be emphasised.*

Mr John Ward

34 The solicitor to whom Mr Davies was referring was Mr John Ward. Mr Ward had qualified as a barrister/solicitor in New Zealand. He was employed by the Treasury Solicitor's Department from 1976/77 to 1989 and acted on behalf of the MoD and the AWE during that time. His duties included appearing on behalf of the AWE at inquests into the deaths of former employees and advising the AWE on its defence in claims for damages for illnesses alleged to have been caused by exposure to radiation. He worked with senior safety managers at the AWE, including successive Board Members for Safety, and was a frequent visitor to the Aldermaston site. Minutes of a meeting held at Aldermaston in June 1980 record, in the course of a discussion of NN's case, that:

> *Mr Ward said that his role in relation to the claims was to clarify the issues involved. Decisions on policy relating to settlement of the claims would be made by the Claims Commission.*

35 Mr Ward was also involved in advising on data to be acquired to help in the defence of any potential claims. One way in which this was done was by his suggesting to coroners that they should hold inquests into deaths of former employees and offering them advice as to how they might best conduct their investigations. There was concern in some cases, in which the death would otherwise have been certified by the general practitioner, that the worker, aware of the provisions of the Official Secrets Act 1911 and concerned about the secrecy of his work, might have kept information on work-related

26 Mr J D Davies was one of the AWE's Board Members for Safety

exposure to radioactive materials from that doctor. An inquest would involve fuller investigation of the history.

36 In some cases, Mr Ward's involvement extended to the preparation of the evidence to be presented: the coroner at one inquest told the jury that *"Mr Ward has in fact done all the spadework and has produced all this evidence which is going to be put before you today"*. This dual role, in advising both an interested party to an inquest and the coroner presiding over it, had the potential to give rise to a conflict of interest in two situations.

- The coroner wished to have organs removed and analysed for plutonium content but the AWE was concerned that if this were to be done, high levels would be discovered which would suggest a link with the death and hinder its ability to defend a claim. It could therefore suggest to the coroner that analysis would be unnecessary and the results unlikely to assist him with his role in determining the cause of death.
- The AWE wished to have organs removed and analysed for plutonium content because it suspected that the levels would be found to be low and hence potentially useful in its defence to any claim, but the coroner or the deceased's doctor was prepared to issue a death certificate without further investigation. The AWE could suggest to the coroner that the results of radiochemical analysis of organs taken from the deceased at post mortem examination could be of relevance to the cause of death.

37 In either scenario, the possibility existed that the coronial process could be manipulated to proceed in accordance with the AWE's wishes. A coroner's experience of investigating the deaths of former radiation workers would inevitably be limited. He would be likely to be readily influenced by advice given by government solicitors whom he would perceive, correctly, as having ready access to expertise from within the nuclear industry. The Inquiry has, however, seen no evidence that this potential conflict actually arose in practice. In general, the Inquiry noted the thoroughness with which the documents indicate that inquests into the deaths of former AWE employees were conducted: proceedings often extended over several days and were held before a jury, the interested parties having full legal representation.

38 The meeting proposed by Mr Ward[27] shortly after NN's death took place in his office on 28 March 1980. Although called primarily to discuss NN's case, the matter of *"the procedures for following up workers after they had left the Establishment and what sort of Register of radiation workers there was"* was

27 See paragraph 25

raised, not by Mr Ward or the AWE but by Dr Britton, the physician instructed alongside Professor Lindop by NN's family. A note of the meeting continues:

> *There was also a discussion on a warning system involving the Coroner and the Pathologist and whether it was best to send off a list of names to a Coroner or advise GPs or what was the best method of ensuring that the body was not ruined for quantitative assessment.*

No further details of the discussion of the proposed "warning system" are available and the Inquiry has seen no evidence that any action was taken to design or implement such a system.

39 On 15 October 1980, Mr Ward visited AWE Aldermaston, attending a meeting with senior management *"to consider a variety of issues concerning the future handling of claims for damages"*. One topic discussed by Mr Ward was *"the considerations which he had to take into account in deciding whether T. Sol should ask for a Coroners Inquest"*. No witness was able to assist the Inquiry in detailing what those considerations were or might have been.

40 A paragraph from the minute of the meeting reads:

> *The view was expressed that although analysis of body tissues of all deceased AWRE R/A workers could produce some useful scientific evidence, consideration would have to be given to the effect on morale of AWRE staff. The agreement of relatives would also be required.*

41 In submissions to the Inquiry, the AWE indicated that it had at that time regarded data derived from analysis of organs taken at post mortem examination:

> *as useful for developing and validating biokinetic models for determining intake of actinides in the human body and the resulting radiation dose. External measurements and measurements from urine and faecal samples were variable and involved a number of assumptions and the biokinetic models were unproven and generic depending on the solubility of material.*

The scientific view that post mortem analysis might provide a more accurate determination of radionuclide intake, and hence radiation dose, during life was widespread at the time. It was considered that results could be of assistance both to the coroner, in determining the cause of death, and to employers, in improving the accuracy of *in vivo* estimates of exposure. The AWE's view is now different:

> *The data gained from analysis of organs is of no use for routine business since biokinetic models are now much improved. Such data might be of use for providing assistance to threat reduction … research and in circumstances where sufficient bioassay data is not available.*

42 The AWE's explanation of its then motive is supported by minutes of a subsequent visit by Mr Ward to Aldermaston on 8 May 1981. Reference was made to *"opportunities for autopsies not to be missed"* and under the heading *"Autopsies"* it was noted that:

> *Ward intends to try for autopsies on all decedents who are considered likely to be the subject of a claim, on the basis that analytical findings at autopsy appear to rectify over-estimating in operational estimates during life. Every effort should be made to inform him as early as possible of deaths or impending deaths (what can we do to improve our information supply on these?).*

Later in the minute it is recorded that *"James*[28] *is seriously concerned about the problem of keeping tabs on ex-radiation workers into their retirement".*

43 In evidence, the AWE expressed itself unable to assist the Inquiry in explaining:

- how Mr Ward intended to *"try for autopsies"*;
- the criteria to be applied in assessing whether decedents were *"likely to be the subject of a claim"*;
- what, if any, steps had been taken *"to improve our information supply"*;
- why *"keeping tabs on ex-radiation workers"* was thought to be necessary or desirable;
- how such tracking could have been implemented.

44 The AWE's motive for *"keeping tabs on"* its former employees, in ensuring that they underwent post mortem examination and in obtaining organs for analysis, might not have been mere scientific curiosity. Plainly, if analysis of organs taken from radiation workers who had died from cancer showed that they contained very low levels of radionuclides, the argument that the cancer had been caused by radiation would be weakened. Obtaining such evidence in the context of a civil claim would be perfectly proper, provided the organs were removed either under coronial jurisdiction or with the consent of the relatives.[29]

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28 Mr R James was Chief Administrative Officer at the AWE

29 Human Tissue Act 1961: see chapter 3, "Law and Guidance"

45 The AWE told the Inquiry that no system for tagging ex-workers and following them into retirement in anticipation of their deaths had ever been implemented. The organisation came to hear of such deaths as and when they occurred, in particular when litigation had been initiated while the individual remained alive.

Cost

46 While MM's and NN's claims were in progress, consideration was given within the MoD not only to whether they could be successfully defended (on the grounds that the deceased men's cancers could not be shown to have been caused by radiation) but also to the likely financial consequences of out-of-court settlement. Although the two individual cases were of fairly limited value, calculations contained in an internal memorandum prepared by the Assistant Under-Secretary at the MoD in March 1982, and circulated to the Secretary of State for Defence,[30] estimated the likely cost of settling similar claims which might be brought against the MoD by radiation workers, past, present and future, in excess of £100 million. An objective interpretation of the facts underlying this conclusion suggests that the true potential liability was very significantly lower.

The Specials file

47 Among the extensive documentation disclosed to the Inquiry by the AWE was a file, headed "Specials", containing extracts from medical and dosimetry records of a number of employees.

48 The Inquiry heard that this file had been opened in the early 1980s and contained records relating to individuals, the results of whose routine WBM scans had not been within normal limits: that is, anyone who had given a repeatedly elevated result. Those results would have been discussed at dose evaluation meetings. The file was maintained by the staff of the Dosimetry Section as it would be necessary to consider with particular care the results of analysis of urine specimens taken from individuals who were known to have had previous exposure to actinides. The AWE indicated that *"while certain dose assessment staff knew of the collection of documents constituting*

30 Rt Hon Sir John Nott MP

the Specials file, certain senior safety managers and health physicists may also have known of it".

The "P.M. requirement" list

49 One document within the Specials file was a single-page, handwritten list containing the names of 44 AWE employees. The list was prepared by Ms Jane Jefferies, then a scientific officer at AWE Aldermaston, probably in 1984. Ms Jefferies told the Inquiry that she had intended to make and maintain a comprehensive list of individuals whose WBM test had given results outside normal levels. The list was held on her own file, to which only a very small number of people had access.

50 A column headed "P.M. requirement" contained, adjacent to some of the names, entries such as *"hand (RHS) Ax LNs+Brachial LNs"*, which the Inquiry understands to mean the right hand and the axillary and brachial lymph nodes. Those entries appear to correspond to individuals known to have sustained wounds contaminated by radionuclides and it is obvious why the AWE might have wished to analyse the parts of the body in which any radionuclides absorbed from the wound would have been concentrated. At the foot of the column is the note, *"For all take liver, lung, TBLN* [tracheobronchial lymph nodes] *and bone samples"*.

51 Ms Jefferies remembered being asked to add that column to the list by Mr Norman Taylor.[31] The rationale was that the AWE would in the future be able to help anyone, such as a coroner, who might request assistance in deciding what tissue could usefully be analysed. She did not recall any such request having been made.

52 According to evidence given to the Inquiry by the AWE, of the 44 individuals whose names appear on the list:

- 22 are known still to be alive;
- 18 are known or presumed[32] to have died;
- the status of the remaining four is unknown.

The Inquiry obtained a variety of documents, including occupational health records,[33] from the AWE relating to each of the individuals named on the list, which enabled it to exclude the possibility that organs had been

31 Head of the dose assessment section at the AWE

32 Because they had more than two years' service, are over pension age and are not receiving an occupational pension

33 As permitted by Foskett J's order: see note 3, above

removed at post mortem in any case of which the Inquiry had previously been unaware.

53 Of those known to have died, three underwent post mortem examination at which organs were removed at coronial request for analysis by the NRPB. Documents seen by the Inquiry suggest that in all three of those cases the deceased's relatives were aware of what was done.

54 Both Ms Jefferies and the AWE denied that the list had been circulated or that it had been used by anyone within the AWE as a source of information to indicate that attempts should be made, in due course, to obtain organs at post mortem examination from the individuals listed. It remains unclear to the Inquiry, if that were the case, what the motive for preparing the list might have been.

"Claimants for particular attention"

55 A typed note dated 25 January 1980, prepared by Dr Stanley Jackson[34] and addressed to Mr Davies, is headed "Claimants for particular attention". It lists 28 employees in whom estimates of chest radionuclide content (assessed by WBM) were or had been considered to be elevated, or who had been removed from "contact" (work with radioactive isotopes). Over the subsequent few weeks, Dr Jackson produced three further handwritten notes for Mr Davies, with the same heading, adding a few names and a little more information. Five of the names on the list appear also on the handwritten "P.M. requirement" list described above.

56 These lists were not contained within the Specials file. The AWE indicated that they comprised individuals who had had evidence of measurable intake of actinide sufficient for them to be placed on restricted duties and who had initiated claims against the AWE. Knowledge of the intake would be a relevant factor in the AWE's handling of the claims and would be of interest to the health physicists working in the Dosimetry Section. According to evidence given to the Inquiry by the AWE, of the 28 individuals whose names appear on the list:

- 14 are known still to be alive;
- 11 are known or presumed[35] to have died;

34 Group Leader, Biological Assessment, AWE

35 Because they had more than two years' service, are over pension age and are not receiving an occupational pension

- the status of the remaining three is unknown.

As it had done when investigating the "P.M. requirement" list, the Inquiry obtained a variety of documents, including occupational health records,[36] from the AWE relating to each of the individuals named on the list, which enabled it to exclude the possibility that organs had been removed at post mortem in any case of which the Inquiry had previously been unaware.

57 Of those known to have died, two underwent post mortem examination at which organs were removed and then analysed for radionuclide content at the request of the coroner. Documents seen by the Inquiry suggest that in both of those cases the deceased's relatives were aware of what was done.

Post mortem analyses

Analysis

58 The AWE had facilities for analysis of environmental samples. It was able to assay radionuclides in human tissue, but in the cases discussed in this chapter generally did not do so: the analyses were performed either by the NRPB or by BNFL. The only analysis of human tissue done by the AWE itself was in the course of research projects which are discussed later in this chapter.[37]

Employees

59 The Inquiry is aware of 20 former employees of the AWE (including the four cases discussed at paragraphs 11–30) and of a further two individuals employed at other government institutions (MoD Woolwich and MoD Greenwich) who underwent post mortem examination and from whom organs were or might have been retained with a view to radiochemical analysis. In the majority (12 out of 18) of the cases not considered above, the analysis was undertaken by the NRPB at the request of the coroner. In all of those, the coroner was of the legitimate view that the analysis would assist in the determination of the cause of death and in the majority, the deceased's family and/or legal representative had also raised the issue.

36 As permitted by Foskett J's order: see note 3, above

37 See paragraphs 80 et seq

The taking of organs was appropriate and the instruction of an independent third party was sensible.

60 Of those 12 cases, two bear further comment as the circumstances were unusual.

- In one, the coroner told the jury at the start of the inquest that he would not have held an inquest had it not been for the advice of the Treasury Solicitor.[38]
- In the other, organs were retained and analysed by the NRPB at the request of the coroner. Some of the tissue was given for further analysis to Professor Henshaw at Bristol University and a file note records, *"It was impressed on* [Henshaw] *that nothing must be said at this stage as otherwise Ward might be upset. Anonymity must be preserved and there must be no publication of results."* [39]

61 Two of the remaining six cases illustrate the difficulties encountered in establishing the facts so long after the event.

OO

62 OO died in 1979. A lung, the liver and some vertebrae were removed at post mortem examination. The Senior Medical Officer at the AWE, Dr Murray Roberts,[40] personally delivered those organs to Sellafield, a round trip from Aldermaston of over 600 miles. The organs were analysed on behalf of Dr Schofield and the results sent to Dr Roberts, who forwarded them to Mr Jones, at Aldermaston. In 1981, following a request from Mr Taylor, Dr Roberts wrote to Dr Schofield asking for more detailed information about the results of the analysis. Dr Schofield replied a couple of months later and Dr Roberts passed his reply to Mr Taylor. In his oral evidence to the Inquiry, Dr Roberts denied any recollection of his involvement in this case. The Inquiry has seen no evidence to indicate why or at whose request organs were taken and analysed or that these actions were taken with the knowledge or consent of OO's relatives. The legality of the harvest and analysis therefore remains uncertain.

38 And indicated that Mr Ward had prepared all the evidence: see paragraph 36

39 See also chapter 8, "The National Radiological Protection Board", paragraph 127

40 Dr Roberts was Senior Medical Officer at the AWE from 1976 to 1985, having previously worked for BNFL at both Sellafield and Springfields

PP

63 PP died in 1985. At post mortem, there was an extensive harvest of organs: half femur, half sternum, six ribs, 12 vertebral wedges, kidney, part of clavicle, part of liver and parts of both lungs. The organs were analysed by the NRPB and the results sent to Mr Taylor. A few months later, in response to a question from Mr Paddy Ashdown MP,[41] the NRPB prepared a list of analyses which it had reported to coroners since 1980. There were 11 names on the list, including PP; his was the only case in which the NRPB indicated that the analysis had been done at the request of the AWE. The coroner had certified the death *"after post mortem without inquest"*. Any analysis could not therefore have been at proper coronial request[42] and would have been lawful only with the relatives' consent, of which the Inquiry has seen no evidence.

64 The AWE was asked to assist the Inquiry in relation to those two cases (OO and PP) but expressed itself unable to provide any further information.

Further cases

65 In two further cases, organs were removed but it appears that no radiochemical analysis was undertaken:

- In one, the Inquiry has seen a handwritten note which records that lung tissue was sent to the Pneumoconiosis Research Unit at Cardiff and, after reference to his employment at the AWE, *"Tissue taken … lung, liver, bone marrow"*. It is unclear whether any radiochemical analysis was performed or how the retained organs might have been disposed of.
- In the other, organs were lawfully retained[43] at the post mortem examination. The AWE informed the pathologist that the deceased had had only slight exposure to radiation and the coroner, advised by the pathologist, decided that no inquest was necessary. The body was cremated. The pathologist ascertained from the AWE that it had no interest in analysing the retained organs and an AWE memorandum records that he *"said he will now 'quietly' dispose of the tissues"*. The documents seen by the Inquiry do not indicate the cause of death, which organs were retained or what was the method of disposal.

41 Then Member of Parliament for Yeovil

42 Under s22 of the Coroners (Amendment) Act 1926: see chapter 3, "Law and Guidance"

43 Because the pathologist suspected that analysis might be relevant to the cause of death: rule 9 of the Coroners Rules 1984: see chapter 3, "Law and Guidance"

66 Of the two remaining cases not discussed above, one was a former AWE employee who died in the early 1980s. A claim had been intimated before his death; two days after he died his solicitors advised Mr Ward that a post mortem was to be carried out and that Professor Lindop would attend. A variety of organs, including the liver, a lung, brain, heart, a testis, stomach, femur, mediastinum, kidneys, spleen and bladder, were removed and analysed at Sellafield, the results being reported to Dr Schofield. The involvement of solicitors suggests that the widow was aware that the organs were to be removed.

67 The one remaining case is straightforward. The deceased, an MoD employee at Woolwich, donated his body to the NRPB and accordingly no issues arise of concern to the Inquiry.

Nuclear test veterans

68 The Inquiry is also aware of 15 ex-servicemen who were or were at some time thought to be veterans of the UK's nuclear tests and whose organs were or might have been removed at post mortem examination with a view to radiochemical analysis. The circumstances differ widely but a common theme is that the AWE's involvement appears to have been confined to advising the MoD, the deceased's family and/or the coroner as to the likelihood of the individual having been exposed to harmful radiation in the course of the test explosions.

69 The earliest of those 15 deaths were in the late 1950s. In two, the femur alone was taken and assayed at Woolwich laboratory for strontium-90, the analysis was undertaken at the request of the coroner and an inquest was held.

70 In four of the remaining 13 cases, while there is evidence that organs were lawfully removed at coronial post mortem there is none that they were actually subjected to analysis. All four men died in the mid-1980s.

- In one, the widow was aware that organs had been removed by the pathologist. There was no analysis; the organs were disposed of seven years later when the pathologist retired.
- In one, the pathologist removed organs for analysis but both the AWE and the NRPB told the coroner that the results would be of no value.
- In one, the post mortem report records that the liver and a femur were taken but no analytical results have been found and it is unclear whether any inquest was held.

- In the last, the post mortem report records only *"routine tissues retained"*. A note held by the AWE indicates that in view of the widow's wishes, the family's solicitor and the coroner did not want to prolong the inquest. No analytical results have been found.

Only in the first of those four cases is there any evidence to indicate what ultimately became of the organs removed at post mortem. It is clear, however, that the pathologist removed them in a genuine belief that analysis might assist in determining the cause of death and so the removal was legitimate, notwithstanding the absence of subsequent analysis.

71 Two further cases involved veterans of the British nuclear tests who died of mesothelioma in the 1980s and whose lungs (and heart in one case) were taken at post mortem for independent investigation of asbestos content. In each instance the coroner was aware of the retention. No radiochemical analysis was performed. Radiation from the nuclear tests was considered (and dismissed) as a possible cause of death.

72 Six of the remaining seven cases were straightforward. These test veterans died in the 1980s and 1990s. In one, the deceased had wished to donate his body for scientific research; in the others,[44] the coroner had properly taken a view that his determination of the cause of death would be assisted by radiochemical analysis of organs and had instructed the NRPB to undertake it. In one of those cases, Dr Mole attended the post mortem and advised the pathologist which organs should be taken. In evidence to the Inquiry, the coroner confirmed that he had been content with that approach and that the analysis was undertaken both at his request and with the widow's knowledge.

73 In those six cases it is therefore clear that organs were lawfully removed and analysed. The one case in which the Inquiry did see evidence giving rise to concern was that of QQ.

QQ

74 QQ was an ex-serviceman who died of lung cancer in 1985. At the request of the coroner, the pathologist retained large quantities of tissue (the liver and left lung, six ribs, four vertebral sections, the left clavicle, left femur and left kidney), some of which were subjected to analysis at the Royal Marsden Hospital, and the results were given in evidence at the inquest. There can be

44 Including Christopher Kersley, whose widow made a formal witness statement to the Inquiry: a Christmas Island test veteran, he died of lung cancer in 1994

no criticism of this procedure. However, the inquest transcripts and other records indicate that two further samples, taken from unidentified individuals who had not been exposed to radiation, were also provided by the coroner's officer to the pathologist and analysed to provide reference readings. There is no evidence that consent was obtained from the relatives of those individuals for tissue to be taken for scientific purposes unconnected with their deaths. The coroner had no power to authorise the removal, even if the individuals were the subject of post mortem examinations done under his jurisdiction, since the results of any analysis could not possibly bear upon the cause of those individuals' deaths. In the absence of consent, the removal of the tissue was unlawful. It is of some interest that the AWE was given the opportunity to analyse the retained organs but declined because of the likely cost, estimated at £3,000.

Removal and transport

75 The AWE was not involved with the removal of organs at post mortem examination, which was done by the pathologist.

76 In most cases, the means by which the organs were transported to the laboratories where they were to be analysed is not apparent from the documents seen by the Inquiry. However, there is some evidence that Dr Roberts was involved in the transport of two sets of organs, the first of which was OO, discussed in paragraph 62.

77 The second man, who is one of the 12 referred to in paragraph 60, died in 1985. One femur, the liver and a lung were removed at post mortem examination and analysed by Dr Donald Popplewell[45] on the instructions of the coroner. Contemporaneous documents indicate that both the coroner and Dr Jackson of the AWE were under the impression that Dr Roberts had attended the post mortem examination. Dr Roberts denied having actually been there (he is not mentioned in the list of people which appears on the post mortem report) but he did remember having taken the organs from the mortuary in Berkshire to the NRPB at Harwell. Both the harvest and analysis would appear, on the limited information available to the Inquiry, to have been at reasonable coronial request and so lawful.

45 Principal Scientific Officer, NRPB

Registry discussions

78 Dr Roberts was involved in discussions concerning the possible establishment of a registry of radiation workers. It was intended that those workers be asked to agree that organs could be taken and analysed after their deaths, to increase scientific understanding of the way in which radionuclides were taken up by, stored in and excreted from the body. These plans are described in detail in chapter 10, "Registries". It is apparent from that description that while the managements of all the organisations involved in those discussions were eager to see a registry established, that of the AWE was perhaps the most supportive.

Strontium

79 The AWE was not involved with the UK studies into strontium levels in human bone. It did have some peripheral involvement between 1957 and 1961 in corresponding studies using bone taken at post mortem examinations in Australia and ashed before being sent to England. A more detailed description of the strontium research may be found in chapter 11, "Strontium and the Medical Research Council".

Publications

80 The Inquiry identified eight publications arising from research in which AWE employees had been involved.

- One involved analysis of thyroid glands and is discussed in detail later in this chapter.[46]
- Three[47] involved analysis of tissue taken at post mortem examination from a single former employee of the AWE.

46 See paragraphs 83 et seq

47 Jefferies SJ and Gunstone KJ, Further work concerning a case of Am contamination in the lateral axillary lymph nodes, *Health Physics*, 1986, 50: 839–42; Tancock NP and Taylor NA, Derivation of a new expression to describe the urinary excretion of plutonium by man, *Radiation Protection Dosimetry*, 1993, 46(4): 229–39; Tancock NP, Taylor NA and Wormald S, A test of plutonium metabolic models developed by Leggett and Priest using measurements from an intake case, *Radiation Protection Dosimetry*, 1993, 46(4): 247–51

- Two[48] appear to relate to the same research project. The first described as part of the investigations analysis of *"a post mortem bone sample"*. No further details were given. The second referred to analysis of nine very small quantities of bone (200mg) and four of brain tissue (500mg). The source of the tissue is not specified in the report, but presumably at least the brain tissue was taken at post mortem examination. Both papers indicate that the analytical methods described had been used extensively in other medical research programmes, data from which were to be published.
- Two[49] were written in collaboration with employees of the NRPB and are discussed in chapter 8, which describes that organisation.

81 There is evidence of consent to the provision of tissue in respect of only one of the papers, which involved analysis of fetal tissue.[50]

82 The AWE was asked to describe the procedures in place by which ideas for research were converted into formal proposals, how such proposals were assessed and how funding and ethical issues were considered. A committee, the Technical Policy Committee, existed in the 1970s and 1980s to consider research central to the AWE's remit, namely the development of nuclear warheads. Its records contained no reference to any research falling within the Inquiry's Terms of Reference. The AWE suggested that smaller projects might have been assessed more informally by a Director or Assistant Director, but was not able to assist the Inquiry further.

The thyroid study

83 A little more information is available on the provenance of thyroid glands used in another study, which is therefore described in more detail.

84 The body's iodine is concentrated in the thyroid gland, where it is used in the manufacture of the two thyroid hormones, thyroxine and tri-iodothyronine. Iodine exists in a number of isotopic forms, of which some occur naturally and others exist only as by-products of nuclear reactions.

48 Goode GC, Howard CM, Wilson AR and Parsons V, Some applications of neutron activation for the analysis of human bone, *Analytica Chimica Acta*, 1972, 58: 363–68; Goode GC, Herrington J and Goddard PC, Neutron activation analysis for aluminium in bone and tissue samples, *Radiochemical and Radioanalytical Letters*, 1977, 31(2): 87–94

49 Popplewell DS, Ham GJ, McCarthy W and Morgan M, Isotopic composition of plutonium in human tissue samples determined by mass spectrometry, *Radiation Protection Dosimetry*, 1989, 26(1): 313–16; Prosser SL, McCarthy W and Lands C, The plutonium content of human fetal tissue and implications for fetal dose, *Radiation Protection Dosimetry*, 1994, 55(1): 49–55

50 Prosser et al: see note 49, above

Iodine-129 is an example of the latter and in the 1960s and 1970s the only major source of this isotope in the UK was Sellafield (then known as Windscale).

85 In 1970, the AWE produced a paper,[51] marked "Official use only", by two employees, Dr Malcolm Dean[52] and Dr I Trevena. The results were reported of the analysis of 18 human thyroid glands obtained at post mortem examination from *"a hospital near Windscale, Cumberland"*.

86 The authors were not investigating any possible danger to health which the presence of iodine-129 might have posed to Sellafield workers or those living near the plant: the isotope is not dangerous. Rather, they observed:

> *A frequent problem encountered by the police is the identification of the dead. In the absence of personal effects it might prove rewarding to consider what constituents of the environment of the living person might be retained by the body after death and be revealed by analysis.*

In evidence to the Inquiry, Dr Dean was less disingenuous as to the primary reason for the research (and the reason why it was treated with secrecy): the scientific technique was suitable for investigating activities at nuclear reprocessing plants in other countries by looking at their emissions of iodine-129.

87 The findings indicated that the average ratio of man-made iodine-129 to naturally-occurring iodine-127 in the thyroid glands of people who had lived within 20 miles of Sellafield was significantly above the expected average for the remainder of the country. The authors concluded:

> *It may be that a correlation between the ratio and distance from Windscale exists; if this can be established a valuable tool could be developed for forensic science.*

88 On 29 July 1970, in a letter to Dr Greg Marley of the UKAEA Radiological Protection Division at Harwell, Dr Dean described his work as *"classified"* . A month later, he wrote again to Dr Marley indicating that *"We plan to extend this work in the future"*. In fact, no further work was done.

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51 Dean MH and Trevena I, *I-129/I-127 in Human Thyroids near Windscale: a Preliminary Investigation*, AWRE Report O92/70 (AWRE, 1970)

52 Radiochemist; later, Board Member for Safety at the AWE

Obtaining the organs

89 How were the thyroid glands obtained for the study? The paper's authors thank *"Dr. E.D. Dyson of the Authority Health and Safety Branch, Harwell who arranged the provision of samples"*.

90 The Inquiry has seen extracts of the minutes of meetings of the Authority Health and Safety Branch (AHSB) of the UKAEA. The first reference, probably in 1968,[53] to thyroid glands records:

> *Arrangements have been made, with the help of Dr. G.B. Schofield at Windscale, to collect human thyroids from Whitehaven Hospital. It is proposed to have these thyroids analysed for total iodine content, in order to obtain representative values of iodine per gram wet weight of thyroid.*

91 At what was probably its next meeting later that year,[54] the AHSB was told:

> *Human thyroids from the West Cumberland Hospital at Whitehaven have been obtained with the help of Dr. G. B. Schofield from Windscale. After inspection and weighing, Dyson has dispatched these to Aldermaston for chemical analysis.*

A later minute, probably dating from 1969, records that results of analysis had been received.

92 In evidence to the Inquiry, Dr Dean was unable to remember how the glands had been obtained. He himself had had no contact with any pathologists. Dr David Smith, consultant pathologist at West Cumberland Hospital, recalled taking thyroid glands at post mortem examination for research at various times but his name rang no bells with Dr Dean.

93 The harvest and analysis of the thyroid glands could not have been for coronial purposes (even if the post mortem examinations were performed at the coroner's request), since there is no suggestion that the results were or could have been considered relevant to the cause of death: in some cases, for example, the individuals had died in road traffic accidents. The Inquiry has seen no evidence that appropriate, or indeed any, steps were taken to obtain the consent of the relatives of the deceased to the removal and analysis of the glands.

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53 The exact date of the meetings of the AHSB cannot be determined from the documents obtained by the Inquiry

54 The minute is undated but was probably prepared in 1968

Summary

94 The AWE and the MoD, its parent organisation for much of the material time, were chiefly concerned with defending themselves against adverse findings at inquests into the deaths of former employees and ex-servicemen and against any claims for damages arising out of deaths or other injuries. Although there was some discussion of positive action to be taken, the AWE's role remained reactive, responding to deaths and claims only as and when they arose.

95 Such research as was conducted by the AWE that involved analysis of organs taken at post mortem examination was, save for one study conducted in the early 1990s, without appropriate consent. The deceased people from whom organs for the studies were taken were few in number and the amounts of tissue taken from the bodies were small. Nevertheless, whether the post mortem examinations were coronial or hospital, agreement to the removal of the tissue for research should have been obtained in every case. Without that agreement, the tissue was not lawfully removed.

Registries

Chapter 10

Registries

Chapter 10

Contents

Introduction

1 Much of this Report has focused on the uses of data obtained from the radiochemical analysis of organs and the failures to obtain consent for the removal of those organs at post mortem examination. In the US, formal arrangements for obtaining such consent are facilitated by a national registry. From time to time attempts were made to set up a similar venture in the UK, but none was successful.

US registries

2 The United States Transuranium and Uranium Registries (USTUR), which includes the US National Human Radiobiological Tissue Repository, is operated on behalf of the US Department of Energy by the Washington State University College of Pharmacy. The USTUR constitutes a research programme which studies actinides in the bodies of persons with documented exposures to these elements. Volunteers allow access to their employment and occupational exposure histories and medical records and agree in due course to undergo post mortem examination at which their organs will be removed for analysis. The USTUR undertakes radiochemical analysis of the donated organs and relates the results to measurements obtained from *in vivo* urinalysis and other health physics measurements using a mathematical model. The research is therefore able to address directly the adequacy of past and current radiation protection guidelines and dose assessment methodologies.

Early research

3 In 1949, a programme of post mortem tissue sampling was initiated at Hanford in Washington, the site of the world's first full-scale plutonium production reactor. Samples of bone, lung and liver were collected from Hanford workers and other residents of Richland, Washington. These specimens, along with a few samples from other tissues, underwent radiochemical analysis to investigate where in the body plutonium was deposited and the results were compared with the values predicted by biokinetic models and excretion data. Limited post mortem sampling of occupationally exposed individuals was also undertaken at the US Atomic Energy Commission's Rocky Flats facility in Denver, Colorado, where

production of the hydrogen bomb had been commenced. Studies of plutonium in the general population were also initiated by the Los Alamos Scientific (now National) Laboratory, New Mexico, in 1959 and by the US Public Health Service in the early 1960s.

4 The Hanford post mortem study found more plutonium in liver than in lung, but data from the bone samples were equivocal. The results were presented in May 1967 to the Seventh Annual Hanford Symposium on Biology. A plea for further investigation and collaboration with other plutonium-handling facilities was expressed. The meeting's concluding paper proposed the establishment of a national plutonium registry.

National Plutonium Registry

5 The precursor of the USTUR was formally established in August 1968 as the National Plutonium Registry. By the end of its first year the registry had established its basic operating methodology and had started recruiting registrants. The registrants consented to undergo post mortem examination at which organs would be removed for analysis. Their families would receive a contribution towards funeral expenses. In 1970, its name was changed to the United States Transuranium Registry (USTR) to reflect its study of other transuranic elements in addition to plutonium. The USTR identified nuclear sites containing suitable populations and established agreements to allow recruitment to begin. Its efforts were rapidly successful: by June 1974, 5,843 transuranium workers had been identified, of whom 3,880 had signed authorities for the release of medical and health physics records and 819 had given authority for post mortem; 45 post mortems had been performed, two-thirds (30) on workers from the Rocky Flats facility.[1]

National Uranium Registry

6 In 1978, the United States Uranium Registry (USUR) was established by the Hanford Environmental Health Foundation, funded by the Department of Energy. It was distinct from the USTR, although it was operated along similar lines. Its three major goals were:[2]

- to characterise the occupational health aspects of the uranium fuel cycle;

1 USTR annual report, 1974

2 www.ustur.wsu.edu/History/USUR.html

- to measure the concentration and distribution of uranium and the uranium decay chain in the tissues of exposed workers;
- to identify populations suitable for health-related studies.

United States Transuranium and Uranium Registries

7 In 1981, the USTR Advisory Committee recommended that the Transuranium Registry and the Uranium Registry be merged. Although this change was not immediately implemented and the two registries remained administratively separate, a combined USTR and USUR Advisory Committee was created. The first Annual Report for the combined registries was published in 1990. The USTR and USUR were merged in 1992 and renamed the US Transuranium and Uranium Registries (USTUR). The Director was Professor Ronald Kathren, who had become the USTR/USUR Director in 1989. The Director now is Professor Anthony James.

8 The USTUR relies entirely on voluntary donations by exposed workers. Usually the individual himself agrees to post mortem donation of organs or his whole body but some agreements have been reached with the next of kin after the individual's death. Prospective registrants are provided with detailed information about the USTUR and its activities. No registrant is accepted unless he has given formal consent for post mortem or whole-body or surgical specimen donation and authorisation for release of medical and radiation exposure records. Agreement is evidenced by signed, dated and witnessed forms. Registration lapses automatically unless renewed, in writing, every five years. When the individual dies, no post mortem examination (for USTUR purposes) or body donation takes place without the additional agreement of the surviving spouse or next of kin.

The UK attitude

9 The utility of analysis of tissue obtained from nuclear workers at post mortem was widely recognised long ago.[3] The first significant study[4] was published in 1958 and included data on organs obtained from 19 individuals (seven Springfields employees and 12 non-nuclear workers for comparison).[5]

3 See, for example, the minutes of the United Kingdom Atomic Energy Authority's Medical Co-ordinating Committee in May 1962, quoted in paragraph 40 of chapter 5, "British Nuclear Fuels Limited"

4 Butterworth A, *Human data on uranium exposure*, US AEC report HASL-58 (US AEC, 1959)

5 See chapter 5, "British Nuclear Fuels Limited", paragraph 33

The extent to which post mortem work at Sellafield undertaken by Dr Geoffrey Schofield,[6] which began in the early 1960s, could be considered a response to recognition within the United Kingdom Atomic Energy Authority (UKAEA) of the importance of such work is discussed elsewhere[7] but clearly both he and Dr Geoffrey Dolphin[8] saw the need for the UK to have a system like that in the US. Both raised the possibility of a UK national registry at an early stage. In June 1967, Dr Dolphin received from Dr Kenneth Duncan, UKAEA Chief Medical Officer, a copy of the paper presented at the Hanford Symposium[9] in which a national plutonium registry had been proposed. Dr Duncan compared it to his own ideas for an "exposure register".

10 It is likely that Dr Dolphin was the author of a letter, dated 17 February 1969, sent to Dr Andrew McLean, Director of Health and Safety at the UKAEA, only the first page of which has survived. Reference is made to discussions with Dr W Daggett Norwood, the founding Director of the National Plutonium Registry:

> *I had quite a long discussion with Norwood and said that we were very anxious to get our material in some reasonably comparable way, but we certainly would not think it advisable to include every possible intake, however trivial, or to define the cases as he wants in terms of estimated body burdens. I thought in practice what we would do is to continue the work at Windscale that Geoff* [Schofield] *and I have been doing on the special cases;*[10] *it might not be a bad idea to formalise this a little more at some stage … One other project somewhat loosely associated with this, is their desire to obtain background post mortem material from non-exposed populations. We have already had some interest in this and might well take it further. Certainly I can see this as being of certain medico-legal importance in the future.*

11 Less than 12 months later, in January 1970, Dr Schofield wrote to Dr Dolphin with a veiled reference to the US practice of offering inducements to those willing to sign up to donation of organs:

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6 Initially Senior Medical Officer, latterly Company Chief Medical Officer, British Nuclear Fuels Limited

7 See chapter 5, "British Nuclear Fuels Limited"

8 Member of the Health and Safety Branch at the UKAEA, latterly Head of the Biology Department and then Assistant Director at the National Radiological Protection Board

9 See paragraph 4

10 By this time Dr Schofield had been involved in the analysis of organs taken at post mortem from six Sellafield workers

When we next have a case of this kind I will get Edgar to dissect out the glands from their supporting tissue … I had a copy of the plutonium register from Andrew McLean when I was last in the big city – how about offering the boys at Windscale a nice gilded funeral and a bit of lolley to go with it!!

Attempts to establish a registry in the UK

12 The rationale behind the creation of a UK post mortem registry is well set out in a paper[11] disclosed to the Inquiry by British Nuclear Fuels Limited (BNFL). It refers to the USTUR correlating biological monitoring data recorded in life with the tissue content and distribution of radioisotopes at death and stresses the need for something similar in the UK:

> *In the UK too we should be making every effort to encourage general practitioners responsible for the care of workers exposed to plutonium and similar radioactive substances to understand and explain the importance of tissue measurements to their patients and their relatives so that, in the event of hospital admissions or death, no additional stress is put on the patients or relatives by requests for tissues for analysis. We should try to remove the fear that the results of any such measurements made could be used adversely to affect any subsequent litigation … we need to learn about the distribution of plutonium in man and the potential harm it may cause. Without such knowledge the nuclear energy industry may either be hampered by over restrictive protection legislation for its workers, or may inadvertently lead the workers to suffer unacceptable long-term radiation injury. We are still at the beginning of a growing programme; it is important that we get it right.*

13 Despite this early recognition of the potential value of a national registry, it was not until 1980 that serious consideration was given to its possible creation. By then several individuals had visited the US to understand better the work of the USTUR: Dr Alexander Stott,[12] Dr Dolphin and Dr John Reissland[13] visited the USTUR in 1977; and in October 1979,

11 The author and date of the paper cannot be definitely established but it appears to have been written by Dr Schofield

12 Chief of Medical Services, UKAEA

13 Head of Physics Department, National Radiological Protection Board

Dr Murray Roberts[14] had visited various US establishments, subsequently reporting on the USTUR to the Atomic Weapons Establishment (AWE) Health and Safety Policy Board:

> *Those on the register and their next of kin agree to permit a post mortem examination to be carried out and various organs to be removed for radiochemical analysis. In return a sum of money – commonly $350 – is paid to the relatives at the time of the Post Mortem Examination. It is believed that this is the only sensible way to acquire factual information about organ burdens for comparison with the burdens estimated from urine analysis, faecal analysis and whole body monitoring.*

14 On 18 June 1980, the first serious steps to explore the idea of a national registry were taken when the Medical Research Council (MRC) Committee on Protection against Ionising Radiations (PIRC) discussed the measurement of radioactive materials in cadavers. On 12 August 1980, Dr Jack Vennart[15] wrote to Dr Schofield:

> *In this country there is no public analyst equipped to do such measurements and the bulk of the work has fallen on BNFL, NRPB* [National Radiological Protection Board] *and the* [UK]*AEA. It is obviously undesirable for interested parties to be involved where a claim for compensation is involved thus limiting the resources available in specific cases.*

He suggested a meeting to explore the most effective means for obtaining post mortem specimens and the available resources for analysis. Dr Schofield responded:

> *As you are aware I have been carrying out radiochemical analyses on autopsy material for many years. At the same time, however, I have always considered that such activities should be placed on a more formalised basis in the UK probably along similar lines to that adopted by the US Transuranium Registry.*

15 Dr Schofield took his thoughts to the BNFL Company Executive in September 1980. His Company annual medical report for 1979 was presented to the Executive by Dr Donald Avery.[16] The minutes of that meeting record:

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14 Senior Medical Officer, Atomic Weapons Establishment

15 Director, MRC Radiobiology Unit

16 BNFL Deputy Managing Director, to whom the Company Chief Medical Officer reported

> *Dr Schofield indicated that there were no clear formal arrangements in the UK for the analysis of autopsy specimens. He suggested that it might be possible to set up a register of volunteers similar to that of the Transuranium Registry in the USA, but that the matter was to be considered by the MRC.*

Dr Avery himself noted:

> *it is timely for consideration to be given within the Company of its interests in and the arrangements for analysis of autopsy specimens. There are no clear formal or informal arrangements within the UK although NRPB appeared to be making proposals some time ago. More recently however MRC have indicated that they are interested in obtaining opinions from different organisations and individuals as to what is needed. It is important to the Company that the maximum amount of information is obtained so as to assist in the clarification of the basis of standards but that this should be done with the minimum impact on the Company's public and legal position.*

16 Dr Vennart's letter to Dr Schofield had also been copied to individuals at several organisations including the Home Office, the NRPB, the Department of Health and Social Security (DHSS), the Ministry of Defence (MoD) and the UKAEA. Dr Roberts, at the AWE,[17] received a copy and reported the proposed meeting to the AWE Health and Safety Policy Board on 28 October 1980. He described it as a meeting *"with a view to establishing an independent authority to obtain post mortem data from personnel exposed to transuranic elements"*. His own opinion, which the Board supported, was that all exposed personnel should be considered to be of interest and the independent authority should obtain specimens as it thought fit.

17 The meeting proposed by Dr Vennart took place on 18 December 1980 and was well attended by representatives of the various organisations he had invited. The minutes record that a number of disparate views were expressed. Perhaps the most far-reaching proposal was made by Dr Roberts and Dr Schofield, who wanted to obtain organs *"from all known cases of exposure"*, whether or not plutonium had been detected in the urine, since there were so little data in existence on the relationship between activity in the urine and actual body content. They wished to approach all workers on the Transuranium Register of the National Registry for Radiation Workers[18] held by the NRPB, with a view to persuading them to donate their bodies for

17 The AWE was then part of the MoD

18 This registry had been established by the NRPB in 1976 as the basis for a large study of UK radiation workers but did not involve post mortem work

examination; Dr McLean, the NRPB Director, responded by stating that the NRPB *"would not wish to become involved in any procedure which involved indiscriminate analysis of tissues for individuals 'flagged' from a transuranium registry"*.

18 A further meeting was held in April 1981 by which time papers had been prepared by Professor Patricia Lindop,[19] dated 25 December 1980, and by Dr Schofield and Dr Roberts, dated March 1981. Professor Lindop wrote:

> *The present situation in the U.K. is indefensible. We have been talking for more than 6 years about the need for p.m. data. In the States the Transuranium Registry works fairly well … In this country only Dr Schofield's efforts have given us data … Important material will be lost if these people are not flagged in some way.*

Dr Schofield and Dr Roberts wrote:

> *It is suggested that autopsy tissue specimens are desirable from the whole range of potentially exposed workers and not just those who are known to be dying of malignant diseases. The problems of attempting to identify those employees who are about to die and approaching their relatives at the terminal stage are considerable. In addition some may die suddenly and unexpectedly and experience shows that cremations and internments* [sic] *have often taken place before Establishment medical departments are aware of the death. It is suggested that any system for systematically attempting to collect tissue samples should be based on approaching potentially exposed employees whilst they are quite fit.*

The employee and his next of kin would be invited *"to plan to inform the Registry immediately upon the death of the worker concerned so that an autopsy could be arranged"*.

19 Dr Schofield and Dr Roberts therefore proposed a registry of workers potentially exposed to transuranic and other radioactive materials. Entry to the registry and the subsequent taking of organs would be based upon consent.

19 Consultant radiobiologist at St Bartholomew's Hospital, London, often instructed by trade union solicitors to advise as an independent expert when a claim for damages was being pursued

1982: the proposal founders

20 The proposal to set up this registry was formally approved and the NRPB agreed to take the lead. In August 1982, after some delay, the NRPB formulated the proposed study, whose objectives were:

> 1. *To collect tissue specimens from the post-mortem examination of potentially exposed workers and to measure the tissue radioisotope content.*
> 2. *To study the relationship between monitoring findings during life and the autopsy findings.*

21 It was suggested that the requirements of the study include:

- drafting of a protocol by the NRPB and its agreement by management and unions;
- compilation, by employers, of a list of exposed workers who would constitute the target population;
- consent of workers in the study group to the proposal that after their deaths their dependants would be asked for permission for post mortem examination, the approach to be made by employers' medical personnel;
- arrangements to ensure that after the death of a worker in the study group the appropriate authorities were notified in time to ensure that a post mortem could be performed;
- arrangements to obtain the necessary organs and transfer them to the NRPB.

22 There was clearly still some work to be done before matters could be finalised. The NRPB proposal noted:

> *It is not at present clear what arrangement is likely to be most effective in ensuring that in the event of a participating worker's death, an autopsy examination is carried out. The arrangements might well differ in respect of workers and ex-workers. The parties who may be involved will include relatives, employers and their medical advisers, general practitioners, pathologists and NRPB staff (plus unions?). Their respective responsibilities will require consideration.*

23 The registry was discussed again at the NRPB on 13 December 1982:

> *Schofield said that he had already accumulated data from 35 cases and that this information had been made available to the US Transuranic* [sic] *Registry. He thought that close co-operation with the Americans should be maintained and that we should employ similar techniques for organ assessment. In addition to the scientific interest, this work has possible medico-legal consequences … The position at the moment regarding plutonium was that any recorded intake during life or any organ burden measured at post-mortem served as potential ammunition for a compensation claim. Schofield was not optimistic about the chances of trade union co-operation in a study that might lead to more objective appraisal, less advantageous to their members … Rae*[20] *… felt that the major difficulties, namely obtaining the workers' permission and then procuring the organs after death, could only be overcome by good local arrangements.*

The non-NRPB attenders[21] were unanimous that NRPB should take the lead in the study so that it could be seen to be independent. It was determined that the MRC should be advised of progress and that the existing group would act as a steering committee and not be enlarged.

24 For reasons which are not clear, the study did not proceed. At a meeting of BNFL senior medical officers on 24 November 1983, Dr Schofield said, when discussing the entirely different topic of a compensation scheme,[22] that the NRPB was not keen on setting up a transuranium registry; but there is no further clue from the papers seen by the Inquiry to explain the apparent change in the NRPB's attitude since 1982. Dr Roberts certainly remained supportive of the project, referring to it on numerous occasions at meetings of the AWE Health and Safety Policy Board throughout the early 1980s but ultimately he could do no more than keep a watching brief. Perhaps the project was not a priority for the NRPB; perhaps it was not considered practicable.

1988: further discussions

25 The Inquiry has seen no evidence of any further concerted attempt to establish a registry before 1988. Following Dr Schofield's death in May 1985

20 Dr Stewart Rae, Assistant Director (Medical) at the NRPB

21 Doctors Schofield, Roberts and Stott

22 The Compensation Scheme for Radiation-Linked Diseases was established in 1982 by BNFL and its recognised trade unions as an alternative to litigation: see chapter 7, "The Trade Unions and the Compensation Scheme"

his successor as BNFL Company Chief Medical Officer, Dr Adam Lawson, continued to liaise with the USTR. On 5 May 1988, Dr James McInroy[23] sent Dr Lawson his analytical protocol and several papers regarding data collected from the analysis of whole bodies. He also visited Dr Lawson the following month.

26 On 22 September 1988, a meeting of the Internal Radiation Dosimetry Group (IRDG)[24] discussed a proposal to set up a European actinide registry similar to the US Uranium and Transuranium Registries. The minutes record:

> *Dr Rex Strong*[25] *replied that BNFL is in principle very interested in participating in such a registry. During his visit to the US he would be having discussions with Professor Kathren of the US Transuranium Registry on this subject. BNFL Sellafield has autopsy results from over 60 cases involving actinide exposures, and would like to publish this data ... Dr Strong was interested to know what data European contributors to the registry might have. Mr Gibson*[26] *replied that the French could be the biggest contributors after the UK, but that problems could arise from the legal position in France regarding confidentiality of medical information. Other IRDG members were generally supportive of moves to set up a registry. Mr Gibson commented that he felt NRPB should take a leading role in the UK; this also seemed to be the view of other IRDG members who would contribute to the registry.*
> *Dr Etherington*[27] *replied that, although no formal commitment could as yet be made, NRPB was nevertheless very interested in the proposal. Some discussion followed on incentives that might be offered to selected workers.*

1989: UNIKORNES

27 In November 1989, Mr David Coulston[28] and Dr Strong prepared a formal proposal for a national UK post mortem registry, which they had begun to draft while visiting Professor Kathren the previous year. They suggested the

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23 Project Leader, Environmental Chemistry Group, Los Alamos

24 The IRDG existed to discuss matters relevant to the measurement of radionuclides taken into the body and comprised representatives from various nuclear organisations

25 Head of the Safety Assessment Group at Sellafield

26 Dr J A B Gibson, Contract Manager, Radiation Protection Division, Harwell laboratory, UKAEA

27 Secretary of the group, based at the NRPB

28 Member of BNFL Health and Safety Directorate, later appointed its Director in 1992

registry would initially operate on a passive basis, relying on receipt of data from coronial post mortems rather than actively seeking organs for analysis. A management group was established, including representatives from BNFL, the NRPB, the UKAEA and the MoD, under the chairmanship of Dr Roger Berry[29] and on 10 May 1990 it met to devise an appropriate protocol. The project became known as the UK Occupational Radionuclide Exposure Study, or UNIKORNES.

28 One of those who attended on behalf of the UKAEA was Dr Gibson, who described the proposal for the European registry and explained why post mortem data were required to confirm the accuracy and effectiveness of internal dose assessment techniques. Mr Coulston, however, pointed out the difficulties of trying to establish protocols for studies on a European basis when there was little uniformity in approach to this area within the UK itself. He and the other BNFL representatives stressed the need to get the UK system in order first. He emphasised BNFL's links to the USTR, upon whose system his initial paper had been based:

> *This registry has been in place for more than 20 years and having supplied USTR with UK data, BNFL enjoy a good working relationship with the people involved.*

One difference in approach, however, was that the UK registry would not actively request donations:

> *BNFL recognises that the next 10 years will be crucial in getting autopsy samples from "interesting" cases, but they will not invite donations in the way the US registers have done. It is not considered politic just at the moment – post-Gardner*[30] *and following the press reports of* [the NRPB's] *interest in obtaining tissues from members of the public in Cumbria.*

29 The first meeting of the UNIKORNES Management Group was held on 18 September 1990. A paper prepared by Mr William Leigh, one of the BNFL in-house legal team, summarised the law on removal of organs at post mortem for radiochemical analysis and addressed the Coroners Act 1988, the Anatomy Act 1984 and the Human Tissue Act 1961. Mr Leigh concluded:

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29 Director of Health, Safety and Environmental Protection, BNFL

30 In 1990 Gardner et al had identified an association between paternal pre-conceptional irradiation and childhood leukaemia and non-Hodgkin's lymphoma in a sub-population of workers at Sellafield (Gardner MJ, Snee MP, Hall AJ, Powell CA, Downes S and Terrell JD, Results of case-control study of leukaemia and lymphoma among young people near Sellafield nuclear plant in West Cumbria, *BMJ*, 1990, 300: 423–9). The paper led to widespread anxiety but subsequent epidemiological research failed to confirm the association

> *before arranging for the removal of organs for Registry purposes it would be prudent to obtain authority from all persons who may have lawful possession of the body … Performing an autopsy and taking organs for analysis as part of a UK Registry programme without "lawful" authority will be a criminal offence.*

Mr Leigh's warning was sensible if overstated: neither the Coroners Act 1988 nor the Human Tissue Act 1961 criminalised performing a post mortem or taking organs for analysis without authority, and the Anatomy Act 1984 expressly did not apply to post mortem examinations.

30 After the meeting, on 26 September 1990, Dr Andrej Slovak[31] reported to Dr Timothy Carter:[32]

> *I did not mention when we met that we have begun to put together a systematic attempt to look at what dosimetric information might be derived from autopsy data. The reason I didn't speak of it was that we had not then met with other folk in the industry to get agreement on action. Now we have met it looks at least possible that some progress will be made. Obviously this is a bit of a touchy issue and yet we are into the period when many "historic high exposure" workers are reaching old age so something must be contemplated. At present we are looking at what might be feasible and what is useful.*

Dr Slovak and Mr Coulston arranged to visit Professor Kathren in the US.

31 Those supporting the creation of a UK registry intended it in due course to cover the whole of Europe. This was emphasised at a meeting on 10 October 1990 of the IRDG at which reference was made to the establishment of European internal dosimetry registries. Three separate registries were to be set up, one of which was to contain post mortem data:

> *Due to legal problems, not all member states are able to participate in this register at present, however, an autopsy register is being established in the UK. Data from this register will be available to European partners who can provide reciprocal data.*

It was also noted that all three registries should ideally be compatible with the US registries so that data could be easily exchanged between them.

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31 Sellafield Chief Medical Officer, Dr Lawson having retired in March 1990

32 Director of Medical Services, Health and Safety Executive

32 One of BNFL's representatives on the UNIKORNES Management Group was Ms Jennifer Woodhouse,[33] who had long believed that post mortem work was of real potential benefit. In 1977, she had co-authored a paper[34] concluding that it would be prudent to obtain post mortem samples from an area far from Sellafield for comparison with local samples, effectively foreseeing the NRPB population studies.[35] In January 1991, she wrote:[36]

> *The way forward from our current position must be to obtain ever more data on human metabolism so that we can truly improve our models and quantify the variations from the mean. To this end post mortem studies and volunteer studies are to be encouraged.*

33 On 17 April 1991, Ms Woodhouse attended a meeting of the IRDG and confirmed UNIKORNES' intentions:

> *In the UK, BNFL is proceeding to set up an autopsy register. Access to this register will be limited to UK participants ... It is hoped that the success of the UK database will encourage other European countries to provide autopsy data to the register and thereby gain access to this database.*

She explained that she would be attending a second meeting of the UNIKORNES Management Group the following day: representatives would be present from BNFL, the UKAEA, the NRPB, the AWE and the MoD and there would be an external chairman, Professor John Tighe.[37] The aims of this meeting were to define the group's Terms of Reference and scientific objectives and to set up suitable committees, expert advisory groups and working groups. It was expected that Professor Kathren would be a member of the Advisory Group and close co-operation with the US registries was anticipated. Funding of the work was expected to be pro rata, with some additional funding for the central management co-ordination being provided by BNFL which would act as the lead organisation. Initially, existing BNFL data would be examined, although this was expected to be of limited value as they had not been specifically obtained for such a study.

34 The following day Ms Woodhouse presented a paper to the UNIKORNES Management Group, exhibiting a list of 54 Sellafield post mortem cases.

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33 Member of the Health Physics Department at Sellafield

34 Ward FA and Woodhouse JA, Consideration of the possibility of detecting plutonium uptake by members of the general public by post mortem, BNFL internal paper, 1977

35 See chapter 8, "The National Radiological Protection Board"

36 Strong R and Woodhouse J, Practical internal radiation dosimetry – the why, how and the limitations, BNFL internal paper, 1991

37 Emeritus Professor of Histopathology at Guy's and St Thomas' Hospital, London

Mr George Tyror[38] highlighted the UKAEA's sensitivity regarding any approach for volunteers from its workforce and made it clear that the UKAEA would participate only if there was full agreement as to how any approach should be made. His note records:

> *It was agreed however that the study could at least proceed on a basis of the currently available autopsy data which had come into the possession of organisations in an historic, adventitious way. There were thought to be about 80 such samples, but it is to be assumed that their source has effectively dried up … A proposal for the collation of the existing, retrospective autopsy data was agreed. In particular a master database will be established …* [to] *be held and operated by BNFL.*

A separate minute held on NRPB files indicates that it was agreed that a *"positive approach to identifying subjects of interest should be adopted rather than relying solely on the autopsy route"* and noted that the AWE agreed to proceed with a questionnaire to their workers to assess the general level of willingness to participate in a post mortem study programme.

35 At this stage all seemed set fair for the project. Ms Woodhouse co-authored a paper[39] which summarised the aims of UNIKORNES. She introduced the paper with a note:

> *Post-mortem studies on occupationally exposed workers represent a major potential source of information for the development of improved metabolic models for use in radiological protection dosimetry … Within the UK an initiative has now been taken to set up a joint industry programme of post-mortem studies to investigate the deposition patterns of radionuclides in occupationally exposed persons. Partners in the joint programme are currently BNFL, NRPB, AEA Technology and MoD. It is intended to maintain close links with the USTR and USUR programmes and with any future developments that may arise in Europe.*

36 The third meeting of the UNIKORNES Management Group was held on 18 June 1991. By then Dr Slovak and Mr Coulston had visited the USTUR and Mr Coulston had prepared a note entitled "Specific questions raised in respect of the operation of the US Registries". One of the questions was whether new cases were still being identified. He wrote:

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38 Director of Safety, UKAEA

39 Subsequently published in 1992: Woodhouse J, Slovak A and Wood R, Introducing Unikornes, IRPA 8 (M2–58), 1992

> *Very much as ourselves, most of the "interesting" cases relate to historical events … where new interesting cases arise then these are recruited wherever possible.*

Perhaps the first sign that the project might not be as straightforward as had been expected is a record of discussion as to how to obtain the support of the workforce. There was concern that the unions could regard post mortem studies with hostility because of the Compensation Scheme: organ content of plutonium estimated by analysis of organs tended to be significantly lower than that estimated by *in vivo* monitoring, potentially decreasing the compensation payable.[40]

37 The intention eventually to broaden any UK national registry to become truly European had been confirmed on 16 May 1991 at a meeting of the European Radiation Dosimetry Group (EURADOS):[41]

> *The intention was to set up the UK registry and then invite participation by other European countries … members were encouraged to explore possibilities in their countries. It is very important to act quickly to identify those with significant intakes in the early days of nuclear fuel handling before they die.*

38 The UNIKORNES Management Group next met on 8 November 1991. It was attended by Professor Kathren, who also gave a detailed presentation to industrial and public relations representatives of the member organisations a week later. On 3 December 1991, Ms Woodhouse reported to the IRDG that Professor Kathren had given useful information as to how to present the registry to employees and the general public. As yet, the proposed scheme had not been discussed with the workers or their union representatives and the next milestone, scheduled for Easter 1992, would be *"the presentation of the UK Autopsy Register to the workforces involved and the general public"*.

39 Hopes that the registry would come into existence were now high but they were soon to be dashed. It was agreed at a meeting on 21 February 1992 that the unions would be sent a briefing paper in March with a view to a press release in May 1992. Dr Gibson took the proposal to the UKAEA Executive in March 1992 in preparation for its presentation to the trade unions and staff-side representatives. However, the Executive decided not to support it: the cost was thought to be out of proportion to the likely benefit.

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40 See chapter 7, "The Trade Unions and the Compensation Scheme" and chapter 5, "British Nuclear Fuels Limited"

41 A pan-European dosimetry discussion group

There were also concerns at BNFL: Dr Slovak advised Mr Coulston on 13 April 1992 that the Sellafield workforce was hostile to the idea of further studies of any kind, that financial support for the project in BNFL was insecure and that it would be inopportune to make any further public statements on the matter in 1992 as to do so could jeopardise the prospect of UNIKORNES' eventual success.

40 Despite this setback Ms Woodhouse remained committed to the idea of a national post mortem registry. She reported to the next meeting of the IRDG on 1 July 1992 that less progress had been made than she had hoped but that work continued in preparation for the setting up of the registry and she anticipated that the scheme would still be presented to unions and staff some time in 1993. The following year, in a lecture presented to an IRDG workshop on 20 April 1993, she remained optimistic that the registry could be introduced:

> *The only route open to assess validity* [of monitoring] *is to look at actual organ deposition in exposed humans – ie. an autopsy programme. This will give a snapshot of organ content at a single point in time and the results can be compared to the predictions of these parameters produced by the models … The chief, and only large scale, systematic autopsy programme mounted to date is that of the United States Transuranium and Uranium Registry – USTUR … there has also been some work in the UK (about 60 cases) although not on a systematic basis. It is hoped to rectify this situation in the near future.*

41 However, six months later the impetus for the scheme had fallen away, at least in part. Minutes of a meeting of the IRDG on 13 October 1993 record:

> [Ms Woodhouse] *reported that the UK Autopsy Register has now contracted to the BNFL research programme into plutonium bioassay. The three aspects of the programme are:*
>
> *i) an autopsy register;*
>
> *ii) human volunteer biokinetic studies;*
>
> *iii) analysis of urine bioassay data.*
>
> *Part (iii) of the study is being initiated to identify potentially appropriate individuals to approach in relation to part (i). However, part (i) will not be initiated until it is appropriate to approach the Unions on this matter.*

42 It appears that the time to approach the unions was never felt to be right and in 1995 Dr Slovak, previously a strong proponent of the registry, wrote in a paper prepared for the BNFL Company Health and Safety Executive Committee (CHSEC) that he now doubted its value:

> *The long-running and quite costly US registries (USUR, USTR) hold what is almost a monopoly in post-mortem validation of dosimetry models. This has long been mooted as an area of research which we could copy and a serious and concerted effort (UNIKORNES) was initiated a few years ago to get it going. This was not successful and now BNFL would have to go it alone. There is no doubt that the US model could be improved on both operationally and in its research effectiveness. There is equally no doubt that cases of interest, perhaps several hundred, could be recruited in the UK. However, when reduced to cases of "unique" interest or value the number is much smaller, say 20 to 25. A separate programme in the UK therefore seems of limited value … The idea of doing large-scale autopsy studies should be abandoned. The possibility of a small number of cases of special interest being taken up by USUR/USTR should be explored and settled … Large scale involvement in classical dosimetry modelling and autopsy work is not recommended although some residual involvement is proposed … CHSEC is asked to endorse these proposals and to empower HSD* [Health and Safety Directorate] *to develop the proposals into a programme of work.*

2005: a final attempt

43 In July 2005, a proposal was drafted jointly by the Health Protection Agency (HPA, into which the NRPB had been incorporated) and Westlakes Scientific Consulting,[42] entitled "Assessment of internal doses resulting from occupational exposure to plutonium". The proposal envisaged collaborative research to ensure that estimates of absorbed dose to the lungs and other organs for Sellafield workers were as accurate as possible. In addition, the two bodies agreed to develop a proposal for further investigations using post mortem data from the USTUR and consideration of a new programme of post mortem studies on selected Sellafield plutonium workers who would give informed consent to join the programme, thus effectively restarting UNIKORNES. It has not been possible for the collaborative research to be implemented due to the institution of the Inquiry, which led to an

42 A private company which employed individuals from BNFL who had been involved in epidemiological studies

agreement that post mortem data should not be used pending production of the Inquiry's Report.

Exchange of information

44 The links between the UK and the USTUR were strong. Much of the USTUR's generic documentation, which explained its procedures, was copied to BNFL. This documentation included:

- an information sheet confirming the history of the USTUR, its objectives and details of its routine autopsy and its post mortem whole body donation programmes;
- a draft memorandum, prepared in May 1982, summarising for a deceased's family the information required at the time of death to facilitate the transportation of the body to the research facilities;
- an example of the consent form used by the USTUR to provide authority for post mortem.

Copies of most of the research papers generated as a result of the US work were also, understandably, held at Sellafield.

45 Dr Schofield and the USTUR also exchanged data derived from their post mortem studies. Minutes, dated 9 October 1985, of the Advisory Committee to the USTUR record:

> *LAWSON indicated his strong desire to continue the cooperative exchange of information begun by his predecessor, GEOFFREY SCHOFIELD. SCHOFIELD, prior to his death in May 1984,*[43] *had furnished the USTR with results on partial body autopsies of 35 British nuclear workers … The cooperative exchange of U.S. and British autopsy information continues to be most appropriate and valuable. It is a classic example of how mutual benefits can be achieved at virtually no additional cost.*

46 Dr Lawson did indeed continue to exchange information: altogether, data from 51 UK cases[44] were sent to the USTUR. In the majority of cases the datasheets provided summarised the data found in the Sellafield laboratory reports and provided further information, typically the total whole body

43 Dr Schofield had in fact died in May 1985

44 Forty-six autopsy cases and one biopsy case involving Sellafield workers and four autopsy cases relating to Aldermaston workers, sent in three batches of 14 cases (by Dr Schofield in the mid-1970s), 21 cases (by Dr Schofield in the early 1980s) and 16 cases (probably by Dr Lawson in 1985)

burden, penetrating external radiation dose, an estimate of plutonium body burden, the number of years employed as a radiation worker, employment dates and cause of death. In some cases additional background information on, for example, smoking habits, radioactive contamination incident data, and height and weight was also provided. Data on levels of plutonium in urine were not sent. In all the cases the names of the individuals were disclosed. Sellafield Limited accepted that the provision of these data constituted a breach of confidence.

47 The existence of the data was mentioned in USTUR annual reports although the individuals themselves have never been named. The data have never been publicly evaluated nor used in studies by US researchers. The failure on the part of US researchers to use the UK data is probably due to the absence of associated data such as urinalysis results, which rendered comparisons of *in vivo* estimations of plutonium concentrations with post mortem estimations less meaningful. The data themselves have, since the establishment of this Inquiry, been erased from the USTUR.

Exchange of tissue

48 Although data were exchanged between the UK and the US, it does not appear that any human tissue was sent to the US. However, on two or three occasions Professor Nicholas Priest[45] brought small amounts of bone from the USTUR to the UK for analysis by autoradiography, a technique on which he is a leading authority. He satisfied himself that appropriate consent had been obtained and instructed colleagues at the UKAEA to return any unused tissue to the USTUR.

49 The Inquiry encountered only one suggestion that tissue had been sent from the UK to the US. The USTUR annual report covering the period 1 October 1989 to 30 September 1990, and dated June 1991, provides a breakdown showing the distribution of *"analyzed autopsy and surgical specimens by participating industrial site for both Registries"*. The total figure is said to be 261 including a figure of 20[46] from the UK. Unfortunately, the report does not specify whether in those 20 cases actual tissue specimens or merely data had been provided. The former interpretation would accord with the report's

45 Then a member of the Biomedical Research Department, UKAEA

46 The figure of 20 is in itself inaccurate given that the number of UK cases where data had been provided by that time was 51

Executive Summary which refers to *"261 autopsy or surgical **specimen donations**, which include 11 whole bodies"* [emphasis added]. However, the Inquiry investigated this issue in detail and could find no evidence that any tissue had been supplied to the USTUR from the UK. Both Dr McInroy and Professor Kathren said that there had been no exchange of tissue and the Inquiry saw nothing to contradict their evidence.

Why did the UK proposals fail?

50 The Inquiry explored with Professor James, the current Director of the USTUR, the reasons why the UK national registry was never established. He perceived a reluctance in the UK to ask for consent for organ donation and analysis. In contrast, the informed consent of the participants lay at the heart of the USTUR. It was explained to employees at an early stage what the registries were, how they worked and why it was important that volunteers came forward. No pressure was applied to employees who did not want to participate, but many did volunteer. The relationship with employees was long-term, their consent was respected and registrants could opt out at any time without detriment to themselves. The existence of the registries was out in the open.

51 The Inquiry considers there to be much to support Professor James's assessment. At critical stages, matters were not put to the unions for their consideration. This may have been because of concern that the proposal might not meet with approval, particularly given issues which occupied the workforce in the light of other ongoing epidemiological projects.[47] Perhaps those primarily involved in supporting the proposals in the 1980s had other matters upon which to focus: Dr Schofield was undertaking his post mortem work in any event, the NRPB's population studies were running and, of course, there was already a good deal of information available from the USTUR. It is apparent that the cost also became an issue.

52 Whatever the reason, it is regrettable that the opportunity to put post mortem work on a legitimate footing was missed. Those who were involved in formulating proposals recognised the potential benefits of a consent-based scheme and the Inquiry heard evidence that the registry would have represented a unique opportunity to investigate the effects of relatively high

47 See, for example, note 30, above, and the issues arising out of Gardner's work

historic exposures, both external and internal, which will almost certainly never be duplicated due to modern, more stringent safety standards. Despite those attractions the will to implement the project was insufficient and it seems highly unlikely that it will ever be re-visited.

Strontium and the Medical Research Council

Chapter 11

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Contents

Introduction

1 Between 1955 and 1973, a series of studies took place in the UK into the levels of strontium-90 in human bone. This radioactive element, formed as a by-product of nuclear fission, caused concern because of its potential danger to human health. Bone for the studies was taken at post mortem from more than 6,000 people. The main organisation involved in running the studies was the Medical Research Council (MRC).

The MRC and radiobiological research

2 The MRC was formed in 1913 as the Medical Research Committee and Advisory Council. It funds scientific and public health research in universities, hospitals and other institutes with the aim of improving human health. Research sponsored by the MRC has led to some of the most significant discoveries in medical science to the benefit of millions of people in the UK and around the world. The MRC is currently a non-departmental public body (government advisory body) funded mainly through the Department for Innovation, Universities and Skills (now the Department for Business, Innovation and Skills). In 2007/08 it spent £625.5 million.

3 The MRC has advised UK governments on the hazards of radiation since the Second World War and it remains one of the principal supporters of research into the biological effects of ionising radiation. Its Radiobiological Research Unit (RRU) was established at Harwell in 1947,[1] under the direction of Dr John Loutit, to investigate the risks posed to those such as industrial workers, doctors and scientists whose work involved exposure to man-made ionising radiation.

4 MRC research on the effects of radiation was also carried out from 1956 by the Clinical and Population Cytogenetics Unit in Edinburgh (later renamed the MRC Human Genetics Unit) and from 1959 until 1972 by the MRC Environmental Radiation Research Unit at Leeds.

5 The MRC formed a number of advisory committees on the biological effects of radiation. The Committee on Protection against Ionising Radiations (known as PIRC) was established in 1951 and was replaced in the early 1980s by the Committee on the Effects of Ionising Radiations (CEIR).

1 In 1969 the unit was renamed the Radiobiology Unit

6 In 1953, the MRC and the Ministry of Health established the Radiological Protection Service (RPS) to provide advice and services for the protection of workers and the public against radiation hazards. It conducted research and provided technical support to the Radioactive Substances Advisory Committee (RSAC), the statutory body that then advised Ministers on radiation matters.

7 In 1970, the National Radiological Protection Board (NRPB) was established by the amalgamation of the RPS and the Radiological Protection Division of the United Kingdom Atomic Energy Authority (UKAEA). The MRC subsequently worked with the NRPB in a number of joint committees.

8 From 1970, the MRC continued to advise government on the risks of radiation exposure. Many of its former statutory responsibilities, including the thorny political issue of setting "permissible exposure levels", were transferred to the newly-created NRPB.

Fallout

9 The explosion of a nuclear bomb creates radioactive particles which either fall to the ground in the locality of the explosion or are drawn up into the stratosphere. The particles are made up of weapon debris and fission products and, in the case of an explosion near the ground, irradiated soil. Those which reach the stratosphere may fall to the ground days or years later, perhaps thousands of miles away from the explosion. This is radioactive fallout. The particles may enter the food chain by contamination of soil, water, plants and animals.

Strontium-90

10 Strontium is a naturally-occurring element, first discovered in lead mines near the Scottish village of Strontian in 1787. Strontium-90 is a radioactive isotope of strontium. It is created only by nuclear fission and so was unknown before the 1940s. It is a component of nuclear fallout and is also produced in nuclear reactors. It emits beta radiation, decaying into

yttrium-90. In the human body it becomes concentrated in bone (a "bone seeker"). It has a radioactive half-life[2] of 29 years.

Early studies in the US

11 In 1949 the United States Atomic Energy Commission (US AEC) initiated a study, known as Project Gabriel, to evaluate the radiological hazard posed by fallout from nuclear weapons. An early conclusion was that the most hazardous element of fallout was strontium-90. In 1953, it was concluded, at a conference held to review Project Gabriel, that there should be a worldwide assay of the distribution of strontium-90.

12 As a result, in 1953 the US AEC set up Project Sunshine to monitor levels of strontium-90 in food, water, cow's milk, soil, vegetation and animal and human bone from 19 countries,[3] including England. It was anticipated that exposure to strontium-90 in England would be very low but that samples would be readily obtainable. It is not clear how this conclusion was reached.

13 On 18 January 1955, the US AEC held a conference at which, among other things, the means by which human material could be obtained for analysis for strontium-90 was considered. Dr Willard Libby[4] said:

> *human samples are of prime importance and if anybody knows how to do a good job of body snatching they will really be serving their country … I don't know how to snatch bodies. In … 1953 we hired an expensive law firm to look up the law of body snatching. This compendium is available to you. It is not very encouraging. It shows you how very difficult it is going to be to do it legally.*

14 The discussion covered the most productive avenues for obtaining bone. Personal relationships with senior pathologists were felt to be an important factor and Dr J Laurence Kulp,[5] who later published a series of five papers[6]

2 Scientific terms are discussed in chapter 2, "Science"

3 Brazil, Canada, Chile, China, Colombia, Denmark, Ecuador, England, France, Germany, India, Iran, Italy, Japan, Liberia, South Africa, Switzerland, United States and Venezuela; Puerto Rico was also included

4 A chemist and then commissioner at the US AEC

5 Professor of Geochemistry at Columbia University

6 Kulp JL, Eckelmann WR and Schulert AR, Strontium-90 in Man, *Science*, 1957, 125: 219–25; Kulp JL, Eckelmann WR and Schulert AR, Strontium-90 in Man II, *Science*, 1958, 127: 266–74; Kulp JL, Schulert AR and Hodges EJ, Strontium-90 in Man III, *Science*, 1959, 129: 1249–55; Kulp JL, Schulert AR and Hodges EJ, Strontium-90 in Man IV, *Science*, 1960, 132: 448–54; and Kulp JL and Schulert AR, Strontium-90 in Man V, *Science*, 1962, 136: 619–32

containing the results of analyses of bone for Project Sunshine, emphasised this:

> *You have to have personal interest in and almost a friendly tie to develop this, because you have to have the medical records … I think that with this connection through one of the top medical people who is internationally known, it would not be hard at all to be able to establish the sites.*

Reliance on personal relationships was also a feature of early research into strontium-90 levels conducted in the UK.

15 The US AEC was aware of potential problems arising from undertaking this work without permission from the deceased's relatives. At the conference Dr John Bugher[7] remarked on the preference for obtaining bone samples such as ribs or vertebrae rather than ashing whole bodies or stillborn babies:

> *It should be easy, particularly at autopsy, to get not only rib, but … one, two or three vertebral bodies … a couple of hundred grams easily of wet bone … It relieves one of the difficulties inherent in getting still born babies … To the extent that we can avoid obliterating the trace of the individual as an individual human being, the better off we are here. When people who have released a body for disposal change their minds and come back and decide they want the body after all, and then realise it is only represented by a few grams of ashes, they are likely sometimes to take a rather dim view of our procedures.*

16 The only British pathologist identified as having supplied bone for Project Sunshine is Dr Cecil Treip, of Central Middlesex Hospital, London. Dr Kulp's papers[8] refer to the analysis of vertebrae, supplied from London, taken from 43 individuals who had died between 1955 and 1958. The bone was sent to the US for ashing and analysis. All records from the Central Middlesex Hospital dating from before 1970 were destroyed in 1999.[9] The Inquiry has seen no evidence that any body parts other than those vertebrae (and certainly not whole bodies) were sent to the US from the UK.

17 Although in Dr Kulp's later papers there are references to data from the strontium research conducted in the UK, it is clear that the bone provided by Dr Treip for Project Sunshine fell outside those studies.

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7 Director of the Division of Biology and Medicine, US AEC

8 See note 6, above

9 On the merger of Central Middlesex Hospital with Northwick Park Hospital

Research starts in the UK

18 The Atomic Energy Research Establishment (AERE) began to monitor levels of radioactivity in the atmosphere in 1948 and deposition from rainwater and air in early 1951. In 1954, it became part of the newly-formed UKAEA.[10] Discussions that year between the US AEC, the UKAEA and the Ministry of Agriculture, Fisheries and Food (MAFF) regarding fallout from nuclear weapons testing led to a programme of analysis of strontium levels in soil, sheep bone and cow's milk which started in March that year. In August 1954, the study was widened to include vegetation.

19 In 1955, concern over the risk posed to health by radiation prompted the Prime Minister, the Rt Hon Winston Churchill MP, to order an investigation by the MRC. To undertake the investigation, a committee on the Hazards to Man of Nuclear and Allied Radiations was established under the chairmanship of Sir Harold Himsworth.[11] It included Sir John Cockcroft, Director of the AERE, Dr Loutit, Director of the RRU at Harwell, and a secretariat comprising MRC headquarters and scientific staff. As Director of the RRU, Dr Loutit was already directly accountable to Sir Harold Himsworth.

20 Sir Harold Himsworth's report[12] was published in June 1956. As well as recognising the potential dangers of nuclear radiation, it and subsequent parliamentary debate focused particularly on the dangers of strontium-90 in nuclear fallout. In the course of the debate the Rt Hon Dr Edith Summerskill MP[13] said:

10 It continued to be referred to as the AERE

11 Then Secretary of the MRC, a role akin to that of Chief Executive

12 *The Hazards to Man of Nuclear and Allied Radiations*, Cmd 9780 (HMSO, 1956)

13 Member of Parliament for Warrington

> *In my opinion … the part of the Report which calls for the most serious concern deals with the effect of radioactive strontium …* [which] *can contaminate drinking water, crops or soil … Subsequently, man and animal will receive strontium both in their food and in their water. Strontium is easily absorbed and then stored for long periods in the bones of the body. Here it can give rise to bone tumours and, by irradiating the bone marrow, to aplastic anaemia or leukaemia … the Committee emphasized the importance of the effect of strontium in the bone … At its present level, no detectable increase in the incidence of ill-effects is to be expected. Nevertheless, recognising all the inadequacy of our present knowledge, we cannot ignore the possibility that, if the rate of firing increases and particularly if greater numbers of thermonuclear weapons are used, we could within the lifetime of some now living, be approaching levels at which ill-effects might be produced in a small number of the population. In my opinion, this constitutes a most serious warning.*[14]

21 In 1955, while Sir Harold Himsworth's committee was preparing its report, research into levels of strontium in human bone had begun at the AERE. The MRC was involved from an early stage in the co-ordination and review of the work.

22 The first report[15] contained preliminary results of the analysis of 17 samples of human bone. It was presented to the MRC's subcommittee on Internal Radiation on 28 June 1956. This was a subcommittee of PIRC chaired by Professor Joseph Mitchell,[16] whose membership included Dr Loutit, Dr Edward Pochin[17] and Dr Andrew McLean.[18] The report was presented by Mr A C Chamberlain of the UKAEA, one of its co-authors, who was himself a member of the subcommittee. Dr Thomas Graham[19] attended the meeting as a guest.

23 The report was circulated widely within the AERE and Atomic Weapons Research Establishment (AWRE) divisions of the UKAEA and at Windscale (Sellafield). The distribution gives an indication of the widespread

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14 Hansard, HC Deb, 16 July 1956, vol 556, cols 928–75

15 Booker DV, Bryant FJ, Chadwick RC, Chamberlain AC and Morgan A, *Radiostrontium fallout in soil, plant and bone up to December, 1955*, HP/M108 (AERE, 1956)

16 A radiotherapist, later to become Regius Professor of Physic at Cambridge University

17 Then Director of the Department of Clinical Research, University College Hospital, London

18 Then Chief Medical Officer, UKAEA Risley

19 Senior Medical Officer at the UKAEA's Sellafield site

knowledge at this early stage of the value of human tissue in radiation research.

24 Neither the source of the human bone nor the period over which it was collected is apparent from the report. However, the subcommittee minutes record discussion about obtaining samples:

> *Further work was being carried out on the strontium content of the bones of children, using specimens provided by Great Ormond Street Hospital. Members of the Sub-committee asked whether it was possible to get bones from persons who had lived in other districts and it was suggested that it would be worth attempting to get material from hospitals covering the North Wales area. Birmingham might prove to be the best source for such material.*

25 Perhaps unsurprisingly, researchers involved in relevant work co-operated in obtaining bone samples. For example, the report and a paper summarising the research presented to the subcommittee thank Dr S R Stitch, who was undertaking work for the MRC on non-radioactive trace elements in human tissue and bone, for his assistance in obtaining the human bone samples.

26 A second report[20] was published on 5 September 1956, again by the UKAEA. The aim of the research was to explore the pathway of uptake of strontium-90 from fallout in soil via plants to animals and then to cow's milk and humans. The report reveals that bone was removed from 29 individuals, ranging in age from stillborn babies to a 65-year-old, and analysed between October 1955 and February 1956. The individuals came from Swindon, Reading, Birmingham, Oxford, Dudley and Carlisle. Most of the bone was rib but some came from the leg – femur or tibia. Data from the 17 samples described in the first report, from June 1956, appear to have been used also in this second paper.

27 This paper was the first of a series of 24 papers on levels of strontium-90 in human bone, the last of which was published in 1973.

28 Bone suitable for the research was not easy to come by. Bone from individuals who had died in accidents was preferred to bone from those who had died after long illnesses because of concern that the terminal illness might affect the results. Such accidental deaths were rare. There was particular interest in bone from babies and young children. They were known to have a high uptake of calcium because they were growing and it

20 Bryant FJ, Chamberlain AC, Morgan A and Spicer GS, *Radiostrontium fallout in biological materials in Britain*, HP/R 2056 (AERE, 1956)

was therefore thought that their bone would contain more strontium than adult bone. This theory was confirmed by the early analyses carried out in 1955 and 1956, and by mid-1956, it appears, efforts were concentrated on obtaining bone from babies and young children:

> *Analyses of 21 bones additional to those reported in HP/R 2056 have been completed … Work has been concentrated on the bones (femurs) of children, since previously it had been shown that they show higher activity than those of adults.*[21]

It is apparent from the paper that the 21 bones were taken from 21 different individuals.

29 In order to improve the geographical coverage of the research, attempts were made to obtain samples of bone from various regions of England. Mr Chamberlain reported progress in a letter, dated 28 May 1957, to Dr Brandon Lush, a Senior Medical Officer at the MRC. Approaches had been made on behalf of the UKAEA by three doctors (Dr Pochin, Dr Robin Mole[22] and Dr Graham) to seven hospitals in England:

Hospital	Specimens supplied (January to May 1957)
Great Ormond Street, London	7
University College, London	3
Carlisle	6
Birmingham Children's	2
Alder Hey, Liverpool	4
Lancaster	–
Shrewsbury	–
Total	**22**

21 Booker DV, Bryant FJ, Chamberlain AC, Morgan A and Spicer GS, *Radiostrontium and radiocaesium measurement in biological materials to December 1956*, HP/R 2182 (AERE, 1957)

22 Then member of staff and later Director of the MRC Radiobiological Research Unit, Harwell

By mid-1957, bone had been supplied by pathologists from England but not yet from Wales, Scotland or Northern Ireland.

30 Ashed samples of sheep bone, but not human bone, were sent from England to the US for analysis and ashed samples of sheep bone, hay and cow's milk were sent from the US to England for the same purpose. These exchanges allowed confirmation that the results from the two sides of the Atlantic were comparable.

31 The UKAEA's small-scale research continued until around the middle of 1957. The published papers[23] suggest that during this period bone had been removed from 86 individuals:

1955 (from October)	13
1956	46
1957 (to end of June)	27

Expansion of the research

32 From mid-1957, steps were taken to expand the research, mainly because of growing public and political concern, particularly in Wales, over increased levels of strontium in sheep bone and cow's milk. The potential health risk resulting from fallout caused by nuclear testing was a major political issue, particularly as the test programmes continued. The Prime Minister, the Rt Hon Harold Macmillan MP, was asked questions on the subject in the House of Commons on no fewer than 19 occasions between March and May 1957.

33 A redefinition of the roles of the organisations involved in the strontium research was proposed and details were provided in a minute, dated 28 June 1957, from the Earl of Home, Lord President of the Council, to the Prime Minister, who responded on 29 June 1957 with a terse note: *"I agree."*

34 On 31 October 1957, the Prime Minister announced the reorganisation to Parliament:

23 Bryant FJ, Chamberlain AC, Morgan A and Spicer GS, *Radiostrontium in soil, grass, milk and bone in the United Kingdom, 1956 Results*, HP/R 2353 (AERE, 1957); Bryant FJ, Henderson EH, Spicer GS, Webb MSW and Webber TJ, Radioactive and natural strontium in human bones (UKAEA Research Group, 1959); Arden JW, Bryant FJ, Henderson EH, Lloyd GD and Marton AG, Radioactive and natural strontium in human bone; UK results for 1959, Part 1 (UKAEA Research Group, 1960)

> *To ensure that the fullest possible precautions are taken, some reorganisation of the machinery for monitoring fall-out, and of the responsibility for its operation, was introduced last summer. The Agricultural Research Council has accepted responsibility for monitoring soil, herbage, farm animals, and milk and other foodstuffs, while the Atomic Energy Research Establishment will remain responsible for monitoring air and rainwater and for analysing the radioactivity present in samples of human bone. The Joint Committee of the Agricultural and Medical Research Councils and the Development Commission on Biological (Non-Medical) Problems of Nuclear Physics, of which Lord Rothschild is Chairman, has been charged with the responsibility for the oversight of this monitoring. To assist it in this task, the Joint Committee has set up a special subcommittee under the chairmanship of Dr. Loutit, Director of the Medical Research Council Radiobiological Research Unit.*[24]

35 In a letter, dated 27 January 1960, Dr Loutit described the structure of the subcommittee and its line of accountability:

> *the Managing Committee on Monitoring* [the subcommittee] ... *reports not only to its senior committee but direct to the Secretaries of the Agricultural Research Council and the Medical Research Council.*

Membership of the subcommittee included representatives from the MRC, a number of government departments, the Agricultural Research Council (ARC), the UKAEA and various independent scientists.

36 The MRC now had overall responsibility for the strontium research programme in the UK. It was responsible for obtaining bone and undertaking initial processing; the UKAEA provided solely an analytical service.

37 An additional reason for the reorganisation was the desire for research into these matters not to be conducted entirely by the UKAEA. A representative of MAFF expressed the view that the involvement of the MRC and the ARC in monitoring would help to avoid criticism that the UKAEA were *"judges in their own cause"* and the preliminary meeting of the newly-appointed Joint Committee agreed that this was beneficial.

38 The involvement of politicians at the highest level of government – the Prime Minister and the Lord President of the Council – is indicative of both

24 Hansard, HC Deb, 31 October 1957, vol 575, col 394

the importance attached to this research and the extent of knowledge of the use of human bone.

39 In the second half of 1957, the MRC tried to expand the sources of bone, making contact with senior pathologists in Wales and Scotland to encourage them to help with the research and to ask their colleagues to do the same. For example, on 8 July 1957 Sir Harold Himsworth wrote to Professor Jethro Gough, of the Welsh National School of Medicine:

> *I am writing to ask for your help on an important matter. As you know, the MRC is responsible for advising the Government on the hazards to man of nuclear and allied radiations … What I need are bone samples from children of 0–5 years of age and from stillbirths and more particularly from children who live in mountainous areas of Wales. We should need a femur from each and the following are the particulars: One femur from each child, this to be cleaned from soft tissues, kept in a refrigerator until ready for dispatch, then parcelled into cellophane, put in a cardboard box and sent through the normal post to … UKAEA, Harwell. We should also need particulars about the subject: Name, date of birth and date of death, whether breast or bottle fed, place where the child has lived, and whether the milk that the child has been taking has come from local cows or is part of a pool drawn from a distance.*

40 Professor Gough agreed to assist and forwarded the request to other pathologists in Wales. Welsh hospitals became a significant source of material for the research. Although in subsequent correspondence it was indicated that bone from deceased older children would also be useful, the majority of bone collected throughout the research, particularly in Wales, was from children under six years of age.

41 The attempt to expand the research bore fruit: while the average number of bones provided from people dying between 1955 and mid-1957 had been approximately 50 per year, the figures from mid-1957 were as follows:

1957 (from July)	98
1958	203
1959	270

42 The largest section of the research into strontium levels in bone in the UK population was described in various ways: the AERE analyses; the UKAEA analyses; and the UKAEA national survey. In this chapter it is referred to as the national survey; this best describes its nature. It was managed by

Dr Loutit of the MRC and the analytical work was carried out by the UKAEA. It received bone from various hospitals around the UK. The research later included smaller, geographically-based studies centred on Glasgow, Cambridge and London, which are considered in more detail in paragraphs 64–71.

Arrangements for the national survey

43 The Inquiry has not identified any unifying protocol in which the basis, design and procedure for the research are set out. The production of such a document would now be standard practice but this was not the case in the 1950s. However, review of the available papers and correspondence has enabled the main practical steps taken in respect of each sample to be identified.

Bone was removed at post mortem

44 The majority of the bones came from post mortem examinations on babies and children under the age of six. They were removed either by the pathologist performing the examination or by his mortuary technician. During the first part of the survey the femur was supplied, often accompanied by other bones from the same body, typically the sternum or tibia but occasionally all or part of the skull or the pelvis. Specimens were *"placed in clean, new cellophane bags provided from the same central store to all collecting centres for storage and transport"*.[25]

45 Dr Loutit had decided early in the survey that the femur would be the bone of choice. The main reason for this was pragmatic. Dr Loutit thought that it was the bone most likely to be available following post mortem because he believed it to be standard practice at post mortem to remove the femur so that the marrow could be examined.

46 The Inquiry heard evidence that while some pathologists in the 1960s did follow the traditional practice of routinely removing the femur, many did not. In 1959, difficulty in obtaining bone drove Dr Loutit to offer payment:

25 Mole RH, Stable strontium in human bone: geographical and age differences in the United Kingdom and their correlation with levels of strontium-90, *British Journal of Nutrition*, 1965, 19: 13–33

> *We are, however, chronically short of samples from children of 1–19 … If you can obtain on account bones like this for me would you address them to me here. We are empowered to offer 5/- out of pocket expenses to the laboratory or its staff for each sample.*[26]

The Inquiry has found no evidence that any payment was made as a result of this offer, or of any more extensive system of payments.

47 At the end of 1965, the MRC decided to use vertebral bodies instead of femora. The rationale for the change was that parts of vertebrae could be removed easily through the standard chest incision, whereas removing a femur required dissection of the leg which might otherwise be unnecessary:

> [vertebral bodies are] *readily accessible without giving difficulty to the PM attendant in reconstructing the cadaver … Many of the present supplying pathologists do not like removing femora and would welcome a change in the selected bones.*[27]

In addition, the absence of the femur led to a lack of rigidity in the leg, requiring reconstruction with a broom handle or similar wooden pole.

Dr Loutit received bone

48 Correspondence from July 1957 indicated that bone was to be sent to the UKAEA at Harwell. However, most of the bone was sent to Dr Loutit at the MRC RRU (also at Harwell). It appears that various different methods of transporting the bone were used, including post and dedicated collections arranged by the MRC. Towards the end of the survey, Dr Loutit described his practical role as follows:

> *I have been largely a co-ordinator and post office. Co-operating pathologists in various cities collect bones from their routine autopsies and send them to me where a central record is kept. I have the bones ashed and the ashes sent to Capenhurst for estimation of ^{90}Sr. Essentially the role I have played is that of interpreter of the results … It has meant some planning in seeking supplies of bone from appropriate age groups.*

26 Letter, 6 October 1959, to the Public Health Laboratory in Aberystwyth

27 Letter, 12 July 1963, from Dr Loutit to Sir Harold Himsworth

Bone was sent to be ashed

49 Bone supplied for the survey was frozen on receipt until required for ashing, which was done at various locations:

To April 1958	UKAEA's Health Physics Laboratory, Harwell
April 1958 to May 1967	ARC, Wantage
From June 1967	MRC RRU, Harwell

Ashing involved incinerating the bone in a furnace and is described in more detail in chapter 2, "Science". At the end of the process, only between 30g and 150g of ash remained and no bone.

Ash was analysed

50 Analysis was not carried out in the same place as ashing. Until the end of 1963, analysis was performed in the UKAEA Chemistry Division's Woolwich Outstation, where Dr F J Bryant[28] had overall responsibility. From 1964, the ashed material was analysed at the UKAEA's laboratory at Capenhurst, Cheshire, under the control, for most of the relevant period, of Dr W Fletcher, chief analyst at the laboratory.

51 The ash was transported to the analytical laboratories in glass bottles. When available, 50g of ash was used for analysis. It was dissolved in strong acid and the strontium from the resulting solution was plated onto a steel disc. The strontium-90 on the disc was then quantified. At the end of the process, any unused ash, the acid solution and the disc were disposed of as laboratory waste. The process is described in various published papers[29] and is similar to the method used for assay of plutonium which is set out in chapter 2, "Science".

The results were published

52 The analytical results were published approximately every six months, initially by the UKAEA and from 1959 by Her Majesty's Stationery Office (HMSO) on behalf of the MRC. The authors of the national survey were

28 Then head of Woolwich Outstation, UKAEA

29 Bryant FJ, Morgan A and Spicer GS, The determination of radiostrontium in biological materials, R 3030 (AERE, 1959); and Bryant FJ and Loutit JF, The entry of strontium-90 into human bone, *Proceedings of the Royal Society (London), B: Biological Sciences*, 1964, 159: 449–65

the members of the UKAEA's teams at Woolwich and Capenhurst who undertook the analytical work. The reports contained the analytical results with minimal comment. Researchers at the MRC published occasional papers in which they discussed the implications of the analytical results.[30]

53 Thanks are expressed in each of the analytical reports from 1959 to those who supplied bone for the survey. As one would anticipate, nearly all the individuals thanked were pathologists. Their names are given but not the hospitals from which they supplied the bone. Approximately 60 are named over the 15 years of the study, most in more than one of the publications. The Inquiry was able to identify 22 who were still living, all of whom were retired from practice and many of whom were very elderly. The Inquiry is grateful to nine who provided witness statements, two of whom also gave oral evidence. Their explanation of pathological practice at the time was helpful and is discussed in paragraphs 85 et seq.

54 The published papers do not include the names of the individuals whose bone was analysed but do include the age at death, month of death, locality and strontium-90 level for each individual. It is apparent from other published papers, however, that more information than was subsequently published accompanied at least some of the samples. The wording of the early requests for bone sent to the pathologists[31] indicates that they were to supply names and addresses to accompany the bone samples. In preparation for the paper published in 1965,[32] Dr Mole was able to identify the home addresses of some of the deceased by looking at the *"original documents which accompanied the bone specimens"*. The documents used by Dr Mole appear to have been destroyed long ago. When asked for information in 1986, Dr Loutit replied:

> *I regret to report that I have destroyed my laboratory records pertaining to the MRC Monitoring Series. These did contain the names of the subjects whose bone was assayed and I think in most cases domicile. The records were an embarrassment in occupation of locked filing cabinet space, for I considered them confidential documents.*[33]

30 For example, Mole, note 25, above; Bryant and Loutit, note 29, above; and Fletcher W, Loutit JF and Papworth DG, Interpretation of levels of strontium-90 in human bone, *BMJ*, 1966: 1225–30

31 See, for example, the letter quoted at paragraph 39

32 See note 25, above

33 Letter, 18 April 1986, to Professor Martin Boborow, Paediatric Research Unit, Prince Philip Research Laboratories, Guy's Hospital, London

From whom was bone taken?

55 The reports indicate that between 1955 and 1973 bone from 3,394 individuals was analysed for the national survey. Most were taken at post mortem in England and Wales from babies and children below the age of five. One sample came from an amputated limb.

56 In fact, bone was sampled from 3,526 individuals.[34] There are various reasons for this difference:

- approximately 120 samples were assigned reference numbers by the MRC but were never received by the UKAEA;
- in a few cases the samples were said to be too small for analysis;
- a small number of samples were discarded because of doubts as to the age of the deceased and/or where he had lived.

57 When considering the total numbers of individuals from whom bone was taken for the purpose of strontium research as a whole, account should also be taken of other studies (the Cambridge, London fetal, Glasgow and West London surveys), which are discussed at paragraphs 66–71.

Identification of individuals

58 While it might be possible to use the information contained in the published papers in conjunction with the pathology and medical records archives of hospitals and/or material from coroners' archives to identify some of the individuals whose bone was analysed, the Inquiry has considered it impractical to do so for the following reasons.

- The places from which the bone came tend to be identified only by county and it is therefore not possible to ascertain with any degree of certainty which hospital was involved in the provision of any particular bone.
- Coronial archives may hold relevant information but it appears that the majority of cases were supplied from hospital post mortems without the involvement of a coroner.
- Some of the hospitals whose pathology departments appear to have supplied bone for the research no longer exist. For those which are still in existence, guidance from the NHS[35] and the Royal College of

34 Excluding 36 samples referred to in published papers which appear to have been used for inter-laboratory comparison exercises and an unidentified number of bones provided by pathologists from people dying after 1970: see paragraphs 83 and 84

35 Department of Health, *Records management: NHS code of practice* Part 1, 2006

Pathologists,[36] on retention of medical records and documentation relating to autopsies respectively, requires that documents are kept for a period of 30 years. Many of the post mortem records which might have been retained by the hospitals involved are therefore likely to have been destroyed.

- Even if records do remain available, the paucity of information (only the month of birth and age at death) means that identification of the individuals would be very difficult.

59 By way of illustration, the Inquiry selected one county in which the factors which might have allowed individuals to be identified appeared promising: the published list of pathologists who had supplied bone suggested that it had all come from a single hospital and it was known that that hospital had retained its post mortem records. Despite those favourable factors, a review of those records did not allow individuals from whom bone had been taken to be identified with any degree of confidence.

60 Furthermore, the research started over 50 years ago and the most recent deaths reported in the published papers were in 1970, nearly 40 years ago. The families of those concerned are likely to have no idea that bone was removed for this research. In accordance with recommended practice[37] it would have been inappropriate, even if the individuals could be identified, for the Inquiry to have approached any surviving relative.

Scientific concerns

61 The purpose of the studies was to monitor levels of strontium-90 in the UK population. Documentation from the early years of the research suggests that those involved in it doubted its scientific, as opposed to political, utility. There was recognised to be a conflict between a scientific preference for a more concentrated study focused on particular areas and a political preference for a national study.

62 The scientific concern was that the data had too many variables to be of epidemiological value:

36 The Royal College of Pathologists and the Institute of Biomedical Science, *The retention and storage of pathological records and archives* (3rd edn, 2005) (currently under review)

37 Brazier M, Organ retention and return: problems of consent, *Journal of Medical Ethics,* 2003, 29: 30–3. *"A final question was raised about how to return organs which were taken a long time ago and which the family had no idea had been retained. The* [Retained Organs] *Commission advises that unless families contact you, the best policy is to remain silent. Some hospitals and coroners have not done this and have proactively and independently contacted families. The result has been a lot of heartache."*

- the supply of bone was dependent upon those pathologists who happened to be asked, and who agreed, to co-operate;
- there was no methodical selection of random samples;
- the results indicated that strontium in bone varied according to locality and age.

As Dr Loutit put it in correspondence:[38]

> *without proper sampling of the population by going out and shooting the little blighters where you want them, I don't think we can get hold of the material that would satisfy a purist.*

63 The minutes of a meeting of PIRC on 8 November 1960 include the following:

> *Fully satisfactory statistical sampling was impracticable as there were so many variables. Dr Mole then asked what would be lost if the bone survey stopped completely. We already knew that the maximum level was less than the warning level. Dr Loutit said that the survey was set up initially for political reasons … The survey had not been entirely without some scientific byproducts … This was, however, a small product for the very large amount of time and money spent on the survey …*
>
> *Dr Loutit commented that the scientific interest required an intensive study probably of a limited area, while the political interest required the sampling to be widespread … Dr Loutit then stated that as a result of the discussion he had the feeling that the survey should proceed for non-scientific reasons and that we should make the most of the material from the scientific viewpoint ... He would ask a statistician to see what more could be squeezed out of the survey for scientific purposes.*

This concern over statistical validity was never resolved, continuing to be expressed in discussions about the ending of the studies in 1971.

Other elements of the UK strontium research

64 The national survey was the largest but not the only component of the research on strontium levels in bone in the UK population between 1955

38 Letter, 8 November 1957, to Dr Lush, MRC

and 1973. Smaller surveys were also undertaken, the results of which were published at various times alongside the results of the national survey.

65 These other surveys were also organised and funded by the MRC and carried out under the control of its Managing Committee on Monitoring.[39] They aimed to meet criticism from scientists on the Joint Committee that the national survey's coverage of such a wide geographical area decreased its scientific validity, since it would give inadequate cover nationally rather than adequate cover on a more local basis. They also avoided the analyses being carried out solely at UKAEA premises, which was felt to be politically undesirable. They were as follows.

The Cambridge survey

66 The Cambridge survey was based at the Cambridge University Department of Radiotherapeutics, where the bone analysis took place. It involved the analysis of femora from 76 stillbirths, children and adults who died between February 1958 and July 1962, supplied by pathologists at hospitals in Cambridge, Newmarket, Bury St Edmunds, Norwich and Chelmsford.

67 The survey ended for various reasons:

- the perceived requirement for a study independent of the UKAEA was being fulfilled by the Glasgow survey;
- anticipated data which would have demonstrated any link between levels of strontium in individuals and their diet had not become available;
- results from an area of low rainfall were being obtained from the West London survey;
- the lead author, Dr R M Holford, left his post at the university and the department was unable to recruit a suitable replacement.

The London fetal survey

68 This work was carried out at the Department of Physics, Royal Cancer (now the Royal Marsden) Hospital, London. It involved the analysis of 91 whole fetus which had been stillborn at various London hospitals between September 1958 and June 1960. The resulting publication[40] does not include any description of the procedure by which the fetus were obtained.

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39 See paragraphs 34 and 35

40 Anderson W and Crookall JO, *Radioactive Strontium in the Human Foetus: London Results for September 1958 – June 1960, 1961; Assay of Strontium-90 in Human Bone in the United Kingdom, Results for 1960, Part 1*, MRC Monitoring Report Series 2, 1961

The Glasgow survey

69 The Glasgow survey was based at the Royal Hospital for Sick Children (RHSC), Glasgow. Femora were collected between January 1959 and December 1970 from 2,052 individuals. The vast majority were obtained from children at post mortem but five came from amputated limbs. Approximately half of the children underwent post mortem at the RHSC and the remainder elsewhere in Scotland. Bone supplied by the pathologists from the relevant hospitals was analysed at the Western Regional Health Laboratory, Glasgow.

70 The Glasgow survey was the subject of an investigation, conducted on behalf of the Scottish Executive, whose report was published in March 2002.[41] The conclusions of that report are reviewed at paragraphs 116–121.

The West London survey

71 In this study, pathologists from three mortuaries in the Inner West London Coroner's District were asked to supply vertebrae from the first two coronial autopsies of each month in various age groups. The supply was authorised by the then Coroner for Inner West London, Dr Gavin Thurston. As in the national survey, ashing was done by the ARC and analysis was undertaken at the UKAEA's Woolwich Outstation. Bone was taken from 418 individuals who died between January 1961 and December 1965.[42] Vertebrae were used, rather than femora, because they were easier to obtain[43] and so that comparisons with studies in other countries, the majority of which used vertebrae, would be straightforward.

Total sample numbers

72 The information available to the Inquiry is that bone was collected for the UK strontium research from 6,072 individuals who died between 1955 and 1970.

41 *Independent Review Group on Retention of Organs at Post-Mortem – Report on Strontium-90 Research* (March 2002) at: www.sehd.scot.nhs.uk/scotorgrev

42 This figure is taken from the contemporaneous published papers. A later paper (Papworth DG and Vennart J, The uptake and turnover of strontium 90 in the human skeleton, *Physics in Medicine and Biology*, 1984, 29: 1045–61) referred to 419 samples. The Inquiry was not able to resolve this minor discrepancy

43 See paragraphs 45–47

National survey	3,526
Cambridge	76
Glasgow	2,052
West London	418
Total	**6,072**

Ninety-one fetus were also analysed: see paragraph 68 above.

Bone from Commonwealth countries

73 It is clear from documents viewed by the Inquiry that the strontium research carried out in the UK involved some bone from other countries. In particular, either bone or ashed bone was supplied from Australia and Hong Kong as a result of two separate initiatives.

Australia

74 A programme of research into strontium in Australian bone took place between 1957 and 1978. It was initially organised and run by the Atomic Weapons Tests Safety Committee (AWTSC) and, from 1973, by the Australian Ionising Radiation Advisory Committee. Both committees reported to the Australian Minister of Supply.

75 While a detailed examination of the programme is outside the Inquiry's Terms of Reference,[44] it appears that UK involvement in the analysis of bone was extensive. From 1958 to 1969, all the bone gathered for the Australian research was ashed in Australia and sent to the UK in batches for analysis. Initially the AWRE received the samples and forwarded them to Dr Bryant of the UKAEA. From around 1960, they were sent directly from Australia to the UKAEA. The UKAEA combined the samples according to age group and analysed the bulked samples. In around 1964, the analytical work was transferred from Dr Bryant at Woolwich to Dr Fletcher

44 It was the subject of a report from the Australian Radiation Protection and Nuclear Safety Agency, *Australian Strontium 90 Testing Program 1957–1978* (2001) at: www.arpansa.gov.au/pubs/reports/sr90pubrep.pdf

at Capenhurst. The results were provided to the AWTSC and published periodically.[45]

76 The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) report indicates that between 1958 and 1969, ashed bone from over 10,000 Australians was analysed by the UKAEA. From 1970, analysis was undertaken in Australia and no further bone was sent to the UK.

Hong Kong

77 Bone from Hong Kong was obtained through the Colonial Office, at the instigation of the MRC, from pathologists at public mortuaries performing post mortem examinations on unclaimed bodies handed over to be buried by the government. Dr Loutit received 31 femora from Hong Kong in June 1961. They were ashed and the ash combined into four bulked samples, categorised by age from newborn to two years old. The samples were then analysed at the UKAEA's Woolwich Outstation under the supervision of Dr Bryant. A one-page summary of the results was produced and provided to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) so that the results from Hong Kong could be incorporated into its work on worldwide strontium-90 levels.

Findings

78 The studies demonstrated that, following extensive nuclear weapons testing in 1961–62 by both the US and the Soviet Union, levels of strontium-90 in human bone peaked in around 1965. The highest recordings were found in children aged 6–23 months in 1965 but even this peak level was significantly below that identified in advance by the MRC as being a cause for concern. After 1965, the levels of strontium-90 fell, first in children's bones and then in adults'.

79 Although concerns had been expressed about the scientific validity of the research,[46] the political importance of the studies should not be under-estimated. In conjunction with similar work carried out in other countries, the research showed that nuclear weapons tests caused increased levels of strontium-90 in human bone. These worldwide studies provided the political

45 Ibid. The report includes a list of the relevant publications

46 See paragraphs 61–63

impetus for the prohibition of above-ground nuclear testing imposed by the 1963 Limited Test Ban Treaty. They also provided reassurance to a worried public that the levels of strontium in human bone were not dangerous and were unlikely to become so with current levels of nuclear weapons testing.

The end of the UK strontium studies

80 The UK research must be seen in the context of worldwide developments in this field. By 1971, it was recognised that the risks to health posed by strontium-90 in fallout were less than had previously been thought.[47] Atmospheric weapons testing had decreased significantly after the 1963 Limited Test Ban Treaty and environmental levels of strontium-90 had declined as a consequence. A model had been developed in the US linking levels of strontium in diet to those in bone and shown to accurately reflect strontium-90 levels in UK human bone. The laborious and expensive tasks of gathering and analysing bone had become unnecessary.

81 These factors led the MRC to advise that the studies should be discontinued. The view was reached provisionally on 10 June 1971 and was confirmed on 4 November 1971. In August 1972, the MRC obtained permission from Ministers to end the programme of research on strontium-90 in bone.

82 The final report in the MRC Monitoring Series was published in 1973. It provided the results of analysis of bone from subjects who had died during 1970.

Continuation of the supply of bone

83 Although analysis ended with individuals who had died in 1970, the supply of bone did not cease. Documents seen by the Inquiry suggest that bone was supplied to the MRC until at least November 1972. In May 1972, Ms Rowena Harris[48] noted in an internal memorandum that *"Collection of bone samples is continuing but analysis ended with the 1970 collection"* and in September of that year she wrote again that she believed collection to be

47 Mole RH, ^{90}Sr in Human Bone, PIRC 71/12

48 Senior scientific officer at the MRC

continuing. A minute of a meeting[49] in November 1972 also suggested that bone continued to be supplied and discussed to what use it might be put. The Inquiry has seen no evidence to indicate how long after that the supply continued, or that the MRC told the pathologists that its study was complete.

84 On the assumption that collection continued at the same rate as in 1970, it is likely that bone from 250–300 individuals was received by the MRC in 1971 and 1972 but not analysed. The files indicate that the collected bone was stored at the MRC's Radiobiology Unit at Harwell. Dr Jack Vennart[50] told the Inquiry that the room in which the bone was stored was emptied at some point before 1977. It is likely that the bone was destroyed then.

Pathological practice

85 The Inquiry obtained witness statements from nine pathologists who had provided bone for the strontium research, three of whom began to supply bone before the Human Tissue Act came into force in September 1961. Most stated that they would perform a coronial post mortem upon request by the coroner but would require evidence of consent from the family of the deceased before performing a hospital post mortem. One indicated that he would perform a post mortem unless there was any objection from the family. An article in the *British Medical Journal*[51] and evidence from pathologists in practice at the time suggest that before 1961 it was assumed that consent for post mortem authorised the pathologist to remove and retain tissue for whatever purpose he saw fit. The advent of the Human Tissue Act 1961 had no impact on this practice.

86 Some of the pathologists recalled assisting with the strontium studies, but others, who had been junior doctors at the time, denied any knowledge of them. Some suggested that the taking of bone for the studies might have been authorised, unknown to them, by senior pathologists and that they were thanked in published articles for their assistance with the studies only because they happened to have undertaken the post mortem and therefore signed the report. This explanation would require that the bone had been removed either for other reasons in the course of the post mortem or solely for the purposes of the study after the formal post mortem had been

49 Working Party on Monitoring of Environmental Contaminants and Pollutants in Bone and Teeth

50 Director of the Radiobiology Unit, 1977–82

51 Any Questions? Ownership of Operation and Necropsy Specimens, *BMJ*, 1954: 1369

concluded. In either event, senior pathologists or mortuary technicians would have had to have been responsible.

87 The pathologists who were in charge of the various departments at the time are now dead and the Inquiry has been unable to locate any documentation to substantiate or refute this hypothesis.

88 Arrangements for the supply of bone were made directly with pathologists, rather than through treating doctors or hospital management. The pathologist, however, was never responsible for obtaining consent for the post mortem from the family of the deceased: that task fell to the doctors who had cared for the patient or to the hospital's administrative staff. Those obtaining consent for the post mortem, therefore, were unlikely even to have been aware of the possibility of bone being taken for the strontium studies, still less to have communicated that possibility to the family.

89 In July 1995, a television documentary, *Deadly Experiments*,[52] was broadcast on Channel 4. The parents of two babies whose bones had been removed for the strontium studies said that they had been completely unaware of what had happened.

90 The Inquiry concludes that consent for removal of bone for the studies was not obtained. Contemporaneous correspondence lends support to this view.[53]

91 Some pathologists suggested to the Inquiry that they complied readily with the request to provide bone because it came from government-sponsored bodies, the MRC and the UKAEA. This would not, of course, affect their legal or ethical responsibilities.

The MRC's awareness of pathology practice

92 The MRC neither stipulated that pathologists should ensure that consent was obtained from the family of the deceased before bone was supplied nor asked for evidence that it had been obtained. It was, however, made aware as early as 1959 of possible legal and ethical difficulties with the supply of bone for the strontium research.

93 On 12 June 1959, Dr Loutit wrote to Dr Lush, then a Senior Medical Officer at the MRC's head office:

52 The documentary is discussed in more detail in paragraphs 113–115

53 See paragraphs 92 et seq

One of the new pathologists I have been writing to for the bone survey has raised the point that we may be infringing the Anatomy Act by snatching femurs. He asked if I could find out about how everyone stands in this connection, as he is in an area which, as he says, is "anti everything". Have you a legal expert on the M.R.C. or can you pick one out of the group of Government solicitors?

94 Dr Loutit was advised to request assistance from Dr Ellice Henderson, Her Majesty's Inspector of Anatomy. Dr Henderson correctly observed that autopsies were not covered by the Anatomy Act, referred him to an article in the *British Medical Journal*[54] and continued:

The removal of tissue accordingly, though not contrary to any Act, is not legally sanctioned in any way and something on the lines of the Corneal Grafting Act would be needed if 100% legality were required.

This response appeared to satisfy both the MRC and Dr Loutit and no further action was taken.

95 In the summer of 1960, the MRC had an opportunity to reassess its understanding of the legal position. Sir Harold Himsworth, then still Secretary of the MRC, received a memorandum[55] drafted by the Ministry of Health advising of a proposal to prepare a Bill to provide for the removal of human tissues for therapeutic, research or teaching purposes. He commented:

There has been a long-felt need for legislation in this field and I therefore welcome the Bill as an important step forward.

96 The Ministry of Health circulated a further memorandum[56] on the subject, dated 22 November 1960. On 24 November 1960, the MRC acknowledged it, saying *"we have no comments to make on this"*. The Inquiry found the MRC's lack of comment or reaction surprising given the content of the memorandum, which included the following:

4 (c) The introduction of a Bill will at once bring into the open the doubt as to the legality of present practices ...

6 While not asking leave to introduce the Bill forthwith, we must warn our colleagues that the need to do so urgently may arise at short notice in either of the following ways:

54 See note 51, above

55 HA (60) 105

56 HA (60) 163

(a) *the Medical Research Council may be pressed to develop new facilities for storing tissues taken from dead bodies; (a request for this has already been made)*

(b) *the legality of current practices may be challenged, directly or indirectly in a court.*

97 The consultation enjoyed by the MRC should at least have alerted it to consider its practice in relation to the strontium research and prompted action to ensure compliance once the Bill was enacted.

98 In May 1961, four months before the Human Tissue Act became law, Dr Edgar Rentoul, a pathologist from Glasgow, wrote to Dr Loutit expressing his views about the legal basis for the provision of bone from hospital post mortems for the strontium research. His letter concluded:

> *The result of all this appears to be, therefore, that probably no legal action can be taken against a doctor who retains material from a post-mortem dissection, but there may be an element of misrepresentation about it which might produce very unpleasant results. I can well imagine a parent who has been told that doctors would like to make a post-mortem dissection of their child, for the purpose of elucidating the cause of death, being somewhat aggrieved when they discover that parts of the body have been removed for some other purpose altogether … I think in cases where there is to be obvious removal of parts of the body, the hospital authorities concerned would be well advised to include in the consent which they obtain from the relatives an additional clause such as "… and the retention of such parts of the body as may be required for scientific purposes."*

99 Dr Loutit passed the letter to the MRC's Assistant Secretary, Mr F Rushton:

> *I don't know whether you feel that any action is required now anymore than was required in the past, but the suggestion in the last paragraph of Rentoul's letter seemed to me a good one. I know the Council is involved not only in the collection of bones but in other tissues for scientific purposes. Perhaps we could discuss this.*

100 Mr Rushton's internal memorandum, dated 6 June 1961, suggests that obtaining consent for the supply of bone for research had not been considered necessary in the past:

I think Rentoul's point about adverse publicity is a good one, and I support his suggestion that consent might be obtained. I wonder whether his wording is sufficient, however. Should the scientific purposes be explained, however briefly, in each case?

101 Mr John Hay, an Administrative Officer at assistant principal level in the MRC's head office, sought advice from the Treasury Solicitor on 9 June 1961:

> *The Medical Research Council sometimes undertakes investigations of a kind which can only be carried out on human cadavers, or on portions of them. At present, for instance, members of the Council's staff are engaged in an analysis of the quantity of Strontium 90 in human bones, which entails the ashing and analysis of large numbers of entire thigh bones. These bones can only be obtained through the co-operation of hospital pathologists, but this co-operation is not always easy to secure and, in particular, the complaint is sometimes made that the procedure in question may not be strictly legal.*
>
> *Enclosed are photocopies of the texts of two letters which have been forwarded to us by Dr. Loutit, the Director of the Council Unit most concerned at the present time. We would be most grateful for your comments on the legal opinions expressed in these letters, and on the legal position both of the pathologists and hospitals who supply us with specimens, and of the Council staff who dispose of these specimens.*

The letter indicates an understanding of the MRC's activity and the legal responsibilities which went with it.

102 The reply, dated 16 June 1961, from Mr Kenneth Ritchie at the Treasury Solicitor's office, further clarified the position:

> *I would agree with Dr Ellice Henderson that the Anatomy Acts do not really apply to the circumstances you mention ... You will observe that he says in his letter that something on the lines of the Corneal Grafting Act 1952 would be needed to put the practice of removal of tissue from a dead body on a completely legal basis, and since his letter just such a Bill has been introduced by the Ministry of Health, the Human Tissue Bill, which had its second reading ... on 20th December last. One of the objects of that Bill was to clear up any doubts as to the legality of the removal of parts of the body for ... research ... I would suggest that you should have a look at it and get in touch with the Ministry of Health direct to see whether in their view its provisions are intended to cover you in the circumstances you raise. My own view is that they will do.*

103 On receipt of that advice, Mr Hay briefed his superior officer, Mr James Whittaker, Assistant Secretary. The first sentence in his brief is misleading:

> *The Human Tissue Bill has now passed its second reading, but it is not being given priority because it will have little importance in practice.*

This was incorrect and is perplexing, given that the rest of the brief accurately describes the proposed requirements for obtaining and using human tissue:

> *The Bill is intended to legalise such established practices ... the doctor or hospital must first make enquiries as to whether the deceased, or any relative of his, had, or would have, any objections ...*
>
> *The conclusion tentatively reached in this office was that it would be advisable to obtain the family's permission for public relations reasons, but it seems that this will in future be demanded by law ...*
>
> *The Treasury Solicitor has suggested that we ask the Ministry of Health for legal advice ... We might be able to get the Bill altered to suit us better, but I do not think there is anything that we need altered.*

104 Mr Hay added a handwritten note to the brief and sent it to another colleague, Dr R C Norton. He summarised the position, albeit not quite accurately:

> *Dr Loutit has been complaining ... about the dubious legality of obtaining specimens for (eg) Strontium 90 tests ... the law is now to be amended to make this perfectly legal, but with a heavy onus on the doctor who does the dissection to check that there are no objections from relatives.*

The onus was not to be placed on the doctor undertaking the dissection but on the person lawfully in possession of the body.

105 Mr Hay followed the Treasury Solicitor's advice and on 24 August 1961 sought further clarification from the Ministry of Health:

> *members of the Council's staff are engaged in an analysis of the quantity of Strontium 90 in human bones, which entails the ashing and analysis of large numbers of entire thigh-bones* [femora]. *These bones can only be obtained through the co-operation of hospital pathologists, but this co-operation is not always easy to secure and, in particular, the complaint is sometimes made that the procedure in question may not be strictly legal.*

106 The reply, dated 31 August 1961, provided the clarity sought:

> *This may all sound very complicated. What it will mean in the usual case is that the nearest relative is asked whether he objects to the removal or knows of any other relative who does. If the answer is "no", then removal can take place subject to the coroner also agreeing in any case where he is likely to be involved.*

The letter ends with an offer to provide the MRC with copies of an information memorandum to hospital authorities and a note for medical journals which would be circulated before 29 September 1961.

107 Mr Hay sent a copy of the letter to Dr Loutit who in turn appears to have forwarded it to Dr Rentoul. By October 1961, the MRC had also received from the Ministry of Health copies of the Human Tissue Act 1961 and of the information memorandum to hospital authorities. Mr Rushton forwarded these to Dr Loutit on 23 October 1961.

108 The Inquiry has seen no evidence that Dr Loutit or any other member of the MRC's staff conveyed the letter, Act or information memorandum to the many other pathologists supplying bone for the strontium research. Mr Hay told the Inquiry that he would have taken the view that it was *"reasonable to assume that pathologists would read the Act and make their own judgements"* and that *"MRC Headquarters and Dr Loutit were justified in*

assuming that pathologists were ... taking all steps that were reasonably practicable to ascertain lack of objection to removal of human tissue".

109 There can be no doubt that the MRC was fully aware of the provisions of the Act and its implications for the strontium-90 research.

110 In the spring of 1968, Dr Vennart, then a member of staff at the RPS, sought advice from MRC head office about the Act, wondering whether publishing the results of research that had used tissue taken at post mortem would contravene its provisions.

111 Once again, the MRC sought advice from the Ministry of Health, this time by telephone. A note of the call suggests that correct advice was given:

> *Spoke to Mr McDonald at Ministry of Health ... He deals with the administration of the Human Tissue Act, and advised that as it is the pathologist's responsibility to procure specimens within the provisions of the Act, then all the Council need do is let the relevant pathologists know that RPS were proposing to publish the results of their work involving tissues provided by them (the pathologists) ~~and say that before publication we wished to confirm that the specimens have been legally obtained~~. Given the necessary assurances by the pathologists, the Council is in the clear, because the Act allows specimens to be used for medical research. I discussed the matter with Mr. Vennart ... I have sent him a copy of the Act.*

The statement struck out above was challenged because it was thought that pathologists would object to it. A note of a later telephone call records Mr McDonald's confirmation that there was *"no legal requirement that the research worker should check with the pathologist before publication".*

112 The internal debate resulted in the following guidance, which was issued to all grades of MRC Medical Officer but not to researchers:

> *Human Tissues* [sic] *Act*
>
> *Advice was recently sought by a member of the Council's staff about the interpretation of the ... Act. He had been provided with ... tissue by pathologists ... The question was whether the use of the specimens ... might be in contravention of the ... Act.*

Mr McDonald of the Ministry of Health ... has advised that, since it is the pathologist's responsibility to procure specimens within the provisions of the Act and since the Act allows specimens to be used for medical research, a research worker using specimens supplied to him by a pathologist need have no fear that he is contravening the Act. If a research worker proposes to publish the results of work involving the use of specimens supplied by a pathologist, it is of course desirable that he should tell the pathologist of his intention and should in the publication acknowledge the pathologist's co-operation. This information may be helpful in answering any future requests for guidance on the subject.

Subsequent investigations

113 In 1995, a television documentary, *Deadly Experiments*, described experiments involving the administration of small amounts of radiation to living subjects and also referred to the strontium studies, reporting that bone had been removed from 6,000 individuals.

The MRC's committee of inquiry

114 Press comment provoked by the documentary led the MRC to commission an inquiry chaired by Rabbi Julia Neuberger, then a member of the MRC's Council, to examine its allegations. The report concluded that the bones taken from the two babies specifically referred to in the documentary[57] had been taken without the parents' consent and that in respect of the research as a whole *"it does not appear that consent for the removal of samples was sought"*.

115 The committee's report:[58]

- in focusing only on two cases, did not mention that the research had involved taking bone from over 6,000 individuals;
- drew no conclusions on the legality of the methods by which bone had been gathered for the strontium research;

57 See also paragraph 89

58 *Radiation in MRC Supported Research in the 1950s and 1960s* (MRC, 1998)

- did not comment on the degree to which the MRC's head office was aware, while the research was in progress, of potential problems with the legality of those methods;
- did not discuss the extent to which the MRC complied with its commitment to ensure that the research it funded was *"unexceptionable"*;[59]
- concluded that, although the bone was taken without parental consent, this practice was not unethical in the context of research practice of the period.

In submissions to this Inquiry, the MRC agreed that the report could not be regarded as a comprehensive review of the strontium research.

The Scottish Independent Review Group

116 In 2001, the Scottish Executive commissioned a report on the strontium research from the Independent Review Group on Retention of Organs at Post-Mortem which had been formed in 2000 to review past practice in Scotland in connection with consent to post mortem examination, organ retention and disposal of organs and to develop guidance on future practice. The report was published in March 2002. It covered the strontium studies and in particular the Glasgow survey.

117 The MRC and the UKAEA indicated to the Review Group that consent had not been sought from the next of kin for the removal of bone for research purposes. The Review Group also heard evidence from Professor Gavin Arneil, a retired paediatrician who had practised at the RHSC in Glasgow and who was one of the authors of the reports on the Glasgow survey. He said that he had given three reasons to parents when requesting permission for post mortem examination:

> *firstly to make sure our diagnosis was correct and complete; secondly to learn whether any better treatment could have been used; and thirdly to obtain samples of tissue for later examination to help our understanding and perhaps benefit other children.*

He also said that:

> *during the strontium 90 studies, I made a point of mentioning this to the parents, that a sample of bone might be taken.*

118 Approximately half the bones for the Glasgow survey were supplied from the RHSC. Of these, many came from stillborn babies who were not under

59 See paragraph 144

Professor Arneil's care. He would therefore have had the opportunity to obtain consent in only a minority of the cases in which bone was taken.

119 Having heard evidence that many pathologists regarded consent to post mortem examination as giving them *carte blanche* to remove organs from the body for research purposes, the Review Group commented that it had heard Professor Arneil's description of the extent of the information he gave *"with some surprise"*. The suggestion that specific consent was being obtained for the taking of bone for research does not accord with the evidence that the Inquiry has received from pathologists regarding either their own practice or hospital practice in general.

120 The Review Group concluded:

> *It is the lack of respect for the role which parents have told us they want to play which has led to the study coming back to haunt not only the parents but also those responsible … The elevated and humanitarian ideals which motivated those who devised the study, and the undoubted benefits which it brought in public health terms, are undermined by the revelation of the underlying attitudes towards parents and their dead children … parents were deprived of control over what happened to their children after death … proper authorisation should be sought and obtained and information provided to those who wish to receive it.*

121 The Review Group accepted that the MRC had not been consulted over the Human Tissue Act 1961 and had not been made aware of the guidance which accompanied the Act. The Review Group appears not to have had access to all of the documents obtained by this Inquiry which are described above[60] and give a rather different impression. It came to no definite conclusions as to whether, in the course of the strontium studies, there had been compliance with the law underlying the taking of bone at post mortem examination.

Removal of bone at post mortem examination

Hospital post mortem before 1961

122 Before the Human Tissue Act came into force in September 1961, there was no statutory provision relevant to the removal of bone for research purposes at post mortem and no relevant decision from the Courts to which to refer.

60 See paragraphs 92–109

Nevertheless, between 1955 and September 1961 bone was taken for the strontium studies from over 1,000 individuals. As was observed in the debate on the Human Tissue Bill:

> *The Bill is one which is mainly concerned with the removal of doubt …* [It] *authorises, subject to a number of reasonable safeguards, the removal of parts of human bodies after death for use for therapeutic purposes or purposes of medical education or research. Without the Bill such removal would be in danger of being held to be unlawful.*[61]

123 This comment illustrates the practical difficulties faced by pathologists and researchers before 1961. It cannot be said that the removal of bone for research was against the law: the legal position was unclear.

Hospital post mortem after 1961

124 The Human Tissue Act 1961 provided that consent, either of the deceased before death or of the relatives after death, was needed before organs could be removed for research. If the coroner was involved in investigating the cause of death, his consent was also required.[62] Guidance which accompanied the Act[63] advised that the nearest relative *"should be asked if he objects or has reason to believe that any other relative would object"* to the body part being removed. The Act's provisions were described in an article[64] in the *British Medical Journal* in 1961.

125 In practice, an individual who was seeking to obtain consent for the removal of bone for the strontium studies was obliged, at the very least, to inform the relatives that it was proposed to take some bone for research and to establish that they did not object. The information could have been given either orally or in writing, for example by use of a consent form (although there was no requirement for the relatives' agreement to be in writing). A family could give meaningful consent only if made aware of the possibility that bone was to be taken for research.[65]

61 Edith Pitt MP, Parliamentary Secretary to the Ministry of Health. Hansard, HC Deb, 20 December 1960, vol 632, col 1231

62 Human Tissue Act 1961, s1(5); see also chapter 3, "Law and Guidance"

63 HM (61) 98, distributed to hospital authorities in September 1961

64 Annotation, Human Tissue Act, 1961, *BMJ*, 1961: 879

65 For further discussion on this point, see chapter 3, "Law and Guidance"

126 This vital information could be given to the relatives only if the person obtaining consent was aware of it. As discussed earlier in this chapter,[66] it is unlikely that the person responsible for obtaining consent in any individual case was aware of the intention to remove bone.

127 The Inquiry received evidence from several of the pathologists who were thanked in the strontium publications. None suggested that any consent form which might have been in use between 1955 and 1972 referred to tissue, still less to specific bones, being removed for research. The Inquiry has obtained copies of a few forms in use during this period. None refers to the provision of bone or tissue for research.

128 The Department of Health issued guidance, widely circulated, on the Human Tissue Act 1961 in both 1961 and 1975.[67] On neither occasion was the introduction of a post mortem consent form suggested.

129 In 1976, following disclosures by a mortuary technician, it became public knowledge that thousands of pituitary glands had been removed at post mortem, without the consent of the relatives, and sent to the MRC in order to treat growth hormone deficiency in children. This practice was pithily described in a letter from a pathologist who was also legally qualified:

> *The legal position requires the permission of the relatives … not only is permission never asked for the removal of tissues, but I am sure that in many cases it would be strenuously refused. Thus the only Act under which pituitaries are taken is the "Blind Eye Act".*[68]

130 In response, the Department of Health published further guidance[69] which did include a suggested consent form for hospital post mortem. The form included agreement that *"amounts of tissue"* could be removed *"for the treatment of other patients and for medical education and research"*.

131 The removal of pituitary glands without consent post-dated the strontium research. It provides further evidence that throughout the period of the strontium research it had been common practice for pathologists to disregard the requirement for consent to the removal of tissue at post mortem for purposes unrelated to the death.

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66 See paragraphs 85–90

67 In 1961, HM (61) 98; in 1975, HSC (IS) 156

68 Letter, 16 March 1977, from Dr Bernard Knight, Pathologist, Welsh National School of Medicine, to Professor James, MRC

69 HSC (IS) 156 1977

132 The Inquiry concludes that when consent was obtained for post mortem examination between 1961 and 1972, no mention was made of the removal of bone for research purposes. Those obtaining consent did not have adequate knowledge of the strontium research to enable them to provide sufficient information in order to obtain meaningful consent. It follows that the bone which was sent to the MRC was taken without consent. The removal of bone failed to comply with the provisions of the Human Tissue Act 1961.

Coronial post mortem

133 A coroner's powers extend only to authorising removal, retention and analysis of material which bears upon the cause of death. The purpose of the strontium research was to determine the levels of strontium in the UK population. There was never any suggestion that the individuals from whom bone was taken had died as a result of exposure to strontium. Indeed, the main purpose of the research was to monitor strontium levels to establish that they were not dangerous to health.

134 In the early years of the study, the results of a very small number of the strontium analyses were passed to the pathologists who had supplied the bone. However, in general the bone was supplied without any expectation of such feedback and feedback was not given. The Inquiry has seen no evidence that the results were either requested by coroners or used by them at inquests.[70]

135 Dr Thurston, the Inner West London Coroner, expressly approved the taking of bone for the West London survey. With that exception, the Inquiry has seen no evidence that coroners actively co-operated with the studies. Although most pathologists from whom the Inquiry heard evidence said that they would not have mentioned the removal of bone in their reports, the Inquiry has seen a small number of reports on coronial post mortems which include, in the *"Parts Preserved"* section, a phrase such as *"femur for Harwell"*. Those reports would have been seen by the coroner and it might be argued that lack of response to this record implied coronial approval of the practice. No pathologist actually adopted such a position and the Inquiry would consider it untenable. In any event such approval, being beyond the coroner's powers, would not have rendered the practice lawful.

70 Results from analyses of femora from two servicemen who had attended nuclear weapons tests in the Pacific were performed appropriately for coronial purposes and included in the published strontium papers

136 There was no authority in coronial law for the provision of bone, or any other material, for scientific research. Even in the West London survey, where the coroner was undoubtedly aware of the taking of bone, any permission he gave did not override the requirements of the Human Tissue Act 1961. Under the Act, in order for bone to be taken at coronial post mortem for the strontium studies, it was necessary also to obtain the consent of the relatives of the deceased. There is no evidence that such consent was obtained.

The ethical position

137 The pathologists involved in the research provided bone to government-sponsored organisations to facilitate what was seen at the time as an important scientific study for the public good. To do so was in accordance with common pathology practice at the time. They considered themselves to be doing nothing wrong. It might be argued that these factors provide ethical justification for the supply of bone without consent. It has been argued that it is inappropriate to apply modern attitudes to consent and self-determination to society in the 1950s and 1960s.

138 Nevertheless, consent was the basis of the legal framework introduced by Parliament in the 1961 Act. Even then, it was not new: the Corneal Grafting Act 1952 had contained similar provisions. Parliament had clearly felt that the safeguard of consent from the family was necessary and appropriate and represented the standard to be expected at the time.

139 Dr Rentoul's letter to Dr Loutit[71] and the responses it provoked demonstrate that pathologists and researchers were aware that the family of the deceased would be *"aggrieved"* if they were to discover that parts of the body had been removed for purposes unconnected with the cause of death. The idea that consent should be obtained was raised with approval in that correspondence.

140 The evidence therefore indicates that consent is not a modern construct, considered to be unimportant in the 1950s and 1960s. Then as now, doctors, researchers and politicians knew that relatives would want to determine how the deceased's body was treated after death.

71 See paragraph 98

141 There was no barrier to the pathologist's arranging for consent to be obtained for the supply of bone for research. To do so would have satisfied the relatives' expectations and, from 1961, complied with the law. Difficulties in ensuring that clinicians or other hospital staff responsible for obtaining consent actually did so, and did so sufficiently often to satisfy the requirements of the research, could and should have been overcome by adequate communication between researchers, pathologists, clinicians and families.

142 The Inquiry considers that, even measured against the standards of the time, the taking of bone for research purposes without the relatives' permission was not ethically justified.

Guidance from the MRC

143 The Inquiry is also concerned that the MRC, despite being aware both of problems relating to consent and, in advance of its becoming law, of the details of the Human Tissue Act 1961, did not issue guidance, ethical or legal, to its researchers or take any steps to ensure that bone it received after 1961 had been taken in accordance with the Act.

144 The MRC's contemporaneous ethical guidance made no reference to the use in research of human organs obtained at post mortem. In 1953 Sir Harold Himsworth issued a statement[72] which addressed the need for researchers to obtain informed consent when conducting research on living individuals and the need to explain specifically when publishing such research that such consent had been obtained. It concluded:

> *In making these observations the Council feel that they should also make known their own position … as the public body most closely connected with this field, the Council consider that there are certain general responsibilities which they must accept. One is to make their views known; another is to do everything in their power to ensure that the practice of all workers whom they support shall be unexceptionable and known to be so.*

An almost identical statement was issued in 1963. While the statements were confined to the ethical issues of consent in research on the living, there is no reason to consider that those issues differed when the subjects of the research were dead.

72 Clinical Investigations, MRC 53/518/B

145 The MRC relied on pathologists to supply bone and was aware that the legal responsibility for compliance with the Human Tissue Act 1961 lay with the pathologists. It failed to encourage pathologists to take bone in accordance with the Act and failed to ensure that bone it received had been supplied in accordance with the Act. It was guilty of turning a blind eye to this issue. As the organisers of the strontium research, the MRC had an ethical responsibility, certainly once it had become aware of the problem, to ensure that bone used in its research had been lawfully supplied.

Conclusions

146 The strontium studies began at a time when there was genuine public concern over the dangers posed to health on a worldwide scale by strontium-90 in fallout from the testing of nuclear weapons. The best way to monitor levels of strontium in the population was by analysis of bone. The UKAEA (in the early years of the study) and the MRC obtained bone taken by pathologists at post mortem examinations on 6,072 stillbirths, children and adults and 91 fetus.

147 These studies were not kept secret. The results were published every six months by HMSO and periodic reviews were published in widely read medical journals. In the late 1950s, and to a lesser extent thereafter, the studies were the subject of questions in Parliament. Nevertheless, the supply of material was not conducted openly. The removal of bone from thousands of bodies over 17 years was not revealed to the relatives of the deceased. A paternalistic culture prevailed among pathologists.

148 From 1955 until the coming into force of the Human Tissue Act 1961, there was an ethical, but no legal, requirement that consent be obtained from the family of the deceased before bone could be taken for research. However, normal practice was not to seek such permission.

149 After 1961, the Human Tissue Act permitted pathologists to remove bone for research at post mortem only after consent had been given by the family of the deceased. Pathologists should have been aware of its provisions, which directly affected their practice, and complied with them: guidance on the Act was sent to hospital boards and an article appeared in the *British Medical Journal* in 1961. Some of the pathologists who gave evidence to the Inquiry were unaware, during the period of the strontium studies, even of the existence of the Act. Others appear to have felt that their existing practice was compliant with the Act despite the absence of any consent for the

removal of bone for research. Normal pathology practice during the 1960s and early 1970s remained to remove organs for research without the consent of the deceased's relatives. This practice was not in accordance with the provisions of the Act.

150 Neither the MRC nor the UKAEA suggested to the Inquiry that consent was obtained from relatives for bone to be taken for the strontium research. It would have been perfectly practicable for bone to have been obtained for the purpose of the research in accordance with the law. It was the responsibility of pathologists who supplied bone for the research to ensure that this was done.

151 The UKAEA initiated the national survey and was responsible for the earliest requests for bone, but in 1957 it ceased to be responsible for obtaining bone and had no direct contact with pathologists. Its role became solely to determine levels of strontium-90 in ashed bone supplied to it by the ARC or the MRC.

152 The MRC was principally responsible for running the studies. It was advised of the law by the relevant government departments both before and after the passage of the 1961 Act. Although made aware in 1961 of concerns over the taking of bone for its research without the consent of the relatives of the individuals concerned, it failed to investigate or rectify the situation. This failure was particularly serious following the passing of the Human Tissue Act 1961, which made the requirement for consent clear beyond doubt. Further, the MRC's failure to ensure that the activities of the research workers it supported were *"unexceptionable"* was contrary to its own statements of practice.

153 The MRC has told the Inquiry that directors of its research units and institutes are now required to confirm compliance with the Human Tissue Act 2004 in their annual reports. It requires that researchers whom it funds adhere to all relevant legislation.

West Cumberland Hospital

Chapter 12

West Cumberland Hospital

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Contents

Introduction

1 West Cumberland Hospital (WCH) in Whitehaven was officially opened on 21 October 1964 by Queen Elizabeth the Queen Mother; it was the first hospital built in England since the creation of the National Health Service (NHS) in 1948. It became the West Cumbria Health Care NHS Trust in 1993 and in 2001 joined Cumberland Infirmary in Carlisle to become the North Cumbria Acute Hospitals NHS Trust.

2 During the period covered by the Inquiry's Terms of Reference, pathologists at WCH supplied organs taken at post mortem for research, including:

- various organs taken between 1960 and 1991 from 57 Sellafield workers for the studies begun by Dr Geoffrey Schofield and continued by Dr Adam Lawson[1] at British Nuclear Fuels Limited (BNFL);[2]
- 18 thyroid glands taken in 1968 for Dr Malcolm Dean and Dr I Trevena, at the Atomic Weapons Establishment (AWE) in Aldermaston;[3]
- various organs taken between 1980 and 1985 from 31 randomly-chosen bodies for the population studies run by Dr Donald Popplewell[4] at the National Radiological Protection Board (NRPB);[5]
- 40 fetus, between 1990 and 1997, for the NRPB's fetal studies.[6]

It is possible that from 1964 bone was provided for the Medical Research Council's strontium-90 studies[7] but most of the samples from the area appear to have been taken at Cumberland Infirmary.

3 This chapter examines the roles of WCH, the local NHS and the employees who provided those organs and considers whether appropriate management safeguards were in place to ensure proper practice.

4 From time to time during this period, the pathologists at WCH also provided organs to researchers not based at UK nuclear facilities.[8] It is possible that on occasion those organs may have been taken from Sellafield workers but

1 Medical officers and eventually Company Chief Medical Officers at BNFL

2 See chapter 5, "British Nuclear Fuels Limited"

3 See chapter 5, "British Nuclear Fuels Limited" (paragraphs 60–62) and chapter 9, "The Atomic Weapons Establishment"

4 Principal Scientific Officer, NRPB

5 See chapter 8, "The National Radiological Protection Board"

6 Ibid

7 See chapter 11, "Strontium and the Medical Research Council"

8 For example, the provision of thyroid glands to Dr Colin Bowlt at St Bartholomew's Hospital, London: see paragraphs 313 et seq of chapter 5, "British Nuclear Fuels Limited"

the studies fall outside the Inquiry's Terms of Reference and are not considered.

NHS management and organisation

5 Management of the NHS has changed greatly over the past 50 years. In the 1960s, hospitals were administered by committee. The Hospital Administrator was the nearest equivalent to a modern Chief Executive, but lacked his wide-ranging managerial and executive powers. Hospital consultants were responsible for clinical services, largely unfettered by managerial influence: the pathology department at WCH, which included the mortuary, was typical, being administered only by the senior consultant pathologist.

6 In the 1970s, consultants generally became more involved in the running of their hospitals. NHS reorganisation in 1974 established multi-disciplinary management teams for the day-to-day running of the hospital, the Hospital Administrator working with heads of departments and senior nursing staff. District management teams and area and regional health authorities were created, to manage and support hospitals.

West Cumbria District Health Authority

7 In the course of another reorganisation, West Cumbria District Health Authority (DHA), based at WCH, was created on 1 April 1982. Mr Eric Urquhart became Vice-Chairman and, on 1 October 1985, Chairman.[9]

8 A hospital Unit General Manager (UGM) was accountable to his counterpart (District General Manager, DGM) in the DHA. Pathology and mortuary services at WCH therefore fell within the DHA's remit. Minutes of relevant DHA meetings are no longer available.

9 Mr Urquhart had acted as Chairman from March 1985 before his formal appointment; he remained as Chairman until October 1991

The Griffiths report

9 The creation of UGMs and DGMs presaged the fundamental overhaul of NHS management stimulated by the Griffiths report[10] in 1983. Consultants became more involved in formal management, and performance monitoring and improved accountability for resources were introduced. The report recommended that clinical services be reorganised into directorates, managed by a clinical director. In practice, however, clinical directors' managerial responsibilities were tacked on to their clinical responsibilities. Management still tended to happen by negotiation rather than through clear lines of accountability and full implementation of the recommendations came slowly.

10 Mr Urquhart told the Inquiry that after the changes:

> *I observed a change in management style and there was much more challenge to the medics and the various professions whereby the self interest of some of the professional groups came under more scrutiny. However, the principal area of concern at the time remained the fabric of the hospital and in particular I was not made aware of any issues relating to the pathology department at West Cumberland Hospital.*

Trust status

11 Another reorganisation in 1990/91 allowed hospitals to apply to become independent NHS trusts, with more control over their affairs. Managers of such hospitals had to provide evidence of financial and organisational fitness and to show that clinicians were involved in management. Applications for trust status were scrutinised by regional health authorities before submission to the new NHS Executive and Ministers for final approval. UGMs had to compete for the new trust Chief Executive posts, whose additional responsibility and anticipated managerial professionalism commanded much higher salaries.

12 The drive to hold clinicians more accountable for their work continued with the introduction of medical audit. Clinical Directors were organised under a

10 Griffiths, Sir Roy, *National Health Service Management Inquiry* (DHSS, 1983)

Medical Director,[11] who sat on the Trust Board and was directly accountable to the Chief Executive and to the Board.

13 On 1 April 1993, WCH became West Cumbria Health Care NHS Trust, with Mr Urquhart as its Chairman and Mr Nigel Woodcock, who had been the UGM at WCH since 1990, as its Chief Executive.

The pathology department

Location

14 The WCH pathology department is located in the main hospital building. Pathology records are stored in an adjoining building known as the Animal House.[12] The mortuary is a separate, isolated building, across a service road from the pathology department.

Management

15 From his appointment in 1967, Dr David Smith was the senior consultant pathologist in charge at WCH, more by accident than by design:

> *I was in overall administrative charge as Dr Rigg*[13] *was not interested in that type of thing. I found that heavy going as I had no previous experience.*

16 In the mid-1980s, Mr Ian Lowis was appointed Pathology Manager and mortuary staff became accountable to him rather than to Dr Smith.[14] Mr Lowis was directly involved in running the mortuary but in practice his ability to influence the consultant pathologists was minimal. Dr Smith remained in *de facto* control of clinical matters, accountable initially to the UGM and, following the creation of the Trust, to Mr Woodcock.

17 Mr Woodcock told the Inquiry how he had prepared the hospital for trust status. He had been eager to involve clinicians in management and had appointed a Medical Director. However, he said:

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11 Clinical and Medical Directors were nearly always medical consultants at the hospital

12 Historically, the area had been used to keep laboratory animals

13 Dr Kathleen Rigg, consultant pathologist, left WCH in 1970

14 Previously, the remit of the Pathology Manager had been confined to the pathology laboratories

> [I had] *very little day to day contact with individual departments ... I would rely on my operational managers for ... running those departments.*

It was some time before he had any involvement with the pathology department:

> *My first recollection of the pathology department at West Cumberland Hospital is that it was quite an outdated building facility ... In the mid 1990s I became involved in the department when disciplinary proceedings were commenced against one of the mortuary technicians.*[15]

18 In the early 1990s, Dr Smith *"passed administrative duties to"* his junior consultant, Dr George Ghazala. Mr Lowis continued to hold overall management responsibility for administration and support staff, including the mortuary technicians.

19 In February 1995, Mr Kenneth Ball, who had worked at WCH from 1979, became Manager of Clinical Support Services. His remit included overall management of the pathology department, although it was but one of 12 departments for which he was responsible. He had no day-to-day contact with the department, relying on Mr Lowis to bring matters to his attention.

The mortuary

20 Mr William Chapman worked in the mortuary at WCH from November 1979 to November 1996 and assisted in the provision of organs to both BNFL and the NRPB. Until Mr Lowis's appointment, he reported to Dr Smith. He said that he was very low in the hierarchy and so did whatever he was told to do by Dr Smith and Mr Lowis.

21 He was initially employed as a porter, starting at the age of 18 in July 1979. After meeting Dr Smith in the mortuary and expressing an interest in the department's work, he was invited to observe a post mortem and Dr Smith began to involve him in mortuary work, even before his appointment as a trainee post mortem room technician.

22 Mr Chapman's work involved preparing bodies for post mortem, including the initial removal of organs. He had no assistance until two trainees started work in the mid-1990s. As there were no domestic staff assigned to the mortuary, his duties also included cleaning and other menial tasks. In the winter the mortuary was unheated, and in the summer the atmosphere

15 Mr William Chapman: see paragraphs 20 et seq

was stifling as there was only one extractor fan. Mr Chapman described his existence in the mortuary as grim.

23 Mr Chapman's description of the mortuary gave an impression of a neglected department. In November 1991, Dr Smith complained to Mr Woodcock about *"the unsatisfactory state of the mortuary and post-mortem suite"* but it was not until 1994, after the Factory Inspectorate had allowed it to remain open only on the understanding that it would be significantly improved, that the mortuary was refurbished.

24 On 15 April 2000, Mr Terence Baxter, anatomical pathology technologist,[16] wrote to Mr Ball setting out a long list of faults, including *"P.M. tables … fused together with blood and bodily remains … teeth found inside the tables … Pathologists work area … having blood and bodily remains"*. The final entry in his list captured the air of neglect that had persisted through the years:

> *Organs had not been thrown out. Some as late as 1987! The whole place was generally unclean and smelling dirty.*

Mr Ball could not recall Mr Baxter's note, nor could he remember what, if any, action was taken in response.

Organs from Sellafield workers

25 Between 1960 and 1991, an extraordinary range of organs[17] taken from 64 Sellafield workers were analysed at Sellafield. The vast majority (57) of the post mortem examinations were performed at WCH, 45 by three pathologists: Dr Smith (20), Dr Ghazala (15) and Dr Philip Whitehead (ten). Dr Smith was the longest serving, being appointed in 1967 and retiring in 1998; Dr Whitehead was appointed in 1970 and moved to Bristol in 1979; Dr Ghazala was appointed in 1983 and died in 1999.

26 The arrangements by which the organs came to be analysed are described in detail in chapter 5, "British Nuclear Fuels Limited". Mr Chapman recalled that a typed list of the organs usually to be removed was kept in the mortuary on a yellow table: the Inquiry has not seen any such list. Dr Schofield and/or one of his colleagues from Sellafield would attend the post mortem to collect the organs. On many occasions Mr Chapman was obliged not merely to make available organs which had been examined in

16 The former job title was mortuary technician

17 See chapter 5, "British Nuclear Fuels Limited", paragraphs 169 et seq

the ordinary course of the post mortem but also to remove bones – typically vertebral bodies and femur – which the pathologist had not examined at all.

27 The femur was important in radiochemical analysis as one of the sites where plutonium was deposited. Mr Chapman would remove the bone after the post mortem had been concluded, and would reconstitute the leg with a broom handle. He told the Inquiry that he would buy the broom handles himself from a local hardware store and reclaim the money from petty cash. The Inquiry saw a number of receipts which appeared to confirm the practice.

Organs to the NRPB

28 The NRPB was provided with organs taken at 31 post mortem examinations at WCH, the majority performed by Dr Smith (18) and Dr Ghazala (seven).[18] Mr Chapman said that he was given a list, similar to that which he recalled being provided by Sellafield. Pending collection the organs were stored in a freezer, purchased for the mortuary by the NRPB. In 1992, the provision of fetus to the NRPB[19] became part of Mr Chapman's job description:

> *Liaison with the National Radiological Protection Board when sending specimens for analysis in sociable and unsociable hours.*

He was paid a small fee by the NRPB for the additional work.

Unorthodox practices

Re-opening of bodies

29 Mr Chapman recalled a number of unorthodox practices within the mortuary. He said that it was not uncommon for him to be asked to re-open bodies to allow the pathologist to examine organs which had not been adequately examined in the course of the post mortem. He remembered on one occasion being asked by Dr Smith to retrieve the body of a Sellafield worker from the mortuary fridge because Dr Lawson wanted to obtain organs for analysis.[20] Dr Smith denied, in evidence to the Inquiry, that bodies had ever been re-opened.

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18 The arrangements are described in detail in chapter 8, "The National Radiological Protection Board"

19 See chapter 8, "The National Radiological Protection Board", paragraphs 115–125

20 See chapter 5, "British Nuclear Fuels Limited", paragraph 164

Surgical procedures

30 To the Inquiry's surprise, Mr Chapman recalled occasions on which bodies in the mortuary, some on which no post mortem examination was planned, were used by medical staff to practise surgical procedures such as abdominal operations. He described how some of these procedures had been filmed, he presumed for training. The Inquiry asked to see videotapes, said to be held at WCH, which might have corroborated his claim but none could be found. Two retired consultant pathologists, who had not worked in Cumbria, told the Inquiry that they had been aware of surgeons practising procedures on bodies in other mortuaries.

31 The Inquiry spoke to an orthopaedic surgeon who had trained at WCH. He had attended one or two post mortems each week as part of his education in anatomy and pathology. From time to time, consultant surgeons or registrars would also attend. On occasion he was invited by the pathologists to assist: for example, he described that on one occasion, when a thrombosis was suspected, he dissected out the veins in the arm. He thought this was common practice at the time and said he always acted under the authority of the pathologists. He did not recall filming of post mortem examinations, nor the performance of surgical procedures in the mortuary.

32 The surgeon's evidence does not corroborate Mr Chapman's recollections of training procedures being performed on bodies in the mortuary, although it is possible that elements of his evidence suggest that Mr Chapman's account might be based upon a misinterpretation of actual events. The Inquiry cannot conclude, on the limited investigation it has undertaken given that the issue lies outside its Terms of Reference, that those recollections are accurate.

Documents

33 Mr Chapman said that it was not until the late 1980s that he began to see documented consent to hospital post mortem, comprising a brief case history and a standard form[21] signed by a relative: there was, in fact, no formal requirement for consent to be documented while no consent was required for coronial post mortem.

21 The Inquiry asked for examples of consent forms used at WCH: the earliest located was dated 1985

34 He described the administrative process after post mortem examination. For each deceased, a copy of the post mortem report was clipped to an "organ sheet" detailing the weights of each organ and what had been sent to histology; in the case of a hospital post mortem, a copy of the consent form was also attached. The papers were kept in chronological order in grey box files. When full, the box files were kept for two years on top of cabinets in the pathology office before being stored in the Animal House.

35 The practice of taking organs at post mortem from Sellafield workers had begun long before Mr Chapman arrived.[22] He recalled a specimen book marked "BNFL" in which organs removed were listed. He described it as a very old, small, green book and recalled that a similar book had been opened when the pathologists began to provide organs to the NRPB. Both books were kept in the mortuary filing cabinet. WCH has not been able to locate them and no other witness remembers them.

WCH knowledge of organ provision

Sellafield

36 It is unclear who at WCH knew of the removal of organs from Sellafield workers. Mr Chapman said Mr Lowis became aware as soon as he was appointed Pathology Manager because he demanded to know every aspect of Mr Chapman's work; the Inquiry has not heard from Mr Lowis, who died before it was constituted.

37 Mr Chapman claimed Mr Woodcock knew of the practice but Mr Woodcock denied it: he had had very little contact with the pathology department and said that had he been aware of the arrangement with BNFL he would have found it *"very concerning and ... would have dealt with it head on"*. On this point, the Inquiry preferred Mr Woodcock's evidence.

38 Mr Chapman also told the Inquiry that Mr Ball, with whom he was friendly, knew of the arrangement but Mr Ball denied it. There is insufficient evidence to determine this issue with any certainty but even if Mr Ball had been told, he was a pharmacist at the time: he did not become involved with the pathology department until 1995, four years after the supply of organs to Sellafield ceased.

22 By the time Mr Chapman started work in the pathology department, organs had been taken at post mortem from 33 Sellafield workers

The NRPB

39 There is no indication that anyone at WCH more senior than Dr Smith knew of the provision of organs for the NRPB's population studies. Such organs should not have been taken without proper consent; the arrangements should, if known to management, have been cause for concern.

40 WCH managers were, however, undoubtedly aware of the provision of fetus to the NRPB in the 1990s. On 3 February 1992, Mr Woodcock responded to a note from the NHS Executive on sensitive disposal of fetus by informing the Northern Region Health Authority that WCH was supplying fetus to the NRPB for research, describing how they were stored and numbered before delivery. In August 1993, he referred to *"a well established procedure with the National Radiological Protection Board in Oxford to provide specimens from late social terminations"*. The fetal studies had received appropriate ethical approval and maternal consent was obtained for each fetus to be supplied: there was therefore no cause for managerial concern.

Mr Chapman's credibility

41 On 15 July 1983, Mr Chapman was awarded the Certificate in Anatomical Pathology Technology by the Royal Institute of Public Health and Hygiene (RIPHH). Possession of the Certificate had been made part of his job requirement.

42 In 1993, Mr Chapman took a course leading to the RIPHH's Diploma but failed the examination. Embarrassed by his failure and his professional pride hurt, he obtained a forged certificate which he submitted to WCH claiming to have passed. In 1996 his deceit came to light and after a disciplinary hearing he was dismissed for gross misconduct. Although he felt the punishment was harsh, as he had not benefited financially from the deception, he did not appeal.

43 Although this deception might call into question the veracity of Mr Chapman's evidence, the Inquiry has taken the view that he had a genuine desire to assist its investigation. He had approached the Inquiry voluntarily and told his present employer the reason for his dismissal by WCH. He acted with integrity throughout the Inquiry process. He expressed remorse for his part in the provision of organs to BNFL and the NRPB, albeit that his actions

were at the request of his superiors. Nevertheless, the Inquiry took care to corroborate Mr Chapman's evidence whenever possible.

44 Mr Chapman's memories of some events were plainly mistaken, but in those areas in which he had been directly involved, such as the removal of organs and bones from bodies in the WCH mortuary, the Inquiry found his evidence to be accurate and of considerable value.

Incidents and indiscipline

45 Apart from Mr Chapman's dismissal, the Inquiry heard of a number of other untoward incidents in the pathology department in the 1990s. Another mortuary technician was dismissed and a third resigned before a disciplinary hearing. Allegations of financial and sexual impropriety were made and investigated. While Mr Chapman was suspended pending his disciplinary hearing, it was alleged that offices were broken into and papers rifled and the car belonging to the Head of Human Resources was also broken into. The picture painted was of a dysfunctional department. As Mr Woodcock put it:

> *there are hidden corners of organisations ... it* [the mortuary] *just had a sense and a feel to it which was by definition wrong ... my sense was there was a darker side of things ... it felt like a Pandora's box.*

Audit

Internal

46 Audit provided another mechanism by which WCH might have been able to monitor the activity of its pathology department. Before the 1990s, such audit as was undertaken within the NHS was financial in nature; only after that did it move into wider management issues. The only internal audits of the pathology department throughout the entire period of the Inquiry's interest were in 1994 and 1996. Each had a narrow focus: the first looked at allegations of theft from bodies in the mortuary and cremation certificate fees and the second was a special review of mortuary procedures relating to income derived from mortuary work. Neither was concerned with the medical work of the department.

External

47 Although procedures were in place at various times for external audit at district and regional level, the Inquiry has seen no evidence of any external audit of WCH's pathology and mortuary services.

Ethics committees

48 Within WCH, both management and audit failed to bring to light the inappropriate provision of organs by the pathology department. Consideration of the research using those organs could have been provided from outside WCH by ethics committees, which from the 1960s had governed research undertaken in or sponsored by the NHS under guidance from the Department of Health.

49 However, early guidance,[23] while emphasising the need for information and consent, referred only to clinical investigations on the living. Research involving organs obtained at post mortem was not mentioned and there was no reference to the Human Tissue Act 1961.

50 In June 1975, the guidance was updated to address the ethical issues of research involving fetal material;[24] this was the first guidance relating to work involving other than the living.

51 It was not until 1991 that Department of Health guidance[25] to what were to become local research ethics committees (LRECs) expressly mentioned the deceased:

> *An LREC must be consulted about any research proposal involving ... the recently dead … No NHS body should agree to such a research proposal without the approval of the relevant LREC … These requirements apply equally to researchers ... within the NHS ... who have no other association with the NHS ... beyond the particular research project.*

52 The post mortem work at BNFL was not submitted for scrutiny by an ethics committee. No ethical approval was sought for the NRPB population

23 Ministry of Health circular HM(68)33: Supervision of the ethics of clinical investigations

24 HSC (IS) 153: Supervision of the ethics of clinical research investigations and fetal research

25 HSG (91) 5: Local Research Ethics Committees

studies.[26] In the absence of specific mention of the deceased in contemporaneous Department of Health guidance there was no overriding requirement for ethical approval.

The Black Advisory Group

53 In July 1984 the advisory group chaired by Sir Douglas Black reported[27] on its investigation into the possible increased incidence of cancer in West Cumbria. The report recommended that further studies of human exposure to radiation be undertaken. At a meeting held at the Department of Health on 22 October 1984 it was noted that:

> *The ethical aspects of such studies needed to be considered, carefully ... it would probably be ethically necessary to ask the relatives' permission to use post-mortem tissues. Dr Terrell*[28] *... said that he would ask the local ethical committee for their opinion on the appropriateness of using post-mortem material and the need to obtain the relatives' consent. The ethical committee did not usually cover this type of project on post-mortem material ... the quantity of tissue was a major factor, since a small piece of liver was acceptable, but a whole fetus was probably not.*

54 On 8 November 1984, the West Cumbria Health Authority Ethics of Research Committee considered a proposal by Dr Terrell arising out of the Black report and commented:

> *it might be usefully promulgated in the West Cumbria community that certain tissue specimens, as they became available, would be routinely examined for radioactivity ... without detailed specific consents for each test; and that reliance should then be placed on any person or relatives who so wished, to opt out.*

55 Just under a month later, on 29 November 1984, Dr Terrell attended a public meeting of the Sellafield Local Liaison Committee (SLLC). This was a body which existed to allow exchange of information between Sellafield and the local community. Its membership included Dr Schofield (and, after his death, his successor Dr Lawson), Mr Peter Mummery[29] and representatives

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26 Although ethical approval for the paediatric and fetal studies undertaken by the NRPB was obtained in 1985 and 1990 respectively: see paragraphs 57 and 115 of chapter 8, "The National Radiological Protection Board"

27 Black, Sir Douglas, *Investigation of the Possible Increased Incidence of Cancer in West Cumbria, Report of the Independent Advisory Group*, Cmnd 667 (122) (HMSO, 1984)

28 DHA Medical Director

29 Director of Health and Safety, BNFL

of the Six Parish Councils Committee (6PCC)[30] and various other local bodies.[31] At the meeting, the 6PCC representatives inquired about research under way or proposed as a result of the Black report. Dr Terrell said:

> *a variety of projects had been discussed for studying actual amounts of radioactive material in the human body. The objective was to have protocols ... for progressing through the appropriate ethical committees.*

56 On 1 April 1985, Dr Eileen Rubery[32] wrote to Ms Marjorie Higham, the Honorary Secretary of the 6PCC:

> *NRPB are collaborating with local physicians and pathologists to obtain post-mortem tissues to assay directly for ... plutonium.*

57 Dr Rubery attended the next 6PCC meeting on 1 August 1985, after which Ms Higham wrote to her:

> *British Nuclear Fuels have been analysing human tissue and bones (including lymph nodes) for at least ten years. The material has been obtained from West Cumberland Hospital. Are you familiar with this work? Dr Schofield assured me this work would be published. Do you know if it has?*

The letter reveals knowledge of the post mortem work and suggests Ms Higham had discussed it with Dr Schofield. Dr Rubery replied to Ms Higham on 17 September 1985, noting:

> *As I said at the meeting DHSS is anxious to encourage work on tissue ... providing that ... it has the appropriate ethical committee approval. The Black Advisory Group did receive details of work done on radionuclide levels in human tissue and bone in workers at BNFL, which it considered before producing its report.*

58 Although after the Black report there was much discussion of the need for post mortem work and of the associated ethical considerations, only the NRPB's fetal studies, for which full ethical approval had been granted, were actually undertaken.

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30 A body composed of representatives from six local parishes: Drigg and Carleton, Ponsonby, Seascale, Gosforth, St Bridget and St John, Beckermet

31 Including West Cumbria Community Health Council, NHS bodies including the DHA and trade unions

32 Senior Medical Officer, Toxicology and Environmental Protection, DHSS

West Cumbria Community Health Council

59 The Reverend Alan Postlethwaite was the vicar at Seascale from 1968 to 1977 and at Whitehaven from 1977 to 1984; he was also Chairman of West Cumbria Community Health Council until 1978.

60 On 1 February 2001, shortly after publication of the Alder Hey Inquiry report,[33] Reverend Postlethwaite wrote to Mr Urquhart, who had succeeded him as Chairman of West Cumbria Health Care NHS Trust:

> *My concern related to the very close association that existed between Geoff Schofield, the then BNFL medical officer, and the WCH pathology department ... Undertakers and others repeatedly asserted that body parts of BNFL employees were routinely being removed to be retained as evidence in any future claims for compensation for industrial injury. Comments like "you never bury a whole BNFL worker" were part of the local mythology. I was never aware in dealing with bereaved families at that time that their consent was asked.*

61 Mr Urquart passed the letter to Mr Brian Earley, acting Chief Executive of the Trust, who wrote to Dr Ian McAndrew, occupational health physician at WCH:

> *It would help if you could assist me in being able to formally refute these assertions as I do not want to have the Reverend Postlethwaite involving the media and whipping up even more anxiety than has already been generated by the disclosures from Alder Hey and indeed the disgraceful journalism exhibited locally.*

62 Mr Earley asked for assistance from Dr Andrej Slovak, BNFL Company Chief Medical Officer. Dr Slovak replied that any organ retention *"would usually have been at* [the relatives'] *request and certainly, implicitly with their consent"* and brusquely dismissed the allegations:

> *The rather flippant hearsay which Mr Postlethwaite refers to has the essential nature of an urban myth which he himself acknowledges. He seems to give it the credence it deserves which is none at all.*

It is plain, in the light of subsequent revelations, that Dr Slovak could not have been more wrong.

33 *The Royal Liverpool Children's Inquiry Report*, HC12-II (TSO, 2001)

63 On 26 March 2001, Mr Urquhart wrote to Reverend Postlethwaite:

> *I was able to instigate a range of enquiries alongside the task of dealing with requests from quite a number of families many of whom simply wanted to know what happened to their loved ones, in some cases many years ago ... there was no specific identifiable evidence that any organs or tissue had been retained relating to any radiobiological factor.*

64 It is regrettable that Mr Urquhart, based upon only a cursory investigation by Dr Slovak, gave such short shrift to Reverend Postlethwaite's queries. Although no organs were provided to BNFL after Reverend Postlethwaite's letter, the matters considered by the Inquiry could have come to the fore much sooner had there been a proper investigation.

The search for evidence

65 On 6 December 2007, the Inquiry met Ms Marie Burnham, Chief Executive of the North Cumbria Acute Hospitals NHS Trust, and the Trust's solicitors to discuss access to documentation held by the Trust. The Trust insisted that the Inquiry's document searches were channelled through its solicitors. Fortunately, all post mortem reports had been kept. Unfortunately, many other records were no longer available. Some had probably been routinely destroyed but others, such as management committee minutes, should still have been available. The Trust's inability to find such documents reflects poorly on the way in which it has been managed in the past.

66 Other difficulties were encountered. When the Inquiry sought to obtain videotapes which it was alleged had been made in the mortuary department,[34] several tapes held in the Postgraduate Centre at WCH were unexpectedly moved, apparently very shortly before the Inquiry's visit: some time later, a few videotapes were located but none was of relevance. Files containing notes of Board meetings went missing and then reappeared. Despite Ms Burnham's instruction that it be left untouched, a locked file store was entered.

67 The Inquiry cannot assess the extent to which further evidence relevant to its investigations might at any point have been available in WCH.

34 See paragraphs 30–32

Conclusion

68 The pathology department at WCH, and in particular the mortuary, languished over many years in a state of neglect, operating in a managerial vacuum. Pathologists complied with requests for organs and delegated the task of supply and organisation to the mortuary technicians. Elsewhere in its Report,[35] the Inquiry describes how consent required by law for the removal of organs at post mortem was not obtained. Absence of managerial scrutiny meant that abuses were not noted and halted. The provision of organs to BNFL survived major NHS reorganisations, changes in management at WCH, the onset of trust status and new governance arrangements. It did so because the mortuary was never considered a priority and was largely left to run itself.

35 Chapter 5, "British Nuclear Fuels Limited", and chapter 8, "The National Radiological Protection Board"

The Families

Chapter 13

The Families

Chapter 13

Contents

Introduction

Background

1 The Inquiry found 76 cases in which it could be sure that organs taken from nuclear workers between 1960 and 1991 had been subjected to radiochemical analysis,[1] either in the laboratory at Sellafield or at Sellafield's request.[2] Sixty-four of those men had worked at Sellafield, four at Springfields, two at Capenhurst, five at Aldermaston and one at Dounreay. All the cases were investigated, with care and in detail.

2 The families of 14 men registered and sustained their interest in the Inquiry's investigation and provided invaluable evidence, giving insight into the events and their consequences. The organs of two of the 14 were analysed by the National Radiological Protection Board (NRPB), one at coronial request and one as part of the NRPB's population studies.[3] The questions the families asked raised issues which were of relevance to all the cases investigated by the Inquiry.

Families' questions

3 The Inquiry carefully considered the questions raised by the families in their statements and evidence. The most commonly asked were as follows:

- What arrangements were in place to inform British Nuclear Fuels Limited (BNFL) of the deaths of an employee or former employee?
- Were particular individuals identified as being of interest, so that their organs could be removed when they died?
- Why were doctors or other staff from BNFL's Medical Department present at post mortem examinations?
- What part did the NRPB play?
- On what authority were organs removed for analysis?
- Which organs were removed?
- Why were organs removed which were not relevant to the cause of death?
- Why were the organs removed not listed on the post mortem report?

1 In one further case, it appears to have been intended that organs be removed from an Aldermaston worker, but it is not clear whether any organs were actually removed or analysed: see chapter 9, "The Atomic Weapons Establishment", paragraphs 17–21

2 In the first three cases in which organs were removed, the analysis was undertaken at Harwell and/or Woolwich: in one further case, the analysis was performed at Harwell because of the nature of the deceased's employment at Sellafield

3 See chapter 8, "The National Radiological Protection Board"

- Why were the families not told that organs were to be or had been removed?
- How were the organs transported from the mortuary to Sellafield and how were they stored there?
- Were the organs, or parts of them, sent for analysis elsewhere?
- Did any money change hands?
- Do the organs still exist and if so, in what form?
- Why was the analysis done?
- What use did BNFL make of the data?
- Do the data still exist and if so, in what form and who has access to them?
- In what publications have the data appeared?
- Were the trade unions aware that organs were being removed and if so, what was their role?
- Why did the coroner not prevent this abuse from happening?

4 In the evidence the Inquiry received from the families, some themes recurred:

- none was asked for permission to remove organs from the deceased person's body, whether for research or for use in litigation;
- most were, understandably, unaware of what a post mortem examination involved and none had considered the possibility that whole organs could be removed for analysis and not returned to the body, still less that this could be done without their knowledge or consent;
- they had been given little or no information, whether by coroners, coroner's officers, treating clinicians, pathologists, solicitors or the nuclear industry;
- none had been made aware at the time that organs had been removed;
- some had had the opportunity to find out that organs had been removed when they heard the expert evidence which was given at the inquest but some found out only many years later, when the Inquiry was instituted;
- the discovery that a body which they had thought had been buried or cremated intact was in fact missing many internal organs came as a great shock;
- much distress was caused by the perceived lack of dignity and respect shown to the body;
- some, had they been asked and given detailed information at the time, would have agreed that the organs could be removed and analysed.

5 This Report addresses all those issues. Some, which are specific to individual cases, are discussed in this chapter. Others, which are common to all or most of the cases which the Inquiry has investigated (such as the systems in place which permitted organs to be removed), are discussed in

detail elsewhere in the Report: see especially chapter 5, "British Nuclear Fuels Limited".

6 The Inquiry's conclusions in respect of the cases it investigated must, of course, be considered in the light of all the matters discussed. Some background information, all of which appears in more detail elsewhere in the Report, is summarised below in order that each story can be understood in isolation.

Post mortem examination

7 A post mortem examination, which is performed in a mortuary by a pathologist, involves opening the body to allow examination of the internal organs. Some or all of the organs are taken out of the body, examined, weighed and returned. Specimens of tissue a few grams in weight are usually removed for examination under a microscope (histology).

8 Post mortem examination can be of enormous assistance in establishing the exact cause of death. Information gathered at such examinations has helped in the advancement of medical science and has improved treatment available to patients. However, it is an invasive procedure and the prospect of a post mortem can cause distress to the deceased person's relatives, particularly coming as it does immediately after the trauma of bereavement.

The coroner

9 The task of the coroner is to investigate sudden and unexpected deaths and deaths which, for whatever reason, are referred to him for investigation.[4] When a death is referred to a coroner, he will often request a post mortem examination. Frequently, the post mortem reveals the cause of death, which the coroner may then certify. In some cases, however, further investigation is required and an inquest – a formal hearing, which takes place in public – may be held.

10 At the conclusion of the inquest, the coroner (or, in some cases, the jury) returns a decision, often called the verdict, as to how the deceased died. One verdict available in cases in which radiation might have contributed to the fatal illness was that the death resulted from an industrial disease.

4 Coroners must also investigate deaths which have occurred in particular circumstances, for example in prison: see chapter 3, "Law and Guidance"

The law

11 There are two types of post mortem examination.

- A hospital post mortem is done with the agreement of the deceased person's relatives, usually after the death has occurred in hospital. Its aim is to provide more information about the cause of death, the presence of other illnesses and the effects of any treatment given. Consent to a hospital post mortem includes consent to tissues and organs being removed from the body if examining them will assist in that purpose.
- A coronial post mortem is undertaken at the request of a coroner to whom the death has been reported. The agreement of the relatives is not required. The scope of a coronial post mortem is more limited than that of a hospital post mortem, being confined to establishing the cause of death. Tissue and organs may be removed from the body only if the pathologist conducting the examination considers that they may be of assistance in determining the cause of death.

12 Whether the examination is a hospital or a coronial post mortem, organs may be removed from the body for reasons unconnected with the purpose of the post mortem, such as medical education or research, only after the agreement of the relatives has been obtained.[5] At a coronial post mortem, the coroner's consent to such removal is required in addition to that of the relatives.

13 Organs and tissue removed at a coronial post mortem may be subjected to basic tests, such as histological examination, without further permission from the coroner. More complex investigations, such as radiochemical analysis, require specific authorisation from the coroner, which he may give only if he has decided to hold an inquest.[6]

14 The Coroners Rules specify certain people whom the coroner must inform when a post mortem which he has requested is to take place. The Rules provide also that he may inform, and allow to attend the examination, anyone else he considers appropriate. There are no statutory provisions governing attendance at hospital post mortem.

15 The law governing post mortem examinations and the removal of tissues and organs from bodies is described in chapter 3, "Law and Guidance".

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5 Human Tissue Act 1961, s1

6 Coroners (Amendment) Act 1926, s22

Compensation claims

16 Relatives of men who had died after working at Sellafield sometimes connected the fatal illness with occupational exposure to radiation and wished to investigate claims for compensation. The unions which represented BNFL's employees at Sellafield would arrange for investigation into the death and representation at the inquest and would assist them in bringing the claim. Both the unions and BNFL recognised that evidence from radiochemical analysis of organs removed at post mortem could influence both the verdict returned at the inquest and the outcome of any civil claim for compensation.

17 In 1982, after several civil claims had been brought and settled, a scheme (the Compensation Scheme for Radiation-Linked Diseases) was introduced, which provided for money to be paid to bereaved relatives without the need for lengthy, complex and expensive litigation. The Compensation Scheme remains in operation and is described in chapter 7, "The Trade Unions and the Compensation Scheme".

Dr Geoffrey Schofield

18 Dr Geoffrey Schofield joined the Medical Department of the United Kingdom Atomic Energy Authority (UKAEA) at Sellafield in 1958 and was promoted to Senior Medical Officer in 1962. He transferred to BNFL when it was created in 1971. He was promoted to Company Senior Medical Officer in 1973, to Chief Medical Officer in 1975 and to Company Chief Medical Officer in 1979.

19 Dr Schofield was a well-liked and highly respected occupational physician. He developed strong links between Sellafield and West Cumberland Hospital in Whitehaven, where for many years he held an honorary post as clinical assistant in radiation medicine. Between 1981 and his death in 1985, he was a member of West Cumbria District Health Authority.

20 Dr Schofield had degrees in engineering and in medicine and was keenly interested in the effects of radiation upon the human body. Radiochemical analysis of organs after death was the most accurate method of assessing the levels of plutonium in the body and from the early 1960s Dr Schofield was involved in obtaining organs from former Sellafield workers for such

analysis.[7] He described the results in several papers, published in established, peer-reviewed scientific journals.

Investigation

21 The Inquiry was eager to hear evidence from relatives of the individuals from whom organs were taken. Its inception was accompanied by considerable publicity, particularly in Cumbria; open meetings were held in Whitehaven; and a telephone helpline was set up by BNFL to allow anyone who suspected that one of his or her relatives might have been involved to obtain information.

22 The Inquiry investigated all cases within its remit, paying particular attention to the 76 mentioned in paragraph 1, and assembled a wealth of material upon which it was able to reach sound conclusions. Occupational health, dosimetry and personnel records, coronial papers and litigation files held by the unions (or their solicitors) and by BNFL were obtained. The laboratory analytical records of each case were also identified and disclosed. Evidence from relevant witnesses was taken where possible. The Inquiry was not surprised that only a relatively small number of the families of those individuals did make contact with the Inquiry: the issues raised are intensely personal and many families simply would not have wanted to know. In accordance with recommended practice,[8] no steps were taken actively to trace the relatives of any of the individuals who had been involved. The stories surrounding the deaths of the men in those cases were representative of the rest: the Inquiry does not consider its investigation to have been impaired by the inability to talk to the remaining families.

Anonymity

23 The anonymity of those families who elected not to give evidence to the Inquiry must be respected. In a tight-knit community such as West Cumbria, where BNFL was the dominant employer, preservation of that anonymity is particularly difficult. Publication of any details of those cases in which the families did not come forward presents a risk of identification:

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7 The analytical process began by converting the organs to ash in a furnace and dissolving the ash in strong acid. It is described in greater detail in chapter 2, "Science"

8 Brazier M, Organ retention and return: problems of consent, *Journal of Medical Ethics*, 2003, 29: 30–33. *"A final question was raised about how to return organs which were taken a long time ago and which the family had no idea had been retained. The* [Retained Organs] *Commission advises that unless families contact you, the best policy is to remain silent. Some hospitals and coroners have not done this and have proactively and independently contacted families. The result has been a lot of heartache."*

just the age and the year and cause of death might give former fellow workers a good idea of who the individual was.

24 Accordingly, it is intended that this Report not include information which would allow an individual to be identified without the consent of his family.

Sellafield

25 Between the start of Dr Schofield's investigations in 1960 and his death in 1985, organs from 53 Sellafield workers[9] were removed at post mortem and subjected to radiochemical analysis. Dr Schofield's successor as Company Chief Medical Officer, Dr Adam Lawson, continued the research until he retired in 1990, adding a further ten cases. The last man from whom organs were taken for analysis died in 1991; his organs were analysed in 1993. No organs have been analysed at or on behalf of Sellafield since then.

26 In total, therefore, organs were taken for radiochemical analysis from 64 former Sellafield workers. All but four of the post mortem examinations were coronial. Forty-two of the men were still employed at Sellafield when they died, one[10] was working at Winfrith (having previously worked at Sellafield) and the remaining 21 had either retired or were working outside the nuclear industry. Not all had been exposed to plutonium in the course of their work.

27 In the 1970s, tissue was obtained and analysed in two cases in the course of surgical operations.[11] In one, the man concerned was unaware that the tissue was to be taken; in the other, absence of proper records prevents the Inquiry from reaching any conclusions.

Categories of case

28 The Sellafield cases covered a wide variety of different circumstances. At one extreme, the organs were removed and analysed as part of a genuine coronial investigation; at the other, there was no reason for the removal and analysis other than research. In between, the motive may have been to use the results in litigation, or the pathologist may legitimately have removed

9 The figure does not include nuclear workers whose organs were taken for the purposes of the National Radiological Protection Board's population studies: see chapter 8, "The National Radiological Protection Board", paragraphs 106–110

10 James Connor, whose case is described in detail later in this chapter

11 See chapter 5, "British Nuclear Fuels Limited", paragraphs 77 and 78

organs which then proved of no interest to the coroner. It is convenient to group the cases in order to facilitate some general observations.

Legitimate coronial cases

29 In some cases, the coroner was told of the death of a nuclear worker from a disease, such as a cancer, which might have been induced by radiation. It was then proper for the coroner to request a post mortem; for the pathologist to remove organs for analysis in the belief that the results might elucidate the cause of death; and for the coroner, after deciding to hold an inquest, to request that the organs be analysed. If the coroner then received the analytical results in evidence at the inquest (with suitable expert interpretation), the removal and analysis would have been part of a legitimate and proper coronial investigation.

30 In such cases there can be no criticism of the coroner, the pathologist or the individual or organisation instructed by the coroner to undertake the analysis. The Inquiry considered that ten of the 60 coronial cases fell into this category, including those of James Connor and Robert McLean, which are described in detail later in this chapter.

31 In one further case, organs were appropriately removed; the coroner opened an inquest and asked BNFL to undertake the analysis; and BNFL sent the results of that analysis to him. However, in breach of several of the Coroners Rules, the coroner then purported to close the inquest, without a hearing, in his own office and wrote to the widow to inform her of his decision. While the Inquiry criticises the coroner for his obvious and unlawful breach of the rules,[12] the removal and analysis were legitimate.

Scientific interest

32 The Inquiry found that in the majority of the Sellafield cases the organs were removed and subjected to radiochemical analysis purely in the interests of scientific research: the results would have been of no value in determining the cause of death. In those circumstances, the organs could properly be removed only with the consent of the coroner and of the family of the deceased, neither of which was sought or obtained.

12 See chapter 5, "British Nuclear Fuels Limited", paragraph 189

33 Dr Schofield himself admitted in an internal BNFL paper[13] in 1982 that *"The initial purpose in carrying out the radiochemical analysis of post mortem tissue was entirely scientific"* and Dr David Smith,[14] who had provided Dr Schofield with organs in several cases, told the Inquiry:

> *in some of the cases where I removed organs it could not be argued that radiation was of any possible relevance to the death and I assumed that Dr Schofield was taking organs in those cases for "control" purposes.*

Agreed by Sellafield Limited

34 In its opening submissions, Sellafield Limited (SL)[15] contended that in 23 of the 60 coronial post mortem cases there was no clear coronial justification and that the organs appeared to have been removed and analysed for scientific research. Among them are the cases of Edward McMullen and Michael Brennan, which are described in detail later in this chapter.

35 In most, the cause of death was heart disease,[16] a condition not then thought to be related to radiation; one had died in a road traffic accident. The Inquiry agrees with SL that in none could the removal of organs be said to have been justifiable. The deaths were signed off by the coroner, without an inquest, as being due to natural causes. The results of the radiochemical analyses were not sent to the coroner (who, after all, had no interest in them). The harvest of organs was often very extensive: in one case, which is not atypical, both lungs, the mediastinum, both kidneys, liver, spleen, vertebral bodies, sternum, ribs, femur, testis, glands and marrow were removed at post mortem and analysed at Sellafield. In nearly all, there is no mention in the post mortem report that organs had been removed.

36 On occasion, the disregard for proper practice by all concerned was blatant. In one case, the coroner noted *"Per Dr Schofield … Not thought to be involved with radiation. Don't want to be at P.M. but would like a lung."* Such casual provision of any organ was unjustified but in fact more than just the lung was removed: the post mortem report records that *"A portion of the right lung, the whole liver and the sternum have been taken by*

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13 "Collection and analysis of autopsy specimens", apparently prepared by Dr Schofield as the precursor to his paper published later that year (Schofield GB, Comparisons between in-vivo estimates of systemic Pu deposition and autopsy data, in *Radiological Protection – Advances in Theory and Practice. Proceedings of the 3rd International Symposium of the Society for Radiological Protection*, vol 2 (1982), pp 525–9): see chapter 5, "British Nuclear Fuels Limited", paragraph 57

14 Consultant pathologist, West Cumberland Hospital

15 The company which now operates the site at Sellafield

16 Formally recorded using terms such as coronary insufficiency, myocardial infarction, coronary thrombosis

Mr. Cartwright of BNFL for further analysis".[17] The note failed to arouse any interest on the part of the coroner.

Not agreed by Sellafield Limited

37 The Inquiry considers that the removal and analysis of organs was for scientific interest in a further 12 of the 60 coronial cases, among them those of Stanley Higgins and Gerard Grears, which are described in detail later in this chapter.

38 SL contended in most of those 12 that the removal and analysis were for legitimate coronial reasons. The Inquiry considered the facts of these cases and concluded that they did not differ in substance from those of the 23 which SL agreed fell into the "scientific interest" category. SL appeared to the Inquiry to place unwarranted emphasis on entries in coronial files which suggested any link, however tenuous, between the death and radiation, while ignoring evidence that neither the coroner nor the pathologist gave any credence to such a suggestion at the time. In some of the 12, Dr Schofield himself assured the coroner that the death could not possibly have been caused by exposure to radiation.[18] The purpose in undertaking the analyses in these 12 cases was purely scientific.

Legitimate removal

39 In a further eight cases, the pathologist could reasonably have believed that analysis of organs which he removed at the post mortem examination would be relevant in determining the underlying cause of death, for example from lung cancer. He would then be obliged[19] to preserve those organs in case the coroner wanted to arrange for radiochemical analysis. When in due course the coroner did not order the analysis, it was nevertheless done, at Sellafield. While this was probably not illegal,[20] it is clear that the analysis took place only in the interests of scientific research.

40 For example, one had been a plutonium worker. His death was reported to the coroner. At post mortem, Dr George Ghazala[21] found the cause of death

17 See chapter 5, "British Nuclear Fuels Limited", paragraph 136

18 For example, the case of Gerard Grears, discussed in detail later in this chapter, in which Dr Schofield told the coroner that the latency period of the fatal illness (carcinoma of the prostate) was such that it could not possibly have been caused by the deceased's employment

19 Under rule 6 of the Coroners Rules 1953 or rule 9 of the Coroners Rules 1984

20 The legal position regarding analysis for non-coronial purposes of organs lawfully removed at coronial post mortem was unclear: see chapter 3, "Law and Guidance", paragraphs 85 and 86

21 Consultant pathologist, West Cumberland Hospital

to have been widespread lung cancer. He recorded in his report to the coroner that:

> *Dr. Lawson the Senior Chief* [sic] *Medical Officer at BNFL attended the post-mortem examination and collected some specimens including: 1. Both lungs. 2. Both kidneys. 3. The whole liver. 4. The spleen. 5. Mediastinal and hilar lymph nodes. 6. Bones (some ribs, sternum, some vertebral bodies and the right femur). Dr Lawson and his colleagues will be carrying out special investigations and analysis on these organs and bones.*

It is apparent from Dr Ghazala's note that he believed the organs he had removed and handed to Dr Lawson would be analysed and that the results could assist the coroner in determining the cause of death. However, the following day, before the analysis had been started, Dr Lawson advised the coroner that the cancer had probably been caused by smoking and noted *"The Coroner is therefore treating this death as being due to natural causes"*. The coroner did not request that the organs be analysed and he held no inquest; the analytical results, which became available about five months later, were not sent to him. The only appropriate conclusion is that, while the removal of the organs at the post mortem cannot be criticised, the analysis was performed out of scientific curiosity.

Summary

41 The Inquiry concludes that in no fewer than 43 of the 60 coronial post mortems relating to Sellafield workers at which organs were removed and later analysed, the primary purpose of the analysis was scientific research.

Litigation

42 In the remaining six coronial cases,[22] the organs were removed at a time when litigation arising out of the illness which had caused the death was either thought to be in prospect or actually initiated. In some, there is evidence that the coroner was actively involved in assisting both BNFL and the family of the deceased to obtain organs so that the analytical results could be used in the litigation. There are two reasons why the pathologist performing the post mortem examination might have felt it appropriate, in the circumstances, to remove organs for analysis.

22 Including Malcolm Pattinson, Geoffrey Southward and John Simpson, whose cases are described in detail later in this chapter

- The fact of the litigation would suggest that it was at least arguable that radiation had contributed to the death. If the pathologist shared that view, he would have been required to remove and preserve organs[23] for analysis at coronial request.
- Alternatively, the relatives' representatives might have been involved in the arrangements for the post mortem: for example, solicitors ostensibly acting for the family had arranged for their medical expert to attend or even requested that organs be removed for him. The pathologist might therefore have believed (wrongly, in at least five of the six) that the relatives had agreed to the organs being removed and hence that the removal was lawful.[24]

The Inquiry has, unsurprisingly, little evidence as to the pathologists' state of mind at the time of the post mortem save in two contrasting cases, both of which are described in detail later in this chapter: John Simpson, where the pathologist recorded on the post mortem report that he had removed organs in the belief that they would be analysed for the coroner; and Malcolm Pattinson, where the pathologist told the Inquiry that *"radiochemical analysis had nothing to do with establishing the cause of death"*.

43 In each case, the removed organs underwent radiochemical analysis. The coroner did not request the analysis and the results were not sent to him. These facts superficially appear identical to those of the "legitimate removal" scientific cases discussed at paragraphs 39 and 40. However, the Inquiry regards it as an oversimplification to ignore the motive for obtaining the organs, which was the evidential value of the results in litigation.

Hospital post mortem

44 The purpose of a hospital post mortem is to establish or confirm the cause of death or to investigate the existence or nature of abnormal conditions. Organs can be removed and analysed if that analysis is necessary for the purpose of the examination. Permission from the relatives of the deceased is required but the coroner is not involved.[25]

45 Organs were taken for radiochemical analysis at hospital post mortem examinations performed on four Sellafield employees. In three, the cause of

23 Under rule 6 of the Coroners Rules 1953 (or rule 9 of the Coroners Rules 1984): see chapter 3, "Law and Guidance"

24 Under the provisions of the Human Tissue Act 1961: see chapter 3, "Law and Guidance"

25 For further information, see chapter 3, "Law and Guidance"

death was obviously not connected to radiation exposure: SL agreed in those three cases that BNFL's interest appeared to be scientific research.

46 In the fourth, it seems that Dr Schofield was informed by the man's union that he had requested that his organs be taken for analysis after his death.

47 In none of the four cases are the hospital records, which might have contained a signed consent form for the post mortem, still available. However, although it was customary for such a form to be completed, there was no legal requirement for consent to be in writing.

Summary

48 In all but four of the 64 Sellafield cases, the post mortem was undertaken at the request of the coroner. Twenty-four inquests were held but in only 11 – fewer than half – of those were the results of the radiochemical analysis received in evidence.

49 In contrast, the Inquiry concludes that in 46[26] of the 64 Sellafield cases the primary purpose of the radiochemical analysis was scientific research and that in 38 of those cases the removal of the organs from the body cannot be justified.

50 Of course, all the analytical results were in due course used for research whatever the original motive might have been. As SL told the Inquiry:

> *The radiochemical analysis conducted by BNFL was done for a variety of purposes, often overlapping: coronial purposes, litigation purposes, or scientific research … even where the analysis was originally requested for coronial or litigation purposes, BNFL did subsequently utilise autopsy data for the purposes of scientific research.*

Nuclear workers from other plants

Springfields

51 Dr Schofield also received for analysis at Sellafield organs taken at post mortem from nuclear workers at other plants. Four had worked at Springfields. The Inquiry regards three of those as falling within the category of "legitimate coronial analysis" discussed at paragraphs 29–31. It is unclear in the fourth case how Dr Schofield acquired the organs which

26 43 coronial cases and three hospital post mortems

were analysed at Sellafield. Although there was an inquest at which the possibility of an occupational link to the death was explored, no mention was made of organs having been taken for analysis nor is there any evidence of the coroner having requested analysis. It seems likely that the primary purpose of analysis in that case was scientific.

52 In one further case, a lung biopsy taken from a living Springfields worker was analysed: the Inquiry has no information as to the circumstances.

Capenhurst

53 Organs taken from two men who had worked at Capenhurst were analysed at Sellafield: one was John Grain, who is discussed in detail later in this chapter. In each case, organs were removed under coronial authority at a second post mortem and the analytical results received in evidence at the inquest. The circumstances in which the organs came to be made available to Dr Schofield were unusual but the removal and analysis were done for legitimate coronial purposes.

Aldermaston

54 Organs taken from five men who had worked at Aldermaston were analysed at Sellafield. They are considered individually in chapter 9, "The Atomic Weapons Establishment".[27] In four of the cases, the removal and analysis were for legitimate coronial purposes or apparently with the consent of the relatives; in the last, there is insufficient evidence to draw a definitive conclusion.

Dounreay

55 Dr Schofield received organs taken at post mortem from one Dounreay worker in the early 1980s. The case is considered at paragraph 35 of chapter 6, "The United Kingdom Atomic Energy Authority": the deceased had asked that organs be removed following his death and analysis was quite properly performed.

27 At paragraphs 11–12, 14–16, 22–30, 62 and 66

Conclusion

56 In most of the 76 cases considered in detail by the Inquiry, relatives were let down at the time when they were most vulnerable by those in whom they were entitled to place an absolute trust. The removal and analysis of organs for genuine coronial reasons occurred in only a minority; in most, it was unnecessary or inappropriate. Relatives were rarely asked for their consent. As a result, families have buried incomplete bodies and many of those who have discovered the truth, years later, have been greatly distressed.

Individual cases

57 The Inquiry heard evidence from relatives of 14 men whose organs had been taken for analysis. The men had a variety of employment histories: ten had worked at Sellafield, two at Springfields, one at Capenhurst and one had never been a nuclear worker. In 12 of the cases, organs were analysed at Sellafield; in the remaining two, the analysis was undertaken by the NRPB. Their stories are representative of those of the 76 men whose organs were analysed at Sellafield and merit telling in detail. They are presented chronologically.

Malcolm Pattinson

12 May 1935 – 28 May 1971

1 Malcolm Forrester Pattinson died on 28 May 1971, aged 36. He was survived by his wife, Bridget, who has since died, and three children, Angela (now Christie), who has given evidence to the Inquiry, Barbara and John.

2 Mr Pattinson was employed as a process worker by the United Kingdom Atomic Energy Authority (UKAEA) from 19 August 1957. In January 1970 he moved, because of his and his family's concern about his health, to work where there was no risk of exposure to radiation.

3 On 27 May 1971, Mr Pattinson was admitted to West Cumberland Hospital because of a massive gastrointestinal haemorrhage. Blood tests led to a diagnosis of leukaemia. He died the following day.

4 When Mr Pattinson was admitted to hospital his wife was already an inpatient there. She was allowed home after her husband died but was readmitted on the day of the funeral (2 June) and remained in hospital for a further three weeks.

5 Mr Pattinson's death was referred to the coroner, Mr Hubert Gough, who considered a post mortem examination to be necessary. On the day of the death Mr Gough telephoned Crutes, solicitors retained by the General and Municipal Workers' Union (GMWU), of which Mr Pattinson had been a member. Crutes's file contains a note:

> *Died. Today. W.C.H. (28/5/71) Leukaemia. 27/5/71 … Monit. UKAEA. PM. Organs … 11 am Sat. Dr Whitehead – Path.*

It is apparent that organs were to be removed at the post mortem. The author of the note has not been identified.

Post mortem examination

6 The post mortem examination was performed by Dr Philip Whitehead[1] on Saturday 29 May 1971. Mr William Ross, consultant radiotherapist from Newcastle, attended on Crutes's instruction. It is not clear whether

1 Consultant pathologist, West Cumberland Hospital

Dr Geoffrey Schofield[2] was present: the post mortem report does not mention either doctor.

7 The report does not refer to organs having been removed. However, lung, liver, bone and mediastinal tissue and lymph nodes were supplied to Dr Schofield for radiochemical analysis. The Inquiry has not been able to determine how Dr Schofield came into possession of those organs. It was his usual practice either to attend post mortem examinations himself or to arrange for organs to be collected by another employee from British Nuclear Fuels Limited (BNFL).[3]

Disposal of the organs

8 The report of Mr Pattinson's post mortem records organ weights as follows:

Right lung	1,315g
Left lung	1,220g
Liver	2,035g

9 Organs analysed at Sellafield for Dr Schofield were:

Lung	1,000g
Liver	830g
Bone	830g
Mediastinal tissue	590g

The "mediastinal tissue" comprised trachea and lymph nodes; the bone comprised ribs, vertebrae and long bone (probably femur). It is apparent that less than half the liver and probably only one lung were analysed.

2 Senior Medical Officer, British Nuclear Fuels Limited (BNFL), Sellafield; BNFL had assumed responsibility for Sellafield in 1971

3 See chapter 5, "British Nuclear Fuels Limited"

10 It is very unlikely that more tissue was analysed at Sellafield than is mentioned in the laboratory records. There are several possible explanations for the differences between the weights of liver and lung noted at the post mortem examination and those analysed by Dr Schofield. The balance of the organs might have been:

- received by Dr Schofield and kept but not analysed;
- analysed somewhere other than Sellafield;
- retained by Dr Whitehead for further analysis and, when no further analysis was requested, incinerated as waste;
- returned to the body in the usual way.

11 The Inquiry received evidence from both Mr Ross and Dr Whitehead. Neither was able to recall what had happened to the balance of the organs. The first possibility is most unlikely: Dr Schofield was keen to analyse as much tissue as he had available in order to increase the accuracy of his results.

12 There is no evidence that the balance of the liver and lung was received by Mr Ross or sent by him to anyone for analysis; sent by Dr Whitehead to anyone for analysis; or sent for analysis to researchers outside the UK, for example in the US.[4] There is no evidence that it was retained by Dr Whitehead.

13 There is indirect evidence that the balance of Mr Pattinson's organs was sent by Sellafield to the National Radiological Protection Board (NRPB).

- Dr Donald Popplewell[5] told the Inquiry that he recalled analysing human organs for the first time in 1972 and that those organs had been sent from Sellafield to his superior at the NRPB, Dr Geoffrey Dolphin, with whom Dr Schofield had worked closely in the past. He was not able to identify the individual from whom the organs had been taken, nor even to recall which organs he had received, and the Inquiry has discovered no documents which might assist.
- In a published paper,[6] Dr Popplewell wrote *"In 1972 we were asked by British Nuclear Fuels Limited, to measure the levels of plutonium in tissues removed at autopsy from several of their former employees who had worked in the plutonium processing industry at Sellafield Works."*

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4 See chapter 10, "Registries"

5 Principal Scientific Officer at the NRPB

6 Popplewell DS, Ham GJ, Dodd NJ and Shuttler SD, Plutonium and Cs-137 in autopsy tissues in Great Britain, *The Science of the Total Environment*, 1988, 70: 321–34

- Dr Popplewell subsequently discovered that he had been asked to undertake the analysis to verify results previously obtained at Sellafield.
- Three sets of organs taken at post mortem examination were obtained by Dr Schofield in 1971: Mr Pattinson's and two others. None was obtained in 1972.

It is therefore possible that the organs which Dr Popplewell analysed in 1972 had been taken from Mr Pattinson.

14 However, correspondence between Crutes, the GMWU and solicitors acting for BNFL indicates that Dr Schofield believed (incorrectly) that the half liver and lung which he had not analysed had been made available to Mr Ross. This suggests that the balance of the organs might have been retained by Dr Whitehead for Mr Ross, against the possibility that he (or the solicitors who had instructed him) would wish them to be analysed. In fact, in the course of Mrs Pattinson's litigation against BNFL, Mr Ross received only microscope slides.

15 The evidence is insufficient to allow the Inquiry to reach a definite conclusion.

16 No material derived from Mr Pattinson's organs is still in existence.[7]

Inquest

17 Mr Gough opened an inquest on 29 May 1971, the day after Mr Pattinson's death; as is common practice, it was adjourned after hearing evidence only of identification. It resumed on 27 August 1971 before Mr Gough and a jury. Evidence was heard from Mrs Pattinson, Mr Huw Howells[8] and Dr Whitehead. Mr Howells indicated that Mr Pattinson had not been at risk of exposure to radiation; Dr Whitehead gave the cause of death as leukaemia and said that he was unable to say whether it had been caused by radiation. Neither Dr Schofield nor Mr Ross attended or gave evidence in writing. The jury returned an open verdict.

18 The organs which had been taken from Mr Pattinson at the post mortem examination were analysed for radionuclide content at Sellafield but the analysis was not completed until 6 September 1971, after the inquest had concluded. The results were not sent to Mr Gough and there is no evidence that he asked for them or considered that they might be of any relevance to his investigation.

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7 Even if the balance of the organs was not returned to the body, the conclusion remains the same

8 Manager, Health and Safety, BNFL Sellafield

Role of the coroner

19 Crutes's file note implies that Mr Gough knew that organs were to be removed at post mortem. Beyond that, his role is unclear. There are two possibilities.

- Mr Gough requested that the organs be analysed. He then felt able to conclude the inquest without the results, perhaps in reliance on Dr Whitehead's view, later expressed at the inquest, that the level of radioactivity in the organs would not be of assistance in determining the cause of Mr Pattinson's leukaemia.
- Mr Gough considered that he should allow the parties to potential litigation to obtain organs for analysis. He therefore informed Crutes, whom he considered it likely would represent Mr Pattinson's family in such litigation, that the post mortem examination was to be held and that he would not object to organs being taken. He had no interest in the results and considered himself able to conclude the inquest without them. He assumed that Crutes would protect the family's interests.

20 It is unlikely that Mr Gough would have considered in May 1971 that analysis was necessary for the inquest and changed his mind by August. The evidence is more consistent with the second possibility:

- the Inquiry heard that Mr Gough's successors, Mr Adrian Walker and Mr John Taylor, followed this approach, understanding it to have been Mr Gough's practice;
- there is no evidence of contact between Mr Gough and Dr Schofield regarding the results of the analysis.

Roles of the union and Crutes

21 The GMWU had given Crutes standing authority to initiate and conduct litigation on behalf of members who had contracted illnesses which might have been caused by radiation.[9] On the day Mr Pattinson died, Mr Gough informed Crutes of his death and they, acting under this standing authority, instructed Mr Ross to attend the post mortem. However, Mrs Pattinson was unaware of what was happening: she did not ask the union to act on her behalf until 6 July 1971. Until she gave instructions, both Crutes and the union were acting without her authority, albeit in what they perceived to be the best interests of the family given the very limited time between the death and the post mortem.

9 See chapter 7, "The Trade Unions and the Compensation Scheme"

22 Mrs Christie, who had been only 13 when her father died, told the Inquiry that neither she nor her mother had been informed that anything had been removed from the body. Mrs Pattinson had not been in touch with the union or Crutes on the day of her husband's death because of her illness for which she was an inpatient and there is no evidence that they made any attempt to contact her.

Litigation

23 A civil claim for compensation arising out of Mr Pattinson's death was brought with support from the GMWU. BNFL eventually admitted liability in 1979 and paid substantial damages. This was the first occasion on which BNFL formally admitted that a worker's leukaemia had been caused by occupational exposure to radiation and so was of particular significance.

Legal analysis

Organ removal

24 There is no evidence that Dr Whitehead removed the organs because he considered that their analysis was of relevance: indeed, Dr Whitehead told the Inquiry that as the diagnosis of leukaemia had already been made *"radiochemical analysis had nothing to do with establishing the cause of death"*. Mr Pattinson's family were not asked to agree to organs being removed and were entirely unaware that it had been done.

25 The removal of Mr Pattinson's organs was therefore not in accordance with the Coroners Rules or the provisions of the Human Tissue Act 1961.[10]

Organ analysis

26 The organs were analysed at Sellafield. The analytical process started before the inquest and continued afterwards. It may be that BNFL assumed that the organs had been removed with the family's consent: it knew that a representative of the family had attended the post mortem and understood him to have taken organs for radiochemical analysis. It had no duty to make further inquiry and acted lawfully in undertaking the analysis.

Relatives' reaction

27 Mrs Christie had been unaware that organs had been removed from her father's body. She has found the knowledge that her father's body was

10 See chapter 3, "Law and Guidance"

buried with many of his organs missing to be very distressing. Her concern is exacerbated by the fact that the organs were removed without compliance with the law. She is particularly aggrieved that decisions appear to have been taken by the union and its solicitors on her mother's behalf without consultation or authority. She believes that her mother would have refused to allow organs to be removed for analysis, even if that meant that a compensation claim could not proceed.

Publication of the data

28 Data derived from the analysis of Mr Pattinson's organs were used anonymously in:

- Schofield and Dolphin, 1974: UK experience on the medical aspects of radiological protection of workers handling plutonium (case 4);[11]
- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 21);[12]
- Jones, 1985: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake (case SEL-9);[13]
- an internal BNFL document in 1996 (case 27).[14]

29 The data were sent to the United States Transuranium and Uranium Registries (USTUR) and were used (case 74) in annual reports in 1978 and 1980. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

30 Mr Pattinson's organs were removed so that the results of analysis could be of use in litigation, which from almost immediately after his death was considered likely by all those involved with the post mortem. His widow was wholly unaware of the removal of the organs and at the time had no thought of legal action. The removal had no connection with the coronial investigation. Proper coronial and pathology practice would have prevented its happening.

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11 *Annals of Occupational Hygiene*, 17(2): 73–83

12 *British Journal of Radiology*, 53: 398–409

13 *Radiological Protection Dosimetry*, 11(1): 19–27

14 DOSTR 36; see chapter 5, "British Nuclear Fuels Limited", paragraph 232

Edward McMullen

21 September 1924 – 13 April 1973

1 Edward McMullen died on 13 April 1973, aged 48. He was survived by his wife, Catherine, who has since died, and two daughters, Margaret (now Holmes) and Patricia. Mrs Holmes gave evidence to the Inquiry.

2 After service in the Royal Navy, Mr McMullen was employed as a process worker by the United Kingdom Atomic Energy Authority (UKAEA) at Sellafield from 1949 until 1953 and from 1956 until his death. He was exposed to plutonium on three occasions in 1960 and 1961 and was later permanently excluded from plutonium work.

3 In mid-March 1973, Mr McMullen fell down the stairs at home, sustaining a serious head injury. He was admitted to West Cumberland Hospital, where despite undergoing neurosurgery he died, without regaining consciousness, some four weeks later.

4 Mr McMullen's death was referred to the coroner, Mr Hubert Gough, who requested a post mortem examination.

Post mortem examination

5 The post mortem was performed on 16 April 1973 by Dr David Smith,[1] who certified the cause of death as bronchopneumonia as a result of cerebral contusion and haemorrhage secondary to a head injury consistent with a fall down stairs.

6 The post mortem report records the weights of various organs, including the lungs (755g and 645g) and liver (1,460g). The findings on histological examination of the lung and brain are set out. There is no reference to any organs having been removed for analysis.

Disposal of the organs

7 Records obtained from British Nuclear Fuels Limited (BNFL) list the organs analysed at Sellafield as ribs, sternum, vertebrae, lung, liver, spleen, kidneys, lymph nodes, connective tissue and mediastinum. Only 600g of lung and 690g of liver were analysed. The total weights of lung and liver,

1 Consultant pathologist, West Cumberland Hospital

taken from the post mortem report, are correctly noted as 1,400g and 1,460g respectively.

8 The Inquiry is not able to determine with certainty what became of the lung and half liver which were not analysed at Sellafield. They may have been:

- taken to Sellafield but not analysed;
- retained by Dr Smith, because he considered that their analysis might assist in determining the cause of death, and later disposed of, probably by incineration as clinical waste;
- sent for analysis somewhere other than Sellafield, such as the National Radiological Protection Board (NRPB);
- returned to the body in the usual way.

9 The first possibility is most unlikely: Dr Schofield was keen to analyse as much tissue as he had available in order to increase the accuracy of his results.[2] The second is also unlikely since, given the clinical history, there would be no reason for Dr Smith to imagine that such analysis would make any contribution to determining the cause of death. The third is possible: although there is no evidence that the organs were sent anywhere other than Sellafield and documents obtained from the NRPB do not mention receipt of any of Mr McMullen's organs, the Inquiry is aware of material being sent from Sellafield to the NRPB at around this time.[3]

10 The evidence is insufficient to allow the Inquiry to reach a definite conclusion. However, the fourth possibility appears the most likely.

11 No material derived from Mr McMullen's organs is still in existence.

Inquest

12 Mr Gough opened the inquest four days after Mr McMullen's death, returning a verdict of accidental death after a short hearing. The results of Dr Schofield's analysis were, of course, not available by that time.

13 There is no evidence that the coroner requested that organs be analysed or was even aware that they had been sent to Sellafield. He neither requested nor received the analytical results.

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2 Save in 1972, when he sent some organs to the NRPB for verification of his own results: see chapter 5, "British Nuclear Fuels Limited"

3 See chapter 8, "The National Radiological Protection Board"

Legal analysis

14 There was no legal justification for the removal and analysis of Mr McMullen's organs. It was not done for coronial purposes, since the organs removed had no bearing on the cause of death. No agreement was sought or obtained from Mr McMullen's relatives.

15 Both the removal and the analysis were done for scientific research. Sellafield Limited[4] accepts that this was the case.

Relatives' reaction

16 Mr McMullen's family did not consent to his organs being removed; they were not asked to do so. Mrs Holmes told the Inquiry she was sure that her mother would have refused permission had it been sought. The family were unaware that organs had been removed and the news that many organs were missing from the body they buried, thinking that it was intact, has caused them much distress.

Publication of the data

17 Data derived from the analysis of Mr McMullen's organs were used anonymously in:

- Schofield and Dolphin, 1974: UK experience in the medical aspects of radiological protection of workers handling plutonium (case 2);[5]
- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 23);[6]
- Jones, 1985: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake (case SEL-7);[7]

4 Sellafield Limited has assumed responsibility for Sellafield site from British Nuclear Fuels Limited (BNFL), which was Mr McMullen's employer at the time he died

5 *Annals of Occupational Hygiene*, 17: 73–83

6 *British Journal of Radiology*, 53: 398–409

7 *Radiological Protection Dosimetry*, 11(1): 19–27

- Lawson and others, 1989: Plutonium deposition in man: comparison between excretion and autopsy analyses, presented at a symposium at Malvern in 1989 and subsequently published (case 19);[8]
- internal BNFL documents[9] in 1990 (case A) and 1996 (case 4).

18 The data were sent to the United States Transuranium and Uranium Registries (USTUR) and were used (case 73) in annual reports in 1978 and 1980. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

19 Mr McMullen's organs were removed and analysed for Dr Schofield's scientific research, wholly unconnected with the reason for his death. Dr Smith, in evidence to the Inquiry, conceded that the organs he removed had had no bearing upon the cause of death and that he had done so only *"because I was specifically asked to by Dr Schofield"*. He had no reason to accede to that request and ought not to have done so.

8 In Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP (Malvern, June 1989)* (Institute of Physics Publishing, 1989)

9 DOSTR 18 and DOSTR 36: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

Geoffrey Southward

29 November 1925 – 8 January 1975

1 Geoffrey Gilbertson Southward died on 8 January 1975, aged 49. He was survived by his wife, who has since died, and two sons, Colin and Derek. Colin gave evidence to the Inquiry.

2 Mr Southward served in the RAF before working at Sellafield from 1951 until his death, first for the United Kingdom Atomic Energy Authority (UKAEA) and then, on its formation, for British Nuclear Fuels Limited (BNFL). He was a health physics monitor, visiting active areas of the site to check levels of radiation.

3 In 1969, he was found to be suffering from chronic myeloid leukaemia; he was a very private individual and, although aware of the diagnosis, he did not tell his sons. He became acutely ill on New Year's Day 1975, and on 7 January was admitted to North Lonsdale Hospital, Barrow, where he died the following morning.

4 Mr Southward's death was reported to the coroner, Mr William Ellison. The coroner's officer, Police Constable Berry, recorded that Dr Waind, consultant haematologist, *"felt that the Leukaemia could have been caused due to radiation exposure"*. Mr Ellison requested a post mortem examination.

Post mortem examination

5 The post mortem was performed on 9 January 1975 by Dr Derek Stansfield.[1] PC Berry and Dr Geoffrey Schofield[2] attended but only PC Berry's name appears on the report. The cause of death was pneumonia secondary to myeloid leukaemia.

1 Consultant pathologist, North Lonsdale Hospital

2 Chief Medical Officer, BNFL Sellafield

6 Dr Schofield noted in Mr Southward's medical records:

> *I attended the post mortem this morning … I discussed the removal of organs with Dr Stansfield, the Barrow Coroner, Mr W M Ross of Newcastle (for the Unions) and with Dr Dolphin of NRPB* [the National Radiological Protection Board]. *The Coroner and Mr Ross agreed that I could remove the organs necessary for carrying out plutonium estimations. I also took duplicate specimens for similar analysis by Dr Dolphin's group in NRPB. Some specimens were also removed for Mr Ross who is intending to forward them for analysis to a Mr Bryant in the Physics department of the Middlesex hospital.*

Disposal of the organs

7 Documents disclosed by BNFL show that a femur, some ribs, sternum, some vertebral bodies, both lungs, the liver, spleen, kidneys, a testis, lymph nodes and the mediastinum were removed and taken to Sellafield. In addition, Dr Stansfield sent *"a portion of liver and part of a vertebral body containing marrow"* to Mr William Ross.[3]

8 On 20 January 1975, Dr Schofield personally delivered half the femur, a large slice of liver, one lung, two ribs, the testis, a lymph node and one kidney to Dr Hylton Smith and Dr Donald Popplewell[4] at the NRPB in Harwell.

9 The analysis of the organs retained at Sellafield was completed within a month. Data from the analysis performed by the NRPB were used for research.[5] Mr Ross sent the samples he had received from Dr Stansfield to Mr T H E Bryant at the Health Physics Department of the Middlesex Hospital, London, but Mr Bryant was unable to derive any useful information from them.

10 No material derived from Mr Southward's organs is still in existence.

Inquest

11 Mr Ellison opened the inquest into Mr Southward's death on 10 January 1975 and adjourned it after hearing evidence only of identification.

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3 Consultant radiotherapist, Newcastle General Hospital

4 Respectively, Head of Biology Department and Principal Scientific Officer, NRPB, Harwell

5 In an internal paper in 1975: see paragraph 23

It resumed on 27 June 1975, when the family were represented by Mr Ian Robertson, a solicitor and partner at Crutes.[6] Although the results of Dr Schofield's analysis were by then available, they had not been sent to Mr Ellison and he had not asked for them. Evidence was heard only from Mrs Southward and Dr Stansfield.

12 The coroner wrote a note of Dr Stansfield's evidence on his post mortem report:

> *I could find no evidence of the leukaemia being caused by one thing rather than another …* [in answer to a question from Mr Robertson] *I do not know the result of the examination of the bone specimens taken.*

Mr Ellison returned an open verdict.

Role of the coroner

13 Mr Ellison knew from PC Berry's note to him that Dr Schofield had attended the post mortem and that Dr Stansfield had sent specimens to Mr Ross. Dr Schofield's note, quoted at paragraph 6, indicates that he had discussed Mr Southward with Mr Ellison but there is no record of what was said. It is not clear whether Mr Ellison knew of the NRPB's involvement.

14 There is no evidence that Mr Ellison requested that the organs be analysed. He did not ask for the analytical results and they were never sent to him. It is likely that, aware that litigation was or might be contemplated, he made arrangements to inform BNFL and Mr Southward's union when the post mortem examination was to take place and allowed them to attend.

Roles of the union and Crutes

15 PC Berry appears to have informed Mr Southward's union, the General and Municipal Workers' Union (GMWU), of the death the day after it had happened, on 9 January 1975, in order to allow it to attend the post mortem. Mr John Noctor, an official of the GMWU, spoke to Mrs Southward the same day and they both signed a form, which bears that date, asking the union to assist her in making a claim.

16 The union informed Crutes, authorising them *"to take the necessary steps to protect his widow's interests"*. Crutes arranged for the post mortem to be

6 A firm of solicitors which often acted on behalf of members of the General and Municipal Workers' Union (GMWU), of which Mr Southward had been a member: see also chapter 7, "The Trade Unions and the Compensation Scheme"

delayed so that Mr Ross could attend; by the time they managed to contact Mr Ross, Dr Schofield had already informed him of the impending post mortem. Mr Ross was not able to be there but he and Crutes were content for the examination to proceed in his absence and for him to be sent specimens by Dr Stansfield. Mr Robertson wrote to Mrs Southward on 9 January, offering condolences and continuing:

> *We have been instructed by the General and Municipal Workers Union in respect of members' cases concerning plutonium poisoning and the Union have authorised us to represent you at the inquest if you so wish and to make enquiries with a view to ascertaining whether the problems your husband had were caused by plutonium poisoning. We understand that a Union representative is to call to see you.*

17 The exact sequence of events on 9 January cannot now be determined. It is clear, however, that at the time they attempted to instruct Mr Ross to attend the post mortem and to secure organs for analysis, Crutes had no instructions from Mrs Southward herself: the next day, Mr Robertson noted *"we had only received instructions from* [Mr Southward's] *Trade Union yesterday and I had yet to receive formal instructions from his widow"*.

Litigation

18 Mrs Southward initiated legal action against BNFL. The claim was eventually settled out of court in June 1981, expressly without any admission of liability on the part of BNFL.

Legal analysis

Organ removal

19 There is no evidence to suggest that Dr Stansfield removed organs from Mr Southward because he believed that their analysis might assist in determining the cause of death, although it is possible that Dr Schofield's presence at the post mortem and Mr Ross's wish to obtain some tissue led Dr Stansfield to that belief. If he did not consider the analysis relevant to the cause of death, Dr Stansfield required permission from both the coroner and Mr Southward's family to remove the organs. It may be that Dr Schofield, who had spoken to Mr Ellison, told Dr Stansfield that the coroner did not object to organs being removed for non-coronial purposes. There is certainly no evidence that Mrs Southward agreed to organs being

removed or was even aware that it had taken place. The request for organs made by Mr Ross, who was ostensibly instructed by Mrs Southward, may have led Dr Stansfield to infer that she did not object: he would not have known that her permission had not in fact been sought.

Organ analysis

20 The organs were analysed at Sellafield (for Dr Schofield), and at the NRPB. Sellafield's results were available well before the inquest resumed. Since those results were plainly of no interest to the coroner, who did not ask for them and concluded the inquest without seeing them, there is no reason to consider that the analysis had taken place at his request. Given that Mr Ross's involvement on behalf of the family implied that they did not object to the organs being removed, it was reasonable for BNFL to conduct the analysis. It was reasonable for the NRPB, providing purely an analytical service, to assume that any material passed to them had been properly obtained. It was similarly reasonable for Mr Ross, instructed by solicitors acting on behalf of Mrs Southward, to assume that the material he sent to Mr Bryant had been properly obtained and for Mr Bryant to make the same assumption.

Relatives' reaction

21 The realisation that organs were removed from Mr Southward's body came as a shock to his sons; the news that Dr Schofield attended the post mortem has caused even more upset.

22 Colin Southward is sure that his mother was not asked to agree to organs being removed from his father's body. However, he thinks that had she been given a full explanation of the possible benefits to science and to other workers in the nuclear industry, and her permission tactfully sought, she might well have agreed to its being done.

Publication of the data

23 Data derived from the analysis of Mr Southward's organs were used anonymously in:

- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 10);[7]

7 *British Journal of Radiology*, 53; 398–409

- Jones, 1985: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake (case SEL-21);[8]
- Lawson and others, 1989: Plutonium deposition in man: comparison between excretion and autopsy analyses, presented at a symposium at Malvern in 1989 and subsequently published (case 9);[9]
- internal BNFL documents[10] in 1990 (case E) and 1996 (case 17);
- an internal NRPB paper in 1975 (case Z4).[11]

24 The data were sent to the United States Transuranium and Uranium Registries (USTUR) and were used (case 75) in annual reports in 1978 and 1980. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

25 It appears that Dr Schofield attended the post mortem examination with Mr Ellison's permission. Although the coroner acted within his powers in allowing Dr Schofield to attend and in not informing Mr Southward's family, it is easy to understand the distress which would be caused by the presence of a representative of the employer which the family believed to have been responsible for Mr Southward's fatal illness.

26 Crutes acted without first receiving formal instructions from Mrs Southward, their client. However, they were instructed by the GMWU to protect her interests; she had signed a form requesting legal assistance from the union; and Crutes were aware of the need to act with alacrity in order to obtain material for analysis before the opportunity was lost.

27 Mr Southward's organs were removed so that the results of analysis could be of use in litigation, which from almost immediately after his death was considered likely by all those involved with the post mortem. His widow was wholly unaware that they had been removed. Their removal had no connection with the coronial investigation: the results were not received in evidence at the inquest. Proper coronial practice would have prevented its happening, or at least have ensured that it did not take place without Mrs Southward's agreement.

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8 *Radiological Protection Dosimetry*, 11(1): 19–27

9 In Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP (Malvern, June 1989)* (Institute of Physics Publishing,1989)

10 DOSTR 16 and DOSTR 36: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

11 Popplewell DS, *Determination of the Plutonium Content of Postmortem Tissues from Two Workers who were Exposed to Plutonium*, NRPB Report, NRPB-R38, September 1975

James Connor

1 June 1937 – 26 January 1976

1 James Joseph Connor died on 26 January 1976, aged 38. He was survived by his wife, Irene (now McAdam), and two children, Elaine and David. Mrs McAdam has given a statement to the Inquiry, assisted by Elaine, who was living in South Africa at the time of her father's death. David now lives in Australia.

2 Mr Connor joined the United Kingdom Atomic Energy Authority (UKAEA) on 10 March 1958 as a process worker at the Calder A reactor before promotion to reactor turbine engineer at Winfrith, where he remained for ten years. He was fit and healthy until March 1975, when he developed leukaemia. He underwent a course of chemotherapy but his condition gradually declined and he died on 26 January 1976 in Dorset County Hospital, Dorchester. Mrs McAdam recalled that before he died he had begun to investigate the possibility of legal action against the UKAEA.

3 Mr Connor's death was reported to the coroner, Mr Maurice Bailey, who requested a post mortem examination.

Post mortem examination

4 The post mortem was performed on 28 January 1976 by Dr Alfred Blades,[1] who found Mr Connor to have died from a ruptured spleen, secondary to leukaemia.

5 Dr Alexander Laylee[2] attended the examination. The report does not mention his presence but does record removal of various organs:

> *Specimens were taken and divided into two equal parts, of sternum, ribs, lung, mediastinal glands, vertebral bodies, kidney, testes, femur and liver, in case further analysis should be required.*

6 Dr Laylee took the removed organs to Winfrith. On 29 January 1976, his employer's Chief Medical Officer, Dr Maurice Hill, wrote to him:

> *Thank you for letting me know so quickly of the death and being so successful in getting the samples; no doubt your close liaison with local hospitals and the patient's doctor helped.*

1 Consultant pathologist, Dorset County Hospital

2 Senior Medical Officer, UKAEA Winfrith

7 The coroner had agreed that Dr Laylee could take the removed organs; on 5 March 1976, he wrote:

> *Dr Laylee particularly asked for the removal of parts of the body and organs, so that an analysis could take place. The specimens taken were divided into two parts and I understood one part was to be made available to the Association of Government Supervisors and Radio Officers* [AGSRO]*, and that an analysis on their behalf could be carried out at Harwell, should they so desire.*

8 Some time after Mr Connor's death, AGSRO sent its condolences to Mrs McAdam and informed her that a claim was being pursued on her behalf. The claim was in due course settled.

Disposal of the organs

9 Dr Hill collected the organs from Dr Laylee the week after the post mortem and took them to the UKAEA site at Harwell. On 8 April 1976, after seeking advice from the Health and Safety Executive (HSE), Mr Bailey asked Dr Stewart Rae, Assistant Director (Medical) at the National Radiological Protection Board (NRPB), to analyse them. Dr Rae passed the request to Dr Geoffrey Dolphin,[3] who agreed to assist. On 5 July 1976, Dr Hill sent half the organs (and the whole of the femur) to Dr Donald Popplewell.[4] The samples, which had been frozen, arrived in plastic bags. The femur was sawn into six pieces and three were returned to Dr Hill. Dr Popplewell's analysis included the three pieces of femur, vertebrae, sternum, testes, liver, ribs, lung and kidney. He sent the results to Dr Geoffrey Schofield[5] on 12 August 1976 and to the coroner on 24 August.

10 The other half of the organs was sent, with the coroner's permission, to Dr Schofield at Sellafield. The solicitor appointed by AGSRO, Mr Philip Avery, instructed Dr Schofield to act as an expert witness in the claim against the UKAEA, although Dr Schofield did point out a potential conflict of interest:

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3 Assistant Director, NRPB

4 Principal Scientific Officer, NRPB

5 Company Chief Medical Officer, British Nuclear Fuels Limited

> *As you may understand, in many ways, the Company* [British Nuclear Fuels Limited (BNFL)] *cannot be regarded as being an entirely independent contractor for the work since of course it is part of the UK nuclear energy industry. However, we have carried out similar analyses in respect of another legal claim on this understanding … We have obtained the approval of the Coroner in the case who was asked by Dr Hill of* [UK]*AEA for permission to remove the specimens for Harwell.*

11 Dr Schofield sent his report to Mr Avery on 29 September 1976. It concluded:

> *the quantities found in Mr Connor's body are not significantly greater than one would find in the ordinary member of the population. The plutonium present is of course due to bomb fall-out.*

He also sent a copy to the Legal Department at BNFL.

12 No material derived from Mr Connor's organs is still in existence.

Inquest

13 The inquest was held on 24 November 1977, having been delayed so that the expert reports could be prepared. Both Dr Popplewell and Dr Schofield gave evidence, agreeing that the very small quantity of plutonium present in Mr Connor's organs was the result of fallout from testing of nuclear bombs and did not differ from the quantity which would be found in any member of the public. The jury returned an open verdict and the death was registered as having been caused by a ruptured spleen due to leukaemia.

Role of the coroner

14 The impetus for the analysis of Mr Connor's organs appears to have come from Dr Laylee but it was done under coronial authority. Mr Bailey asked the NRPB to undertake the analysis and received the reports prepared by Dr Popplewell and Dr Schofield in evidence at the inquest. It is unfortunate that Mr Bailey did not inform Mr Connor's family that his organs had been removed and analysed but there was then no statutory requirement for him to do so.

Roles of the union and Averys

15 There is no documentation to support Mrs McAdam's recollection that Mr Connor initiated a claim before he died. It does not appear that either the union or Averys was aware before the post mortem that organs were to be removed.

16 Analysis of half the organs was carried out on instructions from Mr Avery and not for coronial purposes. Mr Avery wrote to Dr Schofield that he noted *"with some surprise that you have sent copies of the Report to various people"* and asked why he had done so. Dr Schofield replied that he had sent copies to Mr Arthur Scott[6] and Mr J W Creighton,[7] as was his usual practice, and to Dr Popplewell as a courtesy. The solicitor took no further action. It is apparent from BNFL's legal file that most of Dr Schofield's correspondence with Mr Avery was copied to BNFL's Legal Department. Dr Schofield's actions constituted a breach of confidence and were, in the context of contentious litigation, inexcusable.

Legal analysis

Organ removal

17 Dr Blades, who was performing a post mortem at the request of the coroner, acted properly in removing organs which he considered would be of relevance in determining the cause of death.

Organ analysis

18 Half the organs were analysed at the NRPB at the request of the coroner; the remainder was analysed at Sellafield on Mr Avery's instruction, with the coroner's permission. Consent from the family for the NRPB analysis was not required. Dr Schofield was asked by the family's solicitors to analyse organs which had been released to him; the law did not impose a duty on him to make any further inquiry and accordingly he acted lawfully.

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6 Company Secretary, BNFL

7 Legal Department, BNFL

Relatives' reaction

19 Mrs McAdam now knows that a post mortem examination was performed on her husband's body but she does not recall having been advised of this at the time. Her discovery of the retention and analysis of organs in her husband's case came as a great shock. She finds it difficult to come to terms, so long after the event, with the realisation that she did not bury her husband intact.

Publication of the data

20 Data derived from the analysis of Mr Connor's organs were used anonymously in:

- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 29).[8]

21 The data were sent to the United States Transuranium and Uranium Registries (USTUR) (case 178). They were not used in any USTUR report or publication. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

22 Mr Bailey, Dr Blades and the experts from BNFL and the NRPB acted entirely properly in relation to the removal and analysis of Mr Connor's organs and the use of the analytical results at his inquest. It is regrettable that Mrs McAdam was kept in the dark but the law then imposed no obligation on the coroner or the pathologist to keep her informed. Dr Schofield's copying to his employer of confidential correspondence with his instructing solicitors was reprehensible.

8 *British Journal of Radiology*, 53: 398–409

James Wilson

4 July 1907 – 12 February 1978

1 James Edward Wilson died on 12 February 1978, aged 70. He was survived by his wife, Doris, who has since died, and two sons, William and John, who both gave evidence to the Inquiry.

2 Mr Wilson served an engineering apprenticeship and worked as a tradesman in the ship-building industry before starting work for the United Kingdom Atomic Energy Authority (UKAEA) at Springfields on 25 May 1949 as a foreman. In 1959 he was promoted, taking charge of inspecting the production lines for fuel elements for nuclear power stations.

3 Mr Wilson retired in 1970. He became ill in late 1976 and a diagnosis of multiple myeloma (myelomatosis) was made by Dr J C Leonard, consultant physician at Withington Hospital, Manchester. He was treated with chemotherapy but his condition deteriorated over the next 18 months and he died in Withington Hospital on 12 February 1978.

4 Mr Wilson's death was reported to the coroner, Mr Donald Summerfield, who requested a post mortem. Mr Wilson's family wanted a post mortem to be performed as they suspected that his death might have been related to his occupation.

5 British Nuclear Fuels Limited (BNFL)[1] was informed of Mr Wilson's death within two days; it is not clear by whom. There is no evidence that BNFL had any further involvement save for evidence given by Dr Robin Goodfellow[2] at the inquest.

Post mortem examination

6 The post mortem examination was performed at Withington Hospital on 14 February 1978 by Dr John Whittaker, consultant pathologist. His initial impression was that death was due to chronic renal failure secondary to amyloidosis and myelomatosis.

7 Histological examination later revealed no evidence of myelomatosis. On 7 March 1978, Dr Whittaker wrote to the coroner, amending his view of the

1 BNFL had acquired the Springfields site from the UKAEA in 1971

2 Senior Medical Officer, BNFL Springfields

cause of death to chronic renal failure secondary to primary amyloidosis. He also amended his post mortem report and signed the alterations.

8 Before conducting the post mortem, Dr Whittaker consulted Dr Geoffrey Dolphin,[3] at the National Radiological Protection Board (NRPB), and was advised to remove lung with trachea and lymph nodes, kidney, liver, testes and bone from rib, sternum and vertebrae. He followed that advice. The post mortem report does not mention removal of any organ.

Disposal of the organs

9 The organs removed at post mortem were sent to the NRPB and analysed by Dr Donald Popplewell,[4] at Mr Summerfield's request. The Inquiry has seen no evidence to indicate how they were transported but the NRPB's practice was to send an employee to collect them.

10 No material derived from Mr Wilson's organs is still in existence.

Inquest

11 The inquest was opened on 15 February 1978, for identification, and adjourned. It had been due to resume on 18 May 1978 but was postponed, as the NRPB had not yet started its analysis of the removed organs. The analysis was completed on 15 June 1978 and the results sent to the coroner. Mr Summerfield had died; the inquest resumed on 27 June 1978 before his successor, Mr Davies, and a jury. The family were legally represented.

12 Evidence was heard from Dr Goodfellow, Dr Leonard, Dr Whittaker and Dr Popplewell that there was no link between amyloidosis and exposure to radiation. The jury returned a verdict of death by natural causes and the cause of death was registered as chronic renal failure secondary to primary amyloidosis.

3 Assistant Director, NRPB

4 Principal Scientific Officer, NRPB

Knowledge of the removal

13 There was no legal requirement for the pathologist or the coroner to inform Mr Wilson's family that organs had been removed for analysis. On 12 May 1978, John Wilson telephoned Dr Stewart Rae at the NRPB,[5] who recorded that he was *"enquiring today whether there were any results from the post mortem analysis of tissues taken from his father"*.

14 John Wilson telephoned the NRPB again on 20 June 1978 and spoke on this occasion to Dr Hylton Smith,[6] who noted:

> *the coroner has now received our analyses; the inquest will be on Tuesday 27th June, when a Board representative will be present to comment on the results … He asked if I would provide him with a copy of the analytical results on his late father but I said that I would need to seek permission from the coroner before I could do this.*

15 Dr Popplewell gave evidence at the inquest, indicating that he had undertaken analyses for plutonium and uranium on the tissues supplied to him.

16 It is clear therefore that Mr Wilson's family were aware at an early stage that tissue samples had been removed from his body for radiochemical analysis. It is not apparent from the contemporaneous documents that they were made aware of the extent of the organs which had been removed. Their recollection is that they were not: indeed, John Wilson told the Inquiry, *"It would never have crossed my mind that removal of organs was involved."*

Legal analysis

Organ removal

17 The organs were removed by Dr Whittaker because he considered that they might be of relevance to the cause of Mr Wilson's death: at the time, he had no reason to think that the clinical diagnosis of myeloma (a condition known potentially to be caused by radiation) was incorrect. Dr Whittaker properly sought advice from Dr Dolphin as to which organs should be removed. The family's consent to the removal, which was undertaken in the course of a coronial post mortem, was not required.

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5 Assistant Director (Medical)

6 Head of the Biology Department

Organ analysis

18 Mr Summerfield asked the NRPB to undertake the radiochemical analysis at a time when he had been advised by Dr Whittaker that Mr Wilson had died from myeloma. Mr Summerfield was entitled to request the analysis, as he intended to hold an inquest. The analytical results were given in evidence at the inquest.

19 By the time the analysis was actually undertaken, Dr Whittaker had completed his histological examination of the tissue samples he had taken and had informed Mr Summerfield that the cause of Mr Wilson's death was not myeloma but primary amyloidosis. However, Mr Summerfield had no reason to rescind his request for the organs to be analysed: he was not then aware that amyloidosis was not known to be caused by radiation.

Relatives' reaction

20 Mr Wilson's family did not know what a post mortem examination involved. William Wilson assumed that it would involve opening up the body, inspecting it and perhaps taking slivers of tissue for examination under a microscope. He expects his mother would have had a similar understanding. The family knew that *"tissue"* had been taken for analysis by the NRPB but they were not made aware of the full extent of the organs which had been removed. While this is regrettable, there was at the time no legal requirement that they should have been made aware.

21 The deletion of myelomatosis from the post mortem report led Mr Wilson's family to be suspicious of a cover-up in what they perceived to be a secretive nuclear industry. In fact, there was no cover-up. An important function of a post mortem is to establish whether the diagnosis made before death was correct. It is normal practice to remove tissue for inspection under a microscope: such examination can confirm previously suspected diagnoses, identify diseases previously unsuspected or, as in this case, indicate that a diagnosis made before death was wrong. As Dr Leonard later wrote in a letter to Mrs Wilson:

> *It was quite clear from the post-mortem examination that Mr Wilson suffered from a very rare disease known as primary amyloidosis. There is no doubt about this and there was definitely no evidence of myeloma. During life it is sometimes difficult to distinguish between primary amyloidosis and myeloma and this was so in your husband's case … The cause of primary amyloidosis is completely unknown but there is no evidence that it is related in any way to ionising radiation.*

Mrs Wilson replied that this was a *"clear explanation, which I can now understand"*. There is nothing sinister in the revised cause of death on the pathologist's post mortem report or the death certificate.

22 On 24 April 2007, after hearing of the establishment of this Inquiry, William Wilson wrote to the UKAEA to ask for details of his father's career and medical records. Four months later, on 31 August 2007, the UKAEA replied:

> *Our record searches show no indication that a post mortem was carried out. Whilst there is no evidence to date to suggest that the late Mr Wilson had any tissues or organs removed after death, please be aware that the investigation is still ongoing.*

That information was, of course, incorrect: it reflected the facts that by the time of his retirement Mr Wilson had been employed by BNFL and that the analysis was undertaken by the NRPB, not by the UKAEA. However, the UKAEA should have made inquiries of BNFL, which it knew had been Mr Wilson's final employer, before giving out any information.

23 As it was, by the time he heard from the UKAEA, William Wilson had obtained the coronial file relating to his father's death and accordingly realised that organs had been taken and that they had been analysed by the NRPB. It is most unfortunate that the UKAEA, albeit inadvertently, gave him incorrect information.

Publication of the data

24 Data derived from the analysis of Mr Wilson's organs have not been used in any publication and were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

25 Mr Wilson was thought initially to have died from a disease which was known potentially to be caused by radiation. Organs were properly removed at post mortem and analysed at the request of the coroner, who received the results of the analysis in evidence at the inquest.

John Simpson

23 December 1921 – 20 June 1978

1 John Dickinson Simpson died on 20 June 1978, aged 56. He was survived by his wife, Ena, and a daughter, Judith (now Oldfield), who gave evidence to the Inquiry.

2 Mr Simpson was employed at Sellafield from 1949 until his retirement on medical grounds in December 1977, initially by the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 by British Nuclear Fuels Limited (BNFL). Mrs Oldfield described her father as a "workaholic" who often volunteered for additional shifts.

3 In 1976, Mr Simpson became jaundiced and was found to be suffering from advanced pancreatic cancer. He underwent two palliative operations, in 1976 and 1977. He related the condition to his employment and instructed solicitors, Crutes, through the General and Municipal Workers' Union (GMWU), of which he was a member. Crutes notified BNFL of the claim by a standard form letter, dated 24 February 1978.

4 Mr Simpson's condition deteriorated and he died while on holiday in Whitley Bay. His death was reported to the coroner, Mr Gallon, who requested a post mortem examination.

Post mortem examination

5 The post mortem was performed on 21 June by Dr Cecil Jobling,[1] whose report records that Mr William Ross,[2] Dr Geoffrey Schofield[3] and the coroner's officer attended. Dr Jobling found the death to have been due to carcinoma of the head of the pancreas. His report concludes:

1 Consultant pathologist, Preston Hospital, North Shields

2 Consultant radiotherapist, Newcastle General Hospital

3 Chief Medical Officer, BNFL Sellafield

Carcinoma of head of pancreas is a condition encountered fairly often as a naturally occurring disease and the highest probability is that this is a situation in the case of Mr Simpson; however, it is not possible to exclude completely the suggestion that exposure to radiation caused the development of this cancerous tumour. Specimens of lung, thoracic lymph nodes, tumour, liver and bone have been handed to Dr. Schofield to check whether or not it is possible to demonstrate any increase in radio-activity beyond the normal and he will report on this investigation probably in 2–3 months time; he indicated verbally that it is unlikely that he will be in any position to give any dogmatic answer to the question whether or not this individual case was initiated by radiation.

Disposal of the organs

6 Documents disclosed by BNFL show that lung, liver, lymph nodes, vertebrae, sternum, ribs and fibrous tissue underwent radiochemical analysis at Sellafield. Comparison of the weights recorded at the post mortem with those on BNFL's documents shows that one lung and a little over half the liver were analysed.

7 It is not apparent what became of the other lung and remainder of the liver. The Inquiry has considered several possibilities:

- they were retained by Dr Schofield but not analysed;
- they were taken by Mr Ross;
- they were retained by Dr Jobling for further analysis if necessary and, when no further analysis was requested, disposed of as laboratory waste;
- they were sent somewhere other than Sellafield for analysis;
- they were returned to the body, as was usual.

8 The first possibility is most unlikely: Dr Schofield was keen to analyse as much tissue as he had available in order to increase the accuracy of his results.[4] Dr Jobling's report records his having given *"specimens"* to Dr Schofield: it would seem likely that if he had kept organs for his own use or given them to Mr Ross, he would have recorded the fact. Although Mr Ross remained involved with the legal action against BNFL, which Mrs Simpson continued after her husband's death, there is no mention in any correspondence of his having arranged for organs to be analysed. There is no evidence of any organs from Mr Simpson having been analysed anywhere other than Sellafield.

4 Save in 1972, when he sent some organs to the NRPB for verification of his own results: see chapter 5, "British Nuclear Fuels Limited"

9 The evidence is insufficient to allow the Inquiry to reach a definite conclusion. However, it appears most likely that the other organs were returned to the body, as was usual.

10 The organs were analysed for plutonium content; as Mr Simpson had worked in an area of Sellafield associated with fission products, the bone was also assayed for strontium-90. The analysis was completed by 15 September 1978 and the results sent to Mr Ross in November 1978. There is no evidence of the results having been sent to Mr Gallon, or of his having requested them.

11 No material derived from Mr Simpson's organs is still in existence.

Inquest

12 The inquest was held on 23 June 1978, only two days after the post mortem and long before the results of Sellafield's radiochemical analysis could have been available. Mr Ian Robertson, a partner at Crutes, appeared on behalf of Mrs Simpson. After a short hearing, during which evidence was heard only from Mrs Simpson and Dr Jobling, Mr Gallon returned an open verdict.

Role of the coroner

13 Mr Gallon knew, having read Dr Jobling's post mortem report, that organs had been removed from Mr Simpson and taken for analysis by Dr Schofield. It is plain that he had no interest in the results: he held the inquest only two days after the post mortem and although the possible causation of Mr Simpson's cancer by radiation was discussed at the inquest, there is no reference in Mr Gallon's note to the organs which had been removed.

14 Mr Gallon was aware that litigation was pending between Mrs Simpson and BNFL. It may be that he merely acquiesced in the removal of organs so that the analytical results could be used by the parties, whom he knew were both represented at the post mortem. His consent was required to any such removal at a coronial post mortem but it was not his duty to ensure that the consent of Mr Simpson's relatives, which was also required, had been obtained.

Roles of the union and Crutes

15 Mr Simpson had instructed Crutes to act on his behalf and indeed had discussed his claim with Mr Robertson, and signed a witness statement, only a few days before his death.

16 Mr Robertson was notified of Mr Simpson's death almost immediately after it had happened: it is not clear by whom. A flurry of activity ensued. Mr Robertson was asked to speak to Mr Gallon by his coroner's officer because, Mr Robertson noted, *"this is the first case of this sort that Mr Gallon has had"*. Mr Robertson stressed to Mr Gallon his own experience in radiation cases:

> *I told him that I had experience of three other Inquests with Plutonium workers, two of which had been successful and the third of which was still in the Courts … it was probably pretty unlikely that Dr. Jobling would know what to do with the figures that I had obtained for Mr. Ross although Dr. Schofield would know what they meant. I explained about Dr. Schofield and said that it was a matter of interest that he did not think that either of the two people for whom we had got damages had died because of irradiation in the first instance. My purpose in doing this was so Mr. Gallon would take with a pinch of salt anything Dr. Schofield said if he and Mr. Ross seemed to be in wide disagreement … Mr. Gallon said he would go and see Mr. Ross and Dr. Schofield at the Autopsy tomorrow and he would have a word with me Friday before deciding on whether to resume the Inquest or not.*

17 On 28 June 1978, Mr Robertson reported progress to the GMWU:

> *Taking your authority on the telephone I instructed … Mr W.M. Ross to be present at the post mortem … we had thought we should notify Dr. Schofield so that he could have a chance to be present at the Post Mortem as well … I had had a discussion with the Coroner and managed to persuade him that if at all possible he would let us have an Open Verdict, rather than one of natural causes … A fair amount of material was taken for analysis but the specialists believe there will only be a very small amount of plutonium shown in the body generally.*

There is no suggestion that in addition to obtaining authority from the union, Mr Robertson had sought instructions from Mrs Simpson, as he ought to have done: his note of their meeting on the day of the inquest implies that this was the first occasion on which he had discussed with her the possibility of a claim being brought on her behalf.

18 Mr Ross's presence on behalf of Mrs Simpson at the post mortem and his acquiescence in the provision of organs to Dr Schofield could reasonably have led both the pathologist and Dr Schofield to presume that Mrs Simpson had agreed to the organs being removed. Mr Robertson would have been aware of this implication and of its inaccuracy, since he had not sought

instructions from her. However, the need for him to act with speed in what he considered to be Mrs Simpson's best interests is obvious.

Litigation

19 The claim which Mr Simpson had intimated was pursued by Mrs Simpson after his death. It was settled out of court in June 1981.

20 The analytical results from the organs provided to Dr Schofield during the post mortem were used in the course of the litigation. Various medical experts were instructed for both parties including the National Radiological Protection Board (NRPB). While the NRPB did itself analyse organs in other cases, its role here was limited to providing an expert opinion based on the medical reports and analysis already carried out.

Legal analysis

Organ removal

21 Dr Jobling's post mortem report, quoted at paragraph 5, strongly implies that he removed organs from Mr Simpson because he believed that their analysis might be helpful in ascertaining not the cause of death (which was obviously carcinoma of the pancreas) but the underlying cause of the cancer. It is possible that he was influenced in this belief by Dr Schofield and perhaps also by Mr Ross. Whatever the reason, if that was his belief, he was entitled to remove the organs in the course of a coronial post mortem without reference to the coroner. Dr Jobling carefully recorded which organs he had removed from Mr Simpson, his reasons for removing them, to whom he had given them and what he expected to happen to them. His note is exemplary. His actions cannot be faulted.

Organ analysis

22 Whatever Dr Jobling believed, it is quite clear that Mr Gallon did not request that the removed organs be analysed and had no interest at all in the results. As discussed elsewhere in this Report,[5] the legal position at that time regarding analysis for non-coronial purposes of organs lawfully removed at coronial post mortem was unclear.

5 Chapter 3, "Law and Guidance", paragraphs 85 and 86

Relatives' reaction

23 Mrs Oldfield told the Inquiry that she and, she thought, her mother had been aware after Mr Simpson's death that some small samples of tissue might be taken at the post mortem for examination under a microscope but that the idea of whole organs being removed for analysis had never occurred to her. Although it was her mother who made all the funeral arrangements, and indeed pursued the litigation, she is sure that no request was made for permission to remove the organs. Had such a request been made, however, she thinks it at least possible that she and her mother would have agreed.

Publication of the data

24 Data derived from the analysis of Mr Simpson's organs were used anonymously in:

- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 5);[6]
- Jones, 1985: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake (case SEL-24);[7]
- an internal BNFL document[8] in 1996 (case 11).

25 The data were sent to the United States Transuranium and Uranium Registries (USTUR) (case 175). They were not used in any USTUR report or publication. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

26 The organs lawfully removed from Mr Simpson at the coronial post mortem were left in legal limbo by the coroner's lack of interest in them. The analysis was undertaken at Sellafield on Dr Schofield's instructions either for use in litigation (which had already been intimated by Mr Simpson himself) or for purely scientific reasons. In the circumstances, the former seems very much more likely.

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6 *British Journal of Radiology*, 53: 398–409

7 *Radiological Protection Dosimetry*, 11(1): 19–27

8 DOSTR 36: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

Stanley Higgins

29 April 1928 – 11 February 1979

1 Stanley Mark Higgins died on 11 February 1979, aged 50. He was survived by his wife, who has since died, and his son, Dr Stanley Derek Higgins, from whom the Inquiry heard evidence.

2 Mr Higgins served in the Parachute Regiment during the Second World War and returned to Whitehaven in the early 1950s, becoming a process operator at Sellafield in 1953, initially for the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 for British Nuclear Fuels Limited (BNFL). He successfully completed a health physics course at Whitehaven College and became a tutor there while continuing to work at Sellafield.

3 He was promoted to senior shift supervisor and was on duty on the night of the "Head-End" incident on 26 September 1973, in the course of which he suffered heavy exposure to ruthenium which contaminated his nasal passages, throat and lungs. He attracted the nickname "the radioactive man". He was permanently excluded from work in any radioactive area and transferred to the safety department. A Board of Inquiry commended Mr Higgins's bravery in evacuating his shift team from the plant without regard for his own safety.

4 Mr Higgins's health deteriorated: he developed problems with his thyroid gland and on two occasions collapsed on his way to work. He died suddenly at 2pm on 11 February 1979 while playing golf with a colleague, who telephoned Dr Geoffrey Schofield[1] to request the company ambulance. There is a note in Mr Higgins's occupational health records:

> *11.2.79 Died suddenly whilst playing golf at Seascale (about 14:30.). P.M. – C.T.* [coronary thrombosis] *Rh* [sic] *106 confirmed in both lungs.*

5 Mr Higgins's death was also reported to the coroner, Mr Hubert Gough, who noted:

> *Last seen 11/78 – a gum boil. 1977 black-outs. Then* [illegible] *– hypothyroid. Nothing in history to suggest possible sudden death. Widow – never been well since incident at Sellafield in 1973.*

There is no reference in the note to ruthenium. Mr Gough requested a post mortem examination.

1 Company Chief Medical Officer, BNFL

Post mortem examination

6 The post mortem examination was performed on 12 February 1979 by Dr Philip Whitehead,[2] who found the cause of death to have been a heart attack. His report records:

> *Specimens had been taken by me for histological examination and extensive specimens were taken at the time of the post mortem by Dr Schofield from BNFL.*

Dr Schofield had taken vertebrae, mediastinum, kidney, liver, heart, spleen, sternum, both lungs and lymph nodes. Mr Gough knew of Dr Schofield's involvement, recording *"Dr Schofield has taken specimens"*.

7 Following histological examination of tissue he had removed at post mortem, Dr Whitehead reported:

> *In my opinion the histological examination does not show any evidence of disease which could be associated with ionising radiation. It is further my opinion that ionising radiation neither contributed to nor caused Mr Higgins death.*

8 Mr Higgins's family were not told what a post mortem examination would involve, that Dr Schofield would attend or that organs would be removed for analysis.

Disposal of the organs

9 Analysis of the organs from Mr Higgins was completed by BNFL on 31 May 1979. Mr Gough was aware that Dr Schofield had taken what he described as *"samples"* but there is no evidence that he asked for the results of the analysis or that they were provided to him.

10 Mr Higgins's occupational health records indicate that six pieces of lung, weighing 289g, were sent to *"Harwell"*. Both the National Radiological Protection Board (NRPB) and the UKAEA operated sites at Harwell; the Inquiry has seen no evidence to suggest to which organisation the pieces of lung might have been sent or what, if any, analysis was undertaken.

11 No material derived from Mr Higgins's organs is still in existence.

2 Consultant pathologist, West Cumberland Hospital

Inquest

12 Following the post mortem, Mr Gough did not consider an inquest to be required and certified the death on 14 February 1979. Dr Higgins asked Mr Gough why no inquest was to be held and was told that it was unnecessary, given the findings at post mortem. Mr Gough knew that Dr Schofield had taken organs for analysis, but did not inform the family.

Knowledge of the removal

13 Mrs Higgins also worked at BNFL. On 9 July 1979, Mr John Donoghue, Health and Safety Manager, made a note of a telephone complaint from her:

> *Dr Schofield had taken organs from Stan's body but had never told her the results … no one went to see her and she could not get information from anyone … she had spoken to the Coroner who said he knew nothing about radiation … the union did not appear to be doing anything.*

14 Dr Schofield visited Mrs Higgins the next day and noted:

> *I visited Mrs Higgins at her request to discuss the present situation relating to the medical aspects of a possible claim for damages … I also told her that we were now in possession of all the data relating to the post mortem investigations which had been undertaken at the Coroner's request, and that this information was now available, if required, to representatives of the Union.*

His suggestion that the investigations were undertaken at the coroner's request was misleading: while the post mortem had been arranged by the coroner, the radiochemical analysis of Mr Higgins's organs had not.

15 Dr Schofield also met Dr Higgins in the same month and noted:

> *I was visited this morning by Mr Higgins's son to discuss the information contained in the medical records relating ... to the radiation measurements and radiochemical findings on the post mortem specimens. I gave him copies of the post mortem findings … on the understanding that these were for his personal use … I discussed at some length the meaning of the available data.*

16 It is plain that within a few months of Mr Higgins's death his widow knew that organs had been removed and analysed, albeit that she had not agreed in advance. It would appear that Dr Higgins was also given information relating to the results of the analysis by Dr Schofield, although in evidence

to the Inquiry he did not recall being aware of the extent of the organs which had been taken.

17 Mr Higgins's union, the Association of Government Supervisors and Radio Officers, was also aware at an early stage that organs had been removed. A note, probably made by a union official, records conversations between its General Secretary, the coroner and Dr Schofield:

> *spoke to Pathologist – died from heart attack … Post mortem held, Dr Schofield there and took away main organs … also spoke to Dr Schofield, he will give us every co-operation and make these available to us … will phone coroner tomorrow and OK the arrgts* [arrangements] *as made.*

Litigation

18 Mrs Higgins pursued a legal claim against BNFL, alleging that her husband's death had been caused by radiation. BNFL denied liability and no adequate supportive evidence could be found to make it likely that any legal action would succeed. Eventually, some eight years after Mr Higgins's death, BNFL made an *ex gratia* payment, without any admission of liability, in recognition of his bravery during the Head-End incident and of his death just before death-in-service provisions had been initiated.

Role of the coroner

19 Mr Gough knew that organs had been removed for analysis from Mr Higgins's body at a post mortem examination which he had requested. He had no interest in the results, which were not relevant to the cause of death. The removal could lawfully have taken place only with his consent but there is no evidence that such consent was sought in advance of the post mortem.

Legal analysis

Organ removal

20 Dr Whitehead did not remove the organs because he considered they might bear on the cause of death. Mr Gough had not asked him to remove them for analysis, nor had he agreed that they be removed. Mr Higgins's family were not asked to agree to the removal and were unaware of it for at least some

weeks. The removal was not in accordance with the Coroners Rules and was contrary to the provisions of the Human Tissue Act 1961.[3]

Organ analysis

21 The analysis was not carried out at the request of either the family or the coroner. Dr Schofield had indicated on many previous occasions that he did not believe heart disease to be caused by radiation and his analysis was therefore performed purely for scientific research. He received the organs from Dr Whitehead, and it would have been reasonable for him to assume that they had been removed in accordance with the law. If the lung samples sent to Harwell were analysed there, it would have been reasonable for that analyst also not to have questioned the legality of their acquisition.

Relatives' reaction

22 Dr Higgins was disturbed by what he perceived as the secrecy which surrounded the removal and analysis of his father's organs. He told the Inquiry that he had not been aware that organs had been removed and analysed and was sure that his mother had also been kept in the dark. Ironically, had a full explanation been given, setting out the potential benefit to be gained from the analysis, it is likely that, he thought, they would have consented.

Publication of the data

23 Data derived from the analysis of Mr Higgins's organs were used anonymously in:

- Schofield, 1979: Biological control in a plutonium production facility, a lecture later (1980) published in the *British Journal of Radiology* (case 13);[4]
- Jones, 1985: Derivation and validation of a urinary excretion function for plutonium applicable over tens of years post uptake (case SEL-25);[5]

3 See chapter 3, "Law and Guidance"

4 *British Journal of Radiology*, 53: 398–409

5 *Radiological Protection Dosimetry*, 11(1): 19–27

- Lawson and others, 1989: Plutonium deposition in man: comparison between excretion and autopsy analyses, presented at a symposium at Malvern in 1989 and subsequently published (case 8);[6]
- an internal BNFL document[7] in 1990 (case C).

24 The data were sent to the United States Transuranium and Uranium Registries (USTUR) (case 169). They were not used in any USTUR report or publication. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

25 Mr Higgins's organs were removed at a coronial post mortem and analysed for BNFL's scientific research. This could lawfully have been done only with the agreement of his family, which was not sought.

6 In Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP (Malvern, June 1989)* (Institute of Physics Publishing, 1989)

7 DOSTR 18: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

Ronald Gee

3 August 1925 – 14 May 1980

1 Ronald Gee died on 14 May 1980, aged 54. He was survived by his wife, Elizabeth, who has since died, and two daughters, Norma (now Almond) and Eileen (now Wrenshall), both of whom gave evidence to the Inquiry.

2 Mr Gee was employed as a process worker at Springfields from January 1958 until his death, initially by the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 by British Nuclear Fuels Limited (BNFL). In 1979, he was found to have acute myeloid leukaemia, for which he was treated at the Royal Victoria Hospital in Blackpool by Dr Neil Flanagan, consultant haematologist. Although he was able to return to work for a brief period in February 1980, his condition deteriorated and he died in the Royal Victoria Hospital.

3 Mr Gee's death was reported to the coroner, Mr John Budd, who requested a post mortem examination. Mr Gee's family were told that a post mortem was necessary because he had been exposed to radiation, a possible cause of his leukaemia, in the course of his work at Springfields.

Communication with BNFL

4 Mr Gee's occupational health records indicate that someone (probably Dr Robin Goodfellow[1]) discussed his condition with his general practitioner on 21 August 1979 and with Dr Flanagan the next day:

> *Spoke to Dr Flanagan. Not a clear diagnosis. Has responded well to chemotherapy and will be discharged tomorrow(?). Dr Flanagan will cooperate in supply of organs at eventual p.m. – but he seems to be going into remission at the moment.*

5 Dr Geoffrey Schofield[2] became aware of Mr Gee's death on the day it happened and informed BNFL's Legal Department by telephone. There is evidence to suggest that the coroner's office discussed Mr Gee's death on the day it happened with the Medical Department at Springfields and it is probable that Dr Goodfellow informed Dr Schofield.

1 Senior Medical Officer, BNFL Springfields

2 Company Chief Medical Officer, BNFL

Post mortem examination

6 The post mortem was performed on 15 May 1980 by Dr Selwyn Murray, consultant pathologist, who confirmed the cause of death to have been acute myeloid leukaemia. The report records:

> *The lungs and trachea were given intact for further examination to Dr. Goodfellow from British Nuclear Fuels … Two ribs and sternum were also given to Dr. Goodfellow.*

7 From the inquest notes, it is apparent that Dr Goodfellow had asked Mr Budd for permission to take the organs for analysis of their uranium content. Mr Budd had agreed because the analysis might assist in determining the appropriate verdict.

Disposal of the organs

8 The organs which had been given to Dr Goodfellow were taken to Sellafield, probably by car, and analysed there.[3] The analysis was completed by June 1980 and the results sent to the coroner on 5 August 1980.

9 There is no evidence that any organs other than those described above were taken, nor that any organs were sent other than to Sellafield. No material derived from Mr Gee's organs is still in existence.

Inquest

10 The inquest into Mr Gee's death had been opened on 20 May 1980 and adjourned to allow further investigation, including analysis of the removed organs. It resumed on 22 August 1980. Dr Goodfellow gave evidence that in 1974 and 1975 estimates of Mr Gee's exposure to uranium had been marginally higher than those considered safe but that Mr Gee's leukaemia was very unlikely to have been contracted while working at Springfields. Mr Budd adjourned the inquest to obtain an independent report on the likelihood of Mr Gee's leukaemia having been caused by radiation.

11 Mr Budd commissioned a report from Dr Stewart Rae,[4] sending to him Mr Gee's medical records and the results of the analysis which had been conducted at Sellafield. Dr Rae concluded that the probability of the leukaemia having been caused by radiation was 13–19%.

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3 The analytical technique is described in chapter 2, "Science"

4 Assistant Director (Medical), National Radiological Protection Board

12 The inquest resumed again on 23 September 1981. The family were represented by a barrister instructed by the Transport and General Workers' Union (TGWU), of which Mr Gee had been a member. Evidence was heard from Dr Goodfellow, Dr Rae and Dr Murray. Mr Budd was not satisfied that Mr Gee's leukaemia had been induced by radiation and returned an open verdict.

Pressure on the coroner

13 In several letters written between November 1980 and January 1981, Mr Peter Green,[5] on behalf of BNFL, attempted to persuade Mr Budd that he could not return a verdict of death from industrial disease as this would appear to determine civil liability, contrary to the Coroners Rules.[6] Mr Budd manfully resisted the pressure placed upon him, eventually writing:

> *I remain quite convinced that the verdict that the deceased died of the industrial disease would not, per se, appear to determine civil liability, which is entirely a matter for a civil court … I think we have now canvassed the matter as fully as is possible, and unless you have anything further you wish to say upon the subject it seems to me that it would be sensible for us to agree to differ, always assuming that this letter does not induce any change of mind. If it does, please let me know.*

Role of the coroner

14 Mr Budd conducted a thorough investigation into the cause of Mr Gee's death and in particular into the possibility that his leukaemia might have been the result of occupational exposure to radiation. He received the results of the analysis of Mr Gee's organs. These were initially interpreted for him by Dr Goodfellow, who worked for Mr Gee's former employer. Mr Budd was obviously alive to the potential for a conflict of interest on the part of Dr Goodfellow and obtained a second, independent report from Dr Rae. Consent from the family for the removal and analysis of the organs was not required.

5 Chief Legal Adviser and Deputy Company Secretary, BNFL

6 See chapter 3, "Law and Guidance"

Role of the union

15 From the limited evidence available to the Inquiry, the TGWU acted in accordance with the law. Its sole involvement was in securing legal representation for Mrs Gee at the inquest.

Litigation

16 A civil claim was investigated; BNFL denied liability for Mr Gee's death. Mrs Gee applied to the Compensation Scheme for Radiation-Linked Diseases and received an award of 50% of full compensation.[7]

Legal analysis

Organ removal

17 The organs were removed with Mr Budd's approval, presumably because Dr Murray considered that their analysis might bear upon the cause of death. The removal was lawful.

Organ analysis

18 The organs were analysed at Mr Budd's request and the results sent to him and given in evidence. The analysis was lawful.

Relatives' reaction

19 There was at the time no legal requirement for Mr Gee's family to have been informed that any organs had been removed from his body. The discovery that this had happened has caused much distress. Mrs Almond told the Inquiry:

> *My father was cremated and whilst it would be too strong to say that I now feel that it was not really him who was cremated, I do want to look back and think that my father went as a whole person.*

7 See chapter 7, "The Trade Unions and the Compensation Scheme"

Publication of the data

20 Data derived from the analysis of Mr Gee's organs have not been used in any publication and were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

21 The telephone call between the Springfields Medical Department and Dr Flanagan might be interpreted as an attempt to persuade Dr Flanagan to refer Mr Gee's eventual death to the coroner to ensure that a post mortem would be held whatever the cause. However, since Mr Gee did die of leukaemia which it had been suggested was caused by occupational exposure to radiation, the eventual referral was sensible. There is no suggestion that Dr Flanagan's actions were in fact influenced in any way by BNFL.

22 The Inquiry noted with concern the breach of confidentiality implied by the conversation. The information was given to a medical officer, an employee of the potential defendant in any future litigation, albeit one who was already aware from Mr Gee's general practitioner of the underlying diagnosis.

23 Mr Budd, Dr Murray and the various experts involved in performing the radiochemical analysis of organs taken from Mr Gee and in interpreting the results all acted entirely properly. It is regrettable that Mr Gee's family were kept in the dark but the law then imposed no obligation on the coroner or the pathologist to keep them informed.

Kenneth Roberts

29 June 1928 – 9 February 1983

1 Kenneth Roberts died on 9 February 1983, aged 54. He was survived by his wife, Ruth, who gave written evidence to the Inquiry, and three children, Vivienne, Philip and Kathleen.

2 Mr Roberts began work for the United Kingdom Atomic Energy Authority (UKAEA) at Springfields in 1951. In 1964 he moved to Sellafield, where he worked as an instrument engineer until his retirement on medical grounds in April 1982, initially for the UKAEA and from 1971 for British Nuclear Fuels Limited (BNFL).

3 Mr Roberts was fit and well until May 1981, when after a collapse he was found to have metastases in his spine. Extensive investigations failed to provide a definitive diagnosis but the results suggested multiple myeloma, for which he was treated at West Cumberland Hospital by Dr William Berrill, consultant physician. In early 1982, with the help of his union, the Institute of Professional Civil Servants, he instructed solicitors, Gasters, to investigate a claim against BNFL. His condition deteriorated in late 1982 and on 25 January 1983 he was admitted to West Cumberland Hospital where he died a fortnight later.

4 Dr Berrill referred Mr Roberts's death to the coroner, Mr Adrian Walker, who requested a post mortem examination.

Post mortem examination

5 The post mortem was performed on 11 February 1983 by Dr Thomas Bird,[1] who confirmed that Mr Roberts had died from disseminated multiple myeloma (myelomatosis). It is apparent from contemporaneous documents that Dr Geoffrey Schofield[2] attended the post mortem but the report, which is otherwise exceptionally detailed, mentions neither his presence nor the removal of organs for analysis at Sellafield.

6 The Inquiry heard evidence from Dr Bird, who is now elderly. He had no recollection of Dr Schofield's having attended any post mortem he had conducted, nor of having supplied organs from Mr Roberts to Sellafield. The Inquiry is not able at this remove to determine whether Dr Bird's memory of

1 Consultant haematologist, West Cumberland Hospital

2 Company Chief Medical Officer, BNFL

events a quarter of a century ago is imperfect or if Mr Roberts's body was re-opened and the organs removed after Dr Bird had completed his post mortem. The former would seem more likely, as Dr Bird:

- conceded to the Inquiry that he had been told by Dr David Smith[3] of the general arrangements in place at West Cumberland Hospital for organs obtained from former nuclear workers to be sent to Sellafield;
- made a handwritten note of the analytical results on a copy of his histology report which, although undated, was probably written within a couple of months of the death.

Disposal of the organs

7 Liver, spleen, left lung, testis, four ribs, vertebrae, one femur, one kidney, lymph nodes and connective tissue were assayed for plutonium at Sellafield. The weights of liver, lung and kidney analysed at Sellafield and those recorded by Dr Bird at the post mortem do not differ significantly.

8 The results of the analysis conducted at Sellafield were sent to Dr Schofield on 28 April 1983. Dr Adam Lawson[4] prepared a report, dated 5 August 1983, setting out Mr Roberts's medical and employment history, to which Dr Schofield's analytical report was annexed.

9 No material derived from Mr Roberts's organs is still in existence.

Inquest

10 The inquest took place on 11 November 1983. Mr Walker had received the report from Dr Lawson with Dr Schofield's addendum, which concluded:

> *Mr Roberts was at no time exposed to plutonium while at work and no monitoring was carried out for plutonium during his life. The results obtained from the autopsy specimens confirmed that his intake of plutonium from his occupation was negligibly small, and in my opinion could not have contributed to the causation of the disease from which he died.*

Curiously, Dr Schofield refers to his having obtained the organs from Dr George Ghazala, another of West Cumberland Hospital's consultant pathologists, rather than from Dr Bird. It is unlikely that this is other than

3 Consultant pathologist, West Cumberland Hospital

4 Senior Medical Officer, BNFL Sellafield

a simple mistake: Dr Schofield based his reports on a template and similar errors appear in other reports seen by the Inquiry.

11 Evidence was heard from Mrs Roberts, Dr Berrill, Dr Bird, Dr Lawson, Dr Schofield and Mr Frank Ward.[5] Dr Schofield read out his report, which included a list of the organs which had been analysed at Sellafield. The jury returned an open verdict.

Role of the coroner

12 Immediately after being informed of Mr Roberts's death, Mr Walker noted:

> *Telephoned Dr Schofield BNFL. They would like to be represented at the PM and take the normal specimens to which I agreed. p.m. 11.00am tomorrow.*
>
> *I then spoke to Mr Rheinhart of Messrs Gasters and informed him of the position and inquired if he wished for observers to be present. He would take instructions from his union client. He subsequently returned our call and said his clients did not wish for observers but would like a copy of the PM report & tests which would be produced at the inquest.*

13 Mr Walker knew that organs were to be removed at post mortem for analysis at Sellafield. It is not clear whether he wanted the organs to be analysed in order to assist him in determining the cause of death or whether he simply acquiesced in the analysis, the results of which would be used by BNFL and Mrs Roberts in litigation. He would have been aware that in the latter case, the relatives' consent to the removal of organs from Mr Roberts was required but there was no obligation upon him to ensure that it had been obtained: that duty lay on the pathologist who removed the organs.

Roles of the union and Gasters

14 Before he died, Mr Roberts had instructed Gasters to investigate a claim against BNFL. He had not given permission for his organs to be removed after his death. There is no evidence to suggest that Gasters made any attempt to obtain Mrs Roberts's permission for organs to be removed: Mr Walker's note, quoted at paragraph 12, indicates only that they took instructions from the union.

5 Safety Service Manager (Personnel Protection), BNFL Sellafield

Litigation

15 Mr Roberts had issued proceedings against BNFL, but the claim appears not to have been pursued after his death. BNFL's solicitors seem to have suggested at the conclusion of the inquest that Mrs Roberts might consider a claim under the Compensation Scheme for Radiation-Linked Diseases rather than pursuing legal action: when in due course she did make such an application, it was rejected.

Legal analysis

Organ removal

16 If the organs were removed at a second opening of Mr Roberts's body after Dr Bird's post mortem examination had been completed, at Dr Schofield's behest and without Dr Bird's knowledge or Mrs Roberts's consent (see paragraph 6), the removal would not have been in compliance with the provisions of the Coroners Rules or the Human Tissue Act 1961.

17 If Dr Bird, who was performing a coronial post mortem, believed that analysis of the organs would be of assistance in determining the cause of death, he would have acted appropriately in removing them. One copy of Dr Bird's histology report (which, although undated, appears to have been completed some while after the main post mortem report) bears a handwritten note (again undated) that there was no record of Mr Roberts having been exposed to or monitored for exposure to plutonium but there is no evidence that Dr Bird was aware of that fact at the time he removed the organs.

Organ analysis

18 There is no indication that the coroner requested Dr Schofield to undertake the analysis. The results were, however, produced at the inquest, at which Dr Schofield and Dr Lawson gave evidence. As discussed elsewhere in this Report,[6] the legal position at that time regarding analysis for non-coronial purposes of organs lawfully removed at coronial post mortem is unclear.

6 Chapter 3, "Law and Guidance", paragraphs 83 and 84

Relatives' reaction

19 Mrs Roberts was greatly distressed to learn in 2007 that such an extensive list of her late husband's organs had been removed. She had intended him to be cremated intact:

> *I had someone cremated whom I thought was Ken but in fact I now find that I have just cremated a shell. The whole thing is extremely upsetting and very hard for me to take.*

20 Mrs Roberts said that had she been informed of the purpose to be served by analysis of the organs, she might well have agreed to their removal, particularly if the main purpose were to benefit other employees or the community.

Publication of the data

21 Data derived from the analysis of Mr Roberts's organs were sent to the United States Transuranium and Uranium Registries (USTUR) (case 811). They were not used in any USTUR report or publication. The USTUR has indicated that all data received from the UK have now been erased.

Conclusion

22 Mr Roberts had been employed at Sellafield, albeit not as a radiation worker. He died from a condition known potentially to be caused by radiation. If Dr Bird believed that his myeloma might have been caused by radiation and that analysis of his organs might assist in determining whether that was in fact the case, he acted appropriately in removing those organs. Similarly, if Mr Walker held those views, he acted appropriately in requesting that the organs be analysed and in receiving the results of the analysis at the inquest, albeit that his choice of expert, the medical officer of the employer, would in the circumstances have been unwise.

23 On the other hand, legal action against BNFL was in progress at the time of Mr Roberts's death. Dr Schofield would have been anxious, on behalf of BNFL, to obtain organs for analysis whose results could be used in that litigation. If the organs were removed for that purpose, and not to serve the coroner's purpose, the family's consent would have been required: it was not sought.

24 The Inquiry concludes that the first of these possibilities is the more likely and hence that the removal and analysis of Mr Roberts's organs was justified.

John Grain

28 June 1927 – 5 February 1984

1 John Grain died on 5 February 1984, aged 56. He was survived by his widow, Margaret, and two children, Jean (now Downie) and John. Mrs Grain and her son gave evidence to the Inquiry.

2 Mr Grain started work at Sellafield on 2 June 1958 as an engineer/fitter and remained for what his wife described as *"ten wonderful years in Cumbria"*. On 5 February 1968, he was promoted to maintenance foreman and transferred from Sellafield to Capenhurst, in Cheshire, working initially for the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 for British Nuclear Fuels Limited (BNFL).

3 In December 1983, Mr Grain was discovered to be suffering from metastatic lung cancer. He received radiotherapy but died at St John's Hospice, Clatterbridge, on 5 February 1984.

4 The hospice reported Mr Grain's death to the coroner, Mr Rex Taylor, who decided that a post mortem and an inquest were necessary. Mrs Grain had in any event intended to request a post mortem examination, as she believed her husband's cancer to have been caused by his work.

5 Despite Mrs Grain's suspicions that her husband's death might have been related to his employment, neither she nor any relative consulted Mr Grain's union, the Institute of Professional Civil Servants, or solicitors about a potential claim until some weeks after his death.

Post mortem examination

6 The post mortem was performed on 6 February 1984 by Dr John O'Shea.[1] The cause of death was cancer of the bronchus. The report records that mortuary staff were in attendance.

7 Dr Eric Barker[2] was notified of Mr Grain's death; it is not clear when or by whom. He tried to talk to Dr O'Shea, in order to obtain organs from Mr Grain at the post mortem, but was unable to do so until after the examination had been completed.

1 Consultant pathologist, Arrowe Park Hospital

2 Medical Officer, BNFL Capenhurst

8 Mr Taylor discussed Mr Grain's death with the Liverpool coroner, Mr Roy Barter, who had investigated the death of a nuclear worker a few years earlier, and with the pathologist in that case, Dr Charles St Hill. Dr St Hill told him that organs taken at that post mortem had been analysed at Sellafield. Contact was therefore made with Dr Geoffrey Schofield,[3] who recorded:

> *The Birkenhead Coroner's Officer therefore rang me up to ask me if we would be doing the same in the case of Grain as the coroner had decided that such organs should be taken for analysis and had asked Dr O'Shea to re-perform the autopsy … I also mentioned to the Coroner's Officer that the Coroner himself or any Unions which might be involved in the case may ask for an independent analysis of the specimens and that this would need to be done by the National Radiological Protection Board. I spoke to Dr Popplewell[4] at the NRPB … I would divide up the specimens and would leave some in the deep freeze until such time as they may be required for analysis by the Board.*

9 The coroner's officer, Detective Constable Brian Jones, described the identification of Mr Grain's body in a formal statement, as is usual practice. He mentioned only one post mortem, performed on 6 February 1984. At the end of the typed statement, he added in handwriting:

> *With consent of family certain material removed at P.M. and sent for further examination by Dr Schofield at Sellafield and to Dr Hylton Smith[5] at Harwell. Spoke to Union rep at Capenhurst and he said Union would accept Dr Schofield's findings. Further report could have been obtained from Dr Hylton Smith if family wished but they decided not to.*

The statement bears a typed date of 7 February 1984, the date on which the inquest into Mr Grain's death was opened and adjourned, and a handwritten date of 28 June 1984, when the inquest was resumed and concluded. It would seem likely that DC Jones's handwritten addition was made shortly before the inquest resumed, several months after the post mortem.

10 Mrs Grain and her son strongly dispute DC Jones's version of events. They are adamant that they were informed neither of the second post mortem nor of any intention to remove organs for analysis. It may be that by the time he

3 Company Chief Medical Officer, BNFL

4 Principal Scientific Officer, NRPB

5 Head of Biology Department, NRPB

made his handwritten addition to the statement, DC Jones's memory was at fault.

11 The second opening of the body took place on 8 February 1984. Dr Barker attended and wrote to Dr Schofield:

> *I managed to collect the specimens as we arranged … The lungs and mediastinum are included as one specimen (less the sample from left lung taken for histology). They were not weighed and unfortunately had been immersed in formalin for a few hours. The other organs are as we agreed – whole liver (wt 1310g), one kidney (wt 175g), one spleen (wt 270g), the sternum, two ribs, one femur (divided in half for convenient carriage (!)) and some vertebral bodies.*

There is only one post mortem report, which refers neither to this second examination nor to any organs having been removed.

12 The liver, kidney, spleen, lungs, lymph nodes and bone from ribs, sternum, vertebrae and femur were analysed at Sellafield. The weights of liver (1,150g), kidney (118g) and spleen (175g) recorded in the analytical documentation are a little less than those mentioned by Dr Barker. The Inquiry has seen no evidence to explain this discrepancy. Several explanations are possible: Dr Schofield may have preserved parts of the organs for independent analysis, as he had indicated that he would; unwanted tissue may have been trimmed from the organs before they were weighed at Sellafield; fluid may have drained from the organs between the two weighings; or one or both sets of scales may have been inaccurate.

13 Dr Schofield prepared a report, dated 30 May 1984, which he sent to the coroner. He concluded that the plutonium content of the analysed organs was very small and had not contributed to the death.

14 The need for a second post mortem examination meant that the release of Mr Grain's body to his family and hence his funeral were delayed. The family were offered no explanation for the delay.

Disposal of the organs

15 The only analysis of which any record exists took place at Sellafield. Although Dr Schofield indicated to DC Jones that he would freeze part of the organs he received for later analysis by Dr Popplewell, the Inquiry has seen no evidence that he did so: the NRPB's log books, which are a very well-maintained record of the work done in its laboratory, do not record receipt of any of Mr Grain's organs.

16 No material derived from Mr Grain's organs is still in existence.

Inquest

17 Mr Taylor held the inquest into Mr Grain's death on 28 June 1984. It lasted approximately 20 minutes. Mrs Grain did not attend; her son gave evidence of identification. At least some of Dr Schofield's report was read aloud by the coroner. Mr Grain's son was under the impression that this report had been prepared by the NRPB and he remembered gaining no understanding from those parts which were read that whole organs had been removed.

18 A verdict of natural causes was returned, the cause of death being registered as bronchopneumonia secondary to metastatic carcinoma of the bronchus.

Role of the coroner

19 Mr Taylor was informed that a radiation worker had died from cancer. Appropriately, he requested a post mortem examination. He sought advice from a fellow coroner and from another pathologist and concluded that his investigation would be assisted by radiochemical analysis of Mr Grain's organs. By this time, the post mortem had been concluded, so, after asking Dr Schofield which organs should be taken, Mr Taylor authorised a second post mortem examination in order that those organs could be removed. He commissioned a report from Dr Schofield which he admitted as evidence at the inquest.

20 While the second post mortem examination is unusual, and it would obviously have been preferable for it and the reasons for it to have been explained to Mr Grain's family, Mr Taylor acted within his powers.

Compensation

21 About a month after her husband died, Mrs Grain sought advice from his union about a possible claim for damages. No litigation was initiated but the union assisted Mrs Grain in submitting a claim to the Compensation Scheme for Radiation-Linked Diseases and she received an award in early 1985. At no point did Mrs Grain become aware that organs had been removed for radiochemical analysis at Sellafield.

Legal analysis

Organ removal

22 The organs were lawfully removed from Mr Grain's body at the second post mortem examination, under coronial authority. The family's consent to the removal was not required.

Organ analysis

23 The analysis was performed at Sellafield at coronial request and was therefore lawful. It appears that if any tissue remained after the inquest had been completed, it was disposed of, probably as clinical waste: this too would have been lawful. Mr Taylor can be criticised for commissioning the report from Mr Grain's former employer, failing to take into account the obvious potential for a conflict of interest.

Relatives' reaction

24 Neither Mrs Grain nor her son had any real understanding of what a post mortem examination involved; they both thought that although the body would be opened, only small slivers of tissue would be removed for examination under a microscope. The discovery of the extent of the organs removed from Mr Grain's body came as a severe shock to his family, and in particular to Mrs Grain, who has received counselling as a result. Although Mr Grain's family have been concerned that Dr Barker attended the second post mortem examination, it is clear from his note (quoted at paragraph 11) that he did not arrive at the hospital until some hours after the examination had been completed.

Publication of the data

25 Data derived from the analysis of Mr Grain's organs have not been used in any publication and were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

26 Dr O'Shea acted properly in removing organs from Mr Grain, at Mr Taylor's request, believing that the results of the analysis might be relevant to

determining the cause of the disease from which he died. Mr Taylor arranged for the organs to be analysed and received the results in evidence at the inquest, albeit from the employer's medical officer.

27 The re-opening of Mr Grain's body to allow organs to be taken for analysis and the consequent delay in its being released to his relatives was unusual. It is regrettable that the reasons for the delay and the fact of the second post mortem were not explained to them.

Gerard Grears

6 June 1928 – 2 December 1984

1 Gerard James Grears died on 2 December 1984, aged 56. He was survived by his second wife, Mary, who has since died. He had nine children – Desmond, John, Isobel, Frank, Agnes, Kathleen, Daniel, Gerard and Rosa – by his first wife. The Inquiry heard evidence from Desmond, Daniel, Gerard and Rosa (now Balfe).

2 Mr Grears worked as a steel erector at Sellafield from 1957 to 1960, as a contractor, and from 1981 to 1983, employed by British Nuclear Fuels Limited (BNFL). In 1983, he developed back pain and was discovered to be suffering from metastatic cancer of the prostate. He and his wife considered his cancer to have been caused by his work at Sellafield and he wanted a post mortem examination to be done in due course. His condition deteriorated and he died in West Cumberland Hospital on Sunday 2 December 1984. Seven of his children were present when he died; Gerard and Daniel were unable to get to Whitehaven until 4 December.

3 Mr Grears's death was not reported to the coroner until the morning of Tuesday 4 December 1984. The reason for the delay is not clear. Mr John Taylor, deputy coroner, requested a post mortem examination and noted *"Family wish to claim from BNFL … Passed to Path Lab 11.00"*.

Post mortem examination

4 The post mortem was performed by Dr George Ghazala[1] at 9.00am on 5 December. His report ends:

> *Dr. G. B. Schofield, Chief Medical Officer at British Nuclear Fuels Limited attended the post-mortem examination and collected some specimens including liver, left lung, sternum, mediastinal lymph nodes and a portion of the prostatic tumour for further analysis.*

5 Dr Schofield's own note, in Mr Grears's occupational health records, reads:

> *Died 2.12.84 ?Ca* [cancer of] *prostate. Relatives have asked the coroner for an autopsy ?industrial disease.*

1 Consultant pathologist, West Cumberland Hospital

> *5.12.84. P.M. Ca prostate c̄ multiple 2°* [with multiple secondaries]. *Asbestos plaques on pleurae. Material taken for analysis. Deceased 2.12.84.*

6 Dr Schofield certainly attended the post mortem on the morning of 5 December. The combination of Dr Ghazala's report, which records his presence, and his own observation of the plaques (which are not mentioned in the report) leaves no room for doubt.

Disposal of the organs

7 The organs removed from Mr Grears were analysed at Sellafield. The analysis was completed by 14 January 1985. Dr Schofield's report to Mr Taylor is dated 4 March 1985. No inquest was held.

8 No material derived from Mr Grears's organs is still in existence.

Postponement of the funeral

9 Dr Ghazala telephoned the coroner's office on the morning of 5 December, to convey his findings at the post mortem he had just completed. Mr Taylor wrote a note which implies that Dr Ghazala left a message rather than speaking to him or to Mr Adrian Walker, the coroner:

> *11:15am 5/12/84. Dr Ghazala telephoned with result of P.M. JAHW* [Mr Walker] *spoke to undertaker and advised funeral could not take place at noon as we wished to speak to Dr Schofield re: exposure of dec'd* [deceased] *to radiation and this type of cancer had an association with radiation.*

10 Mr Grears's family recalled that, a matter of minutes before the funeral was due to take place, at noon on 5 December, they were told by the undertaker that it could not proceed because the coroner would not release the body due to BNFL's involvement. Mr Grears was not buried until the following day, 6 December 1984.

Why was the funeral delayed?

11 The funeral scheduled for noon on 5 December was cancelled by Mr Walker. He knew that when a Sellafield worker died of cancer, the disease was often blamed on exposure to radiation and that Mrs Grears was indeed considering litigation. He knew that on occasion the results of radiochemical

analysis of organs removed at post mortem were given in evidence at inquests into such deaths. However, since Dr Ghazala had left a message when he telephoned rather than speaking to the coroner, Mr Walker did not know when he took the decision that Dr Schofield had attended a post mortem examination that morning and already had organs for analysis. He therefore wished to delay the funeral so that the opportunity to obtain organs for radiochemical analysis was not lost.

12 Later that day, contact was made with Dr Schofield and Mr Taylor made a note:

> *"Radiation worker". Whole body penetrating dose 1.1rem – (negligible amount).* ***Less than limit of detection is expected.*** *No record of exposure to significant dose of radiation. Started employment – 1981.*[2] *Latency for this type of tumour is minimum of 10yrs. Nothing whatever to do with radiation.* [emphasis added]

The time this note was made is not recorded but Mr Grears's body had been released to his family by 1.30pm that day, within an hour and a half of the planned funeral.

13 It appears from the emphasised sentence that when the coroner spoke to Dr Schofield, he learned that organs had already been taken and that Dr Schofield expected the radiochemical analysis to find no plutonium. By then, though, the funeral had already been cancelled.

Was there an earlier post mortem examination?

14 There is no doubt that Dr Schofield obtained organs for analysis at a post mortem which took place at 9.00am on 5 December. However, the Inquiry received evidence which suggested that Mr Grears also underwent a post mortem examination on 4 December.

a. Agnes, Rosa, Gerard and Daniel saw their father in the mortuary at the hospital at about 7.00pm on the evening of 4 December. The body was covered with a white sheet and the face with a white veil. Gerard lifted the sheet to check that Mr Grears's St Christopher necklace was in place and noticed a piece of gauze, under which he recalls seeing a black line, running down the middle of his father's chest and abdomen. Daniel, who in the course of his own work had seen bodies which had undergone post mortem examinations,

2 Dr Schofield would not have known that Mr Grears had worked at Sellafield as a contractor in the 1950s

thought the appearances typical. Agnes was told by the mortuary technician that the gauze was in place to cover the wound from the post mortem examination and that the body would be ready for collection the following morning.

b. After Mr Grears's funeral, Mrs Grears wrote to BNFL asking that it bear the cost of the catering for the cancelled funeral. BNFL replied on 30 January 1985:

> *The request for a further post-mortem examination came from a family representative to the Coroner's office and it was only as a matter of courtesy that the coroner informed our Company Chief Medical Officer. The Company had no role whatever in delaying the funeral. I am however prepared, solely because I realise that you have had a most worrying experience during what must have been a period of considerable personal suffering, to offer an ex-gratia payment in respect of the catering costs incurred.*

Although the letter supports the idea that two post mortem examinations took place, it betrays some confusion, in that it indicates a belief that it was the second post mortem that had been done at the family's request, rather than the first.

c. Other factors which might suggest that a hospital post mortem examination had taken place on 4 December are:

- Mr and Mrs Grears had considered his cancer to have been caused by his work and Mr Grears had expressed a wish that there be a post mortem;
- notes of an interview with Mrs Grears[3] suggest that a request for a hospital post mortem was made[4] and that Mrs Grears understood that it would take place on 4 December.

None of Mr Grears's children from whom the Inquiry heard evidence was aware of any request for a hospital post mortem but their relationship with Mrs Grears was not close.

3 Unsigned and undated but probably conducted in the mid-1980s by a reporter from Yorkshire TV

4 Medical records, which would be expected to contain a signed consent form agreeing to the post mortem, have long since been destroyed

Litigation

15 Mrs Grears investigated the possibility of a claim against BNFL. A barrister advised that the prospects of success of any claim in which it was contended that Mr Grears's death resulted from exposure to radiation were slim. In a second advice, the barrister discussed avenues for obtaining compensation for what he described as the "theft" of the organs. No claim was pursued. An application to the Compensation Scheme for Radiation-Linked Diseases was unsuccessful.

Role of the coroner

16 Mr Taylor acted appropriately in requesting a post mortem. He did not ask for organs to be removed or analysed. In oral evidence, Mr Taylor told the Inquiry that he would have been both surprised and annoyed to discover that this had taken place when the analysis could have had no possible connection with the cause of death.

17 On 21 February 1985, Mr Taylor wrote to Dr Schofield:

> *The Solicitors have asked for a copy of your report following your tests on the organ samples that were taken at post mortem. I presume your report is not yet available and perhaps you could let me know when you anticipate the same will be prepared.*

18 It is apparent from Mr Taylor's handwritten note of 5 December 1984 (see paragraph 12) and from his letter of 21 February 1985 that he was well aware very soon after the post mortem that organs had in fact been taken and that he was reminded of the fact two months later. His lack of any desire to investigate why organs had been taken despite the death being *"nothing whatever to do with radiation"* suggests calm acquiescence rather than surprise and annoyance.

19 On 2 October 1989, Mr Taylor sent a copy of Dr Schofield's report to Mrs Grears's solicitors:

> *I also instructed Dr G. B. Schofield, the Chief Medical Officer of British Nuclear Fuels PLC, to attend the post mortem, and take various organs and tissues for radiochemical analysis.*

Mr Taylor conceded to the Inquiry that this assertion was wrong: he had given no such instruction.

20 The Inquiry finds Mr Taylor's inaction quite reprehensible. When he discovered that, without his permission, Dr Schofield had attended a post

mortem conducted under his authority and that organs which had no possible bearing on the cause of death had been removed from a body under his control, he took no steps to investigate how such abuse could have happened or to prevent it from happening again.

Legal analysis

Organ removal

21 It does not appear that Dr Ghazala removed organs from Mr Grears because he considered that their analysis might be relevant to the cause of death. He knew that radiation could cause cancer only after many years had elapsed (the *"latency"* period referred to in paragraph 12); and he would have been told by Dr Schofield, who was present at the post mortem, that there had been insufficient time for any radiation to which Mr Grears might have been exposed at BNFL to have caused his cancer.

22 Such evidence as exists strongly suggests that consent to the removal of the organs was not sought from, still less given by, any of Mr Grears's relatives. The removal was therefore not in accordance with the provisions of either the Coroners Rules or the Human Tissue Act 1961.

Organ analysis

23 Mr Taylor could not legitimately have asked for Mr Grears's organs to be analysed as he had not decided to hold an inquest. Although his note implies that he was aware that the analysis was to take place (and the results were in due course sent to him), there is no evidence to suggest that he requested it be done.

Relatives' reaction

24 The postponement of the funeral caused immense distress. Mr Grears had been a popular man and the church was full; many of those present on 5 December were not able to return the next day and the funeral, when it took place, was not well-attended.

25 Mr Grears's family were shocked and upset to realise that organs had been removed from his body, which they had believed they were burying intact. In her evidence to the Inquiry, Rosa said that the news:

some 23 years after we thought we had laid our dad to rest was a total bombshell. To say we were stunned does not come near to how we all felt, and it brought flooding back all the sad memories of that time. We are all extremely upset, sad and angry … we began to wonder whether any part of his body was actually in his coffin, or what part of him we did lay to rest.

Publication of the data

26 Data derived from the analysis of Mr Grears's organs have not been used in any publication and were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

27 The events which followed Mr Grears's death are on any interpretation quite extraordinary. The postponement of a funeral some five minutes before it was due to begin is astonishing. It seems to have been caused by a failure of communication, Dr Ghazala not mentioning when he left his message for the coroner that Dr Schofield already had organs for analysis.

28 The Inquiry concludes, on balance, that there were two post mortem examinations, one at the widow's request and one coronial. Although this was most peculiar, the family's description of the appearance of Mr Grears's body on the evening of 4 December was compelling.

29 The analysis was performed for Dr Schofield's scientific interest. Although litigation had been considered, the notes of his conversation with the coroner indicate his firm and reasoned view that Mr Grears's cancer had *"nothing whatever to do with radiation"*. The results of the analysis would not, therefore, have been of assistance in BNFL's defence to a legal action.

James Cavanagh

26 June 1918 – 14 March 1985

1 James Cavanagh died on 14 March 1985, aged 66. He was survived by his wife, Julie, who has since died, and a stepdaughter, Pauline (now Fowler), from whom the Inquiry heard evidence.

2 Mr Cavanagh worked as a contractor on various labouring jobs at Sellafield for about 15 years from the early 1950s and was there at the time of the Windscale fire in 1957. He was not directly employed by either the United Kingdom Atomic Energy Authority (UKAEA) or British Nuclear Fuels Limited (BNFL).

3 For about 15 years before his death, Mr Cavanagh suffered from a blood disorder, myelodysplasia, the cause of which could not be discovered. He was admitted to West Cumberland Hospital in March 1985, suffering from a chest infection, and died soon afterwards.

4 Mr Cavanagh's death was reported to the coroner, Mr Adrian Walker, who was told that Mr Cavanagh worked at Sellafield at the time of the fire and noted:

> *family want an investigation as to cause of death … Dr Lawson*[1] *states that Mr Cavanagh was never employed by* [UK]*AEA or BNFL.*

Dr Lawson was correct: as Mr Cavanagh had worked only as a contractor, BNFL held no occupational health records for him.

Post mortem examination

5 Mr Walker requested a post mortem examination, which was performed on 18 March 1985 by Dr David Smith,[2] who found that Mr Cavanagh had died of heart failure due to chronic bronchitis and emphysema. Dr Smith appears to have been informed, incorrectly, that Mr Cavanagh had been a process worker for BNFL. His report concludes:

> *In view of the indication that a solicitor had been consulted re his work* [at Sellafield] *in the past, certain specimens were retained in case further examination of them should be required.*

1 Dr Adam Lawson, Senior Medical Officer, BNFL Sellafield

2 Consultant pathologist, West Cumberland Hospital

The family had not instructed a solicitor. Dr Smith's reference to *"certain specimens"* hides his removal of a number of whole organs and bones.

6 Mrs Fowler recalls being told by the undertaker that he thought two Sellafield doctors might have been present at the post mortem. It would seem unlikely that the undertaker was correct: the Inquiry has seen no evidence of any involvement by BNFL in the events following Mr Cavanagh's death.

7 Mr Walker decided that an inquest was unnecessary.

Disposal of the organs

8 At the time of Mr Cavanagh's death, the National Radiological Protection Board (NRPB) was conducting a series of studies into levels of radionuclides in organs taken at post mortem from small numbers of randomly-chosen members of the public.[3] Individuals who had lived close to Sellafield were of particular interest but nuclear workers were supposed to be excluded. Since 1980, Dr Smith had co-operated with the NRPB by supplying organs taken at post mortem examinations he had conducted.

9 The organs removed from Mr Cavanagh were sent to the NRPB to be analysed for inclusion in its population studies. Irrespective of the legality of removing organs in these circumstances (see below), he was not eligible for inclusion in the studies as he had worked at a nuclear plant. The need to exclude him was not recognised, probably because neither the UKAEA nor BNFL had any record of having employed him.

10 The organs were collected by Mr George Ham[4] on 30 April 1985; usual practice suggests that pending collection they would have been kept in the pathology department at the hospital in a freezer provided for the purpose by the NRPB.

11 The NRPB kept comprehensive log books in which organs received for its studies were recorded. It received the liver, a femur, several ribs, several vertebrae, the sternum, a lung, lymph nodes and some muscle taken from Mr Cavanagh. The analysis was performed by Dr Donald Popplewell.[5] It was started on 1 May and completed in about August 1985.

12 No material derived from Mr Cavanagh's organs is still in existence.

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3 The population studies: see chapter 8, "The National Radiological Protection Board"

4 Assistant Scientific Officer, NRPB

5 Principal Scientific Officer, NRPB

The role of the coroner

13 Mr Walker properly requested a post mortem to assist in investigating the cause of a death which had been referred to him. There is no evidence that he authorised, requested or even knew of the removal of any organs during the post mortem examination or that he was aware that Mr Cavanagh's organs were to be used in the NRPB's population studies. The analytical results were not sent to or requested by him.

14 Had Mr Walker read the post mortem report – and the Inquiry has heard evidence to suggest that this is unlikely – he would have realised that Dr Smith had removed *"certain specimens"* for reasons unconnected with his own investigation without obtaining his permission, which was required. He ought then to have investigated further.

Legal analysis

Organ removal

15 Dr Smith did not remove organs because he considered that their analysis might bear upon the cause of death but rather (according to his report) because he believed they might be of value in pending litigation. Given his co-operation with the NRPB, it may be that on learning after the post mortem that Mr Cavanagh had not in fact been a process worker for BNFL, he sent the organs he had already removed to the NRPB for its population studies. He acted beyond his remit, which in a coronial post mortem was limited to discovering the cause of death. He could remove organs for other purposes only if both the coroner and Mr Cavanagh's relatives agreed. There is no evidence that they did so. The removal of Mr Cavanagh's organs was not done in compliance with the Coroners Rules or the Human Tissue Act 1961.

Organ analysis

16 Mr Cavanagh's organs were analysed as part of the NRPB's population studies. The NRPB presumed that tissue supplied to it by consultant pathologists had been lawfully obtained. This is discussed in chapter 8, "The National Radiological Protection Board".

Relatives' reaction

17 Mrs Fowler considers what was done to her stepfather to have been wrong and has been *"devastated"* by the news. She believes that had her or Mrs Cavanagh's permission to remove organs for analysis been sought, it would have been refused. She wishes all data derived from the analysis to be deleted.

Publication of the data

18 Data derived from the analysis of Mr Cavanagh's organs were used anonymously by the NRPB (case 92; results from liver (92.1) and lung (92.5)) in:

- Popplewell and others, 1989: Isotopic composition of plutonium in human tissue samples determined by mass spectrometer.[6]

19 The data were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

20 Organs were not removed from Mr Cavanagh for any lawful reason and were analysed by the NRPB in the course of scientific research.

6 *Radiation Protection Dosimetry*, 26(1): 316–19

Michael Brennan

20 February 1923 – 14 February 1987

1 Michael Brennan died on 14 February 1987, aged 63. He was survived by his wife, Isabella, who has since died, and two sons, Michael and Brian. Michael gave evidence to the Inquiry.

2 During the Second World War, Mr Brennan served in the Army in India, Malaysia and, as a member of the Chindits, in Burma. He worked at Sellafield for 39 years, from 15 July 1948 until his death, as a labourer, machinist and finally process worker, initially for the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 for British Nuclear Fuels Limited (BNFL).

3 In the course of his employment he was exposed to plutonium on at least 14 occasions, one of which involved an open wound. In 1970, he was found on routine monitoring to have an excessive chest burden of plutonium and was removed from plutonium work; in May 1972, he was classed as permanently unfit for plutonium work because of the extent of his exposure.

4 Mr Brennan was admitted to West Cumberland Hospital on the morning of 14 February 1987 because of a ruptured abdominal aortic aneurysm. He was taken to the operating theatre but died on the table. His death was reported to the deputy coroner, Mr John Taylor, who requested a post mortem examination.

Post mortem examination

5 The post mortem was due to be performed by Dr David Smith[1] on 16 February 1987 but was postponed until the following day. Mr Brennan's family were informed by the funeral director that the postponement was to allow a representative from BNFL to attend, and in evidence to the Inquiry Dr Smith accepted that that was the likely explanation.

6 Dr Smith's report confirmed death to have been due to rupture of an atheromatous aneurysm of the abdominal aorta and recorded:

1 Consultant pathologist, West Cumberland Hospital

> *The deceased had been a plutonium worker at Sellafield for many years. Dr Adam Lawson[2] of BNFL was present during the post-mortem examination and he took away a number of samples for further examination.*

The report does not detail the organs removed, which were both lungs, the liver, the spleen, both kidneys, the sternum, six ribs, several vertebral bodies, a femur and some lymph nodes.

7 Mr Brennan's family were not asked to agree to the removal of organs from his body and were not told that it had happened.

8 Dr Smith informed Mr Taylor of his findings by telephone, as was his usual practice, and Mr Taylor certified Mr Brennan's death without holding an inquest.

News of the death

9 Mr Brennan's occupational health records contain a note made by Ms Anne Thompson, a nurse:

> *16.2.87 phone call on 14.2.87 Michael had ?heart attack ?haemorrhage this morning was admitted into WCH where he died this afternoon. AL Thompson.*
>
> *16.2.87 09.45 advised by Dr Lawson Michael had died from an abdominal aneurysm. AT.*

10 The Inquiry received evidence from Ms Thompson. She had known Mr Brennan and his wife well and described Mr Brennan as one of the nicest men she had ever met. She remembered being informed by telephone that Mr Brennan had been admitted to hospital: she is unsure whether the call had come from a relative or a family friend but is certain that it was not from a nurse or doctor at the hospital. She does not recall a further telephone call but believes that she became aware of Mr Brennan's death later that afternoon, before she finished work at 15.40.

11 Mr Brennan's family are sure that no relative made the telephone call and it is understandable that they might in the circumstances not have regarded informing his employers a priority. The Inquiry has not been able to identify the caller.

2 Company Chief Medical Officer, BNFL

Disposal of the organs

12 Sellafield laboratory records indicate that analysis of the liver and sternum was completed in December 1988, nearly two years after the death, but that analysis of the lungs, spleen and kidney (and presumably the remainder of the bone) was still in progress. The Inquiry is aware that the remaining organs were ashed but has seen no document to indicate when, or indeed if, they were actually analysed. Some remaining solution was kept at Sellafield for several years before being disposed of at some point between 1999 and 2003; some residue from the analytical process is still held at Sellafield.[3]

Role of the coroner

13 Mr Brennan's death was reported to Mr Taylor because it had occurred on the operating table. Mr Taylor properly requested a post mortem examination and, after hearing from Dr Smith, decided not to hold an inquest.

14 Mr Taylor did not authorise or request the removal or the analysis of Mr Brennan's organs: he was not even aware that it had happened. He failed to notice the reference on the post mortem report to organs being removed, probably because, as he admitted to the Inquiry, he did not read the reports which were sent to him unless he intended to hold an inquest.[4] This was unacceptable.

Role of the union

15 Some 12 years before his death, with the support of the General and Municipal Workers' Union, of which he was a member, Mr Brennan's solicitors had sought information from BNFL on his work history and exposure to plutonium. BNFL provided the information and no further action was taken. No real possibility of any claim remained at the time he died. The union was not involved in the events following Mr Brennan's death.

3 See chapter 5, "British Nuclear Fuels Limited", paragraphs 197–200

4 Ibid, paragraphs 143 and 144

Legal analysis

Organ removal

16 Dr Smith did not remove organs from Mr Brennan's body because he considered that they might be of value in determining the cause of death. He conceded in evidence to the Inquiry that *"in some of the cases where I removed organs it could not be argued that radiation was of any possible relevance to the death"*: plainly, Mr Brennan was one such. Mr Taylor did not know that it had happened. Mr Brennan's family were not asked for their permission and his son is adamant that they would have refused if they had been asked. The removal was not in accordance with the Coroners Rules and was contrary to the provisions of the Human Tissue Act 1961.[5]

Organ analysis

17 The analysis was not requested by the coroner: it was done without his knowledge or permission. It was not done with the consent of the family.

Relatives' reaction

18 Mr Brennan's family did not understand why a post mortem examination was necessary, as the cause of death was already known; they are now aware that a post mortem is commonly performed after a death on the operating table. They did not know what a post mortem examination involved, or that organs might be removed. Their expectation was that, at most, small samples of tissue for microscopic examination might be removed.

19 The family remained unaware that organs had been removed from Mr Brennan's body until this Inquiry was established, more than 20 years later. They are aggrieved about the way in which his body was dealt with. They were excluded from the decision-making process. They thought they were burying him intact when in fact a large number of his organs had been removed.

20 Mr Brennan's family believe that because of his long service with BNFL, his occupational health records had been flagged for attention when he died. There is no evidence of such flagging, either generally or in Mr Brennan's case. However, the Inquiry was struck by the speed with which the news of Mr Brennan's death reached BNFL: he died, suddenly and unexpectedly, on

5 See chapter 3, "Law and Guidance"

a Saturday, yet BNFL was aware of his admission to hospital and death within three hours of its happening.

Publication of the data

21 Data derived from the analysis of Mr Brennan's organs were used anonymously in:

- Lawson and others, 1989: Plutonium deposition in man: comparison between excretion and autopsy analyses, presented at a symposium at Malvern in 1989 and subsequently published (case 21);[6]
- an internal BNFL document[7] in 1996 (case 1).

22 The data were not sent to the United States Transuranium and Uranium Registries (USTUR).

23 Mr Brennan's son wishes the data derived from the analysis of his organs to be destroyed, as they were obtained without the necessary legal procedures being followed.

Conclusion

24 There are several causes for concern:

- Dr Smith's agreement to delay the post mortem examination by one day in order to allow Dr Lawson to attend was highly irregular;
- Dr Smith acted inappropriately in removing the organs without the consent of the family and the coroner, yielding to BNFL's request when the law mandated consent;
- Mr Taylor had the opportunity to realise that organs had been retained but failed to read the post mortem report.

25 Mr Brennan's organs were not removed for any lawful purpose and were analysed at Sellafield, on Dr Lawson's instructions, for purely scientific purposes. In its submissions to the Inquiry, Sellafield Limited[8] agreed that this was the case.

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6 In Goldfinch EP, ed., *Radiation Protection – Theory and Practice: Proceedings of the 4th International Symposium of SRP (Malvern, June 1989)* (Institute of Physics Publishing, 1989)

7 DOSTR 36: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

8 The company which has assumed responsibility for the former BNFL site at Sellafield

Robert McLean

13 March 1922 – 31 March 1987

1 Robert McLean died on 31 March 1987, aged 65. He was survived by his two sons, Donald and Duncan. Duncan gave evidence to the Inquiry.

2 During the Second World War, Mr McLean served in the RAF. He started work at Sellafield on 16 May 1949 and was later promoted to health physics monitor/foreman; the job involved reacting to radiation incidents. In the course of his employment he was exposed to plutonium on several occasions, including the Windscale fire in 1957. His sons described him as *"a company man who had Sellafield written right through him"*. He remained at Sellafield for 34 years, working initially for the United Kingdom Atomic Energy Authority (UKAEA) and from 1971 for British Nuclear Fuels Limited (BNFL).

3 Mr McLean took early retirement from Sellafield on 31 July 1983, aged 61. He was fit and well. In February 1987, he was admitted to West Cumberland Hospital, where he was found by Dr Nicholas West, consultant haematologist, to be suffering from acute lymphoblastic leukaemia. His condition deteriorated and he died without leaving hospital.

4 Mr McLean's death was reported to the coroner, Mr Adrian Walker. Mr Walker was told by Dr Adam Lawson[1] that Mr McLean had worked at Sellafield and had 20% of the maximum permissible body burden (MPBB) of plutonium. Curiously, the entry in Mr McLean's occupational health records which notes his death mentions that he had 50% MPBB and in the coroner's own note the figure appears to have been changed from 50 to 20. The Inquiry was not able to resolve this issue.

5 Mr Walker requested a post mortem examination: this was contrary to the wishes of Mr McLean's family, who felt that the cause of death was already known, but Dr West explained to them that it was a matter for the coroner to decide.

Post mortem examination

6 The post mortem was performed on 2 April 1987 by Dr David Smith.[2] Dr Lawson attended the examination and Dr Smith recorded on the post mortem report that *"Certain organ and bone specimens were obtained and*

1 Company Chief Medical Officer, BNFL

2 Consultant pathologist, West Cumberland Hospital

handed to [Dr Lawson] *for further examination"*. Analytical records from Sellafield indicate that the *"organ and bone specimens"* comprised both lungs, some lymph nodes, liver, kidneys, spleen, sternum, vertebrae, femur and ribs. There is no evidence that the heart was taken.

7 On 26 February 1988, Dr Lawson submitted his report to Mr Walker. He concluded that *"there was insufficient radioactive material found at autopsy to account for Mr McLean's death from leukaemia"*.

8 After receiving Dr Lawson's report, Mr Walker requested further advice from Dr Kenneth Duncan,[3] of the National Radiological Protection Board (NRPB), sending him Dr Lawson's report, the post mortem report, Mr McLean's dosimetry reports and a summary of the medical records. Dr Duncan identified a possible conflict of interest, in that he had been invited to serve as a member of the expert panel of the Compensation Scheme for Radiation-Linked Diseases (the Compensation Scheme). With Mr Walker's consent, he therefore passed the instructions to Dr Hylton Smith,[4] who reported that:

> *the chance of Mr McLean's death from acute lymphoblastic leukaemia being caused by occupational exposure to radiation is much less than the chance of the disease being caused spontaneously by other carcinogens. In my opinion the probability could be about one thirty-third of the spontaneous rate.*

Dr Hylton Smith informed the coroner in his report that he too had been invited to serve on the Compensation Scheme expert panel.

Disposal of the organs

9 The organs were analysed at Sellafield. Some residual solution was kept at Sellafield for several years before being disposed of at some point between 1999 and 2003.[5] No material derived from Mr McLean's organs is still in existence.

Inquest

10 The inquest, which had been opened and adjourned shortly after Mr McLean's death, resumed on 28 April 1988. The medical evidence was

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3 Assistant Director (Medical)

4 Head of the Biology Department at the NRPB and also Secretary of the International Commission on Radiological Protection (ICRP)

5 See chapter 5, "British Nuclear Fuels Limited", paragraphs 197–200

unanimous in not attributing Mr McLean's leukaemia to his employment. However, the family's barrister submitted a recently-obtained handwritten letter from Dr Edward Radford, an expert in radiation effects, whose opinion was that the probability that plutonium was the cause of Mr McLean's leukaemia was 55–78%. Mr Walker declined to admit the letter in evidence.[6] The jury returned an open verdict by a majority of eight to two.

11 Two of the figures included in Dr Lawson's report were wrong: the amount of plutonium in the analysed bone was under-estimated by a factor of six, and of americium by a factor of four.[7] The correct figures are handwritten on the copy of the report found in the coroner's file. It is not clear when those alterations were made or whether any of the expert evidence given at the inquest took the corrected figures into account.

Compensation

12 Mr McLean's family made a claim under the Compensation Scheme. The application was refused. Before his death, Mr McLean had told his family that he had kept his dosimetry records in his attic. A disparity between those records and the records used by the Compensation Scheme was raised and explained by the Compensation Scheme as being due to the use of the data derived from the analysis of organs taken at post mortem.

13 However, the Compensation Scheme used the uncorrected post mortem data. The Inquiry has been told by Sellafield Limited[8] that if the correct data had been used the family would have received an award of 25% of full compensation.[9]

14 In 1992, the McLean family's claim was reassessed as part of the Compensation Scheme's retrospection exercise. The rules had changed: post mortem data were not used and dosimetry data were handled in a different way. An award of 75% of full compensation was made. The use of incorrect data in the first application therefore delayed the payment of 25% of full compensation for three or four years but made no difference to the eventual outcome.

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6 Rule 37 of the Coroners Rules 1984 prevented him from so doing: Dr Radford did not attend and documentary evidence from a witness who was alive but not present at the inquest could be admitted only if it was unlikely to be disputed, which was plainly not the case

7 Errors in several analytical results were discovered in the course of a review of the data at Sellafield: see chapter 5, "British Nuclear Fuels Limited", paragraphs 206–210

8 Sellafield Limited has assumed responsibility for the site at Sellafield

9 For details of the Compensation Scheme, see chapter 7, "The Trade Unions and the Compensation Scheme"

Legal analysis

Organ removal

15 Mr McLean died from an illness, leukaemia, known potentially to be caused by exposure to radiation. It was therefore appropriate for Dr Smith to remove organs for analysis in the course of a coronial post mortem examination, believing that the results might bear upon the cause of death.

Organ analysis

16 Mr Walker decided to hold an inquest. He therefore acted within his powers in requesting that the organs be subjected to radiochemical analysis and in receiving the results of that analysis, with expert interpretation of their significance, in evidence at the inquest.

Relatives' reaction

17 Mr McLean's family have raised many questions about the events immediately following their father's death. There do remain unresolved issues, including the conflict in the recorded fraction of MPBB which Mr McLean had received and the effect which the corrected analytical figures might have had on the conclusion reached by the inquest jury.

18 The family did not know that Dr Lawson had attended the post mortem and would have objected had they known; they have difficulty understanding what connection Sellafield had with the post mortem as Mr McLean had long since retired.

19 A handwritten list of the analytical results contains a line *"4 bone samples"*. Duncan McLean was concerned that this implied that more bone had been taken than was specifically described. However, it is plain from the records that this line refers to the sum of the weights of the four bone samples which were mentioned (sternum, vertebrae, femur and ribs).

20 Dr West had explained to the family that "samples" would be removed from the body but had not referred to removal of whole organs. The family thought they had buried Mr McLean's body intact. It is plain to the Inquiry that there was a failure at the time to inform Mr McLean's relatives what was being done and the reasons why it was being done. It was this failure of communication which led to their distress when, many years later, they became fully aware of what had taken place.

Publication of the data

21 Data derived from the analysis of Mr McLean's organs have not been published in any peer-reviewed article or other publication, although they were used in an internal BNFL document[10] in 1996 (case 3). The data were not sent to the United States Transuranium and Uranium Registries (USTUR).

Conclusion

22 It was perfectly proper for Mr McLean's death to be reported to the coroner: his leukaemia might have been caused by radiation. There is no evidence to suggest that Mr McLean was somehow "flagged" by BNFL as a suitable candidate for organ removal and analysis. The family's consent to the post mortem was not required. Mr Walker acted appropriately in requesting a post mortem examination and would have been entitled to invite Dr Lawson to attend.

23 While Mr Walker might be criticised for obtaining a report from Dr Lawson, the occupational physician of Mr McLean's former employers, he quite properly did not accept that report as the sole expert evidence but commissioned a second report from the NRPB, an independent organisation. The Inquiry considers Dr Duncan's perception that his position as a member of the Compensation Scheme's expert panel was in conflict with his ability to act as an independent expert to have been unnecessarily cautious and does not criticise Dr Hylton Smith, who was in the same position, for having provided a report to the coroner. Dr Lawson's report, containing the detailed analytical results for each organ, was read aloud at the inquest and when he was questioned on its contents by the family's barrister he was asked about the organs which had been removed and analysed.

24 The family's disappointment that the coroner did not accept Dr Radford's letter in evidence at the inquest is understandable but as Dr Radford was not present at the hearing Mr Walker was obliged to refuse to admit it. There is nothing to suggest that the lawyers advising Mr McLean's family sought an adjournment in order to allow him to attend.

25 The Inquiry is satisfied that Mr McLean's organs were removed and analysed in accordance with the law.

10 DOSTR 36: see chapter 5, "British Nuclear Fuels Limited", paragraph 232

Findings

Chapter 14

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British Nuclear Fuels Limited

1 British Nuclear Fuels Limited (BNFL) was created in 1971 from the production group of the United Kingdom Atomic Energy Authority (UKAEA).

2 Organs were taken at post mortem for analysis from 64 former Sellafield workers between 1960 and 1991, the first seven while the site was operated by the UKAEA. Not all had been occupationally exposed to plutonium. The discovery of these analyses led to the establishment of the Inquiry. All the men have been identified.

3 The driving force behind the analytical work was Dr Geoffrey Schofield, an occupational health physician who worked at Sellafield from 1958 and became BNFL's Company Chief Medical Officer (CCMO). The work was continued after his death in 1985 by his successor as CCMO, Dr Adam Lawson.

4 Of the 64 Sellafield workers:

- seven died in the 1960s, 27 in the 1970s, 29 in the 1980s and one in the 1990s (1991);
- 42 were still employed at Sellafield when they died, one was working at Winfrith (having previously worked at Sellafield) and the remaining 21 had either retired or were working outside the nuclear industry;
- 60 underwent coronial post mortem and four, hospital post mortem.

5 Of the 60 coronial cases, 53 were handled by the Coroner for West Cumbria, successively Mr Hubert Gough (23), Mr Adrian Walker (20) and Mr John Taylor (ten, all while assistant deputy or deputy coroner before his appointment as coroner in 1995).

6 If organs were to be removed at post mortem for other than legitimate coronial purposes, such as scientific research, the consent of the relatives of the deceased was required. It was not obtained.

7 Analysis of the organs removed at post mortem was done:

- for legitimate coronial purposes in 11;
- for purely scientific reasons in 35;
- for reasons connected to litigation in six.

In the remaining eight, the organs were lawfully removed by the pathologist in the belief that they were relevant to the cause of death but the coroner

did not request they be analysed: the legality of the analysis, which was performed at Sellafield, is not clear.

8 An informal arrangement between Dr Schofield and the pathologists at West Cumberland Hospital (WCH) meant that he was told when a post mortem was to take place on the body of a former Sellafield worker. He was therefore easily able to obtain organs for analysis. Where the death might have been caused by radiation, Dr Schofield would usually be contacted by the coroner in order to obtain the man's radiation history.

9 Dr Schofield was eager to obtain organs from nuclear workers who had been exposed to radiation in the course of their employment. No structured arrangement existed to flag those workers while alive in order that organs could be obtained at eventual post mortem. On three occasions, however, contact was made for that purpose with workers' treating doctors.

10 Dr Schofield, Dr Lawson or another member of Sellafield staff would usually attend the post mortem to collect the removed organs. They were not involved in actually removing the organs from the body. The deceased's relatives were not informed they would be there. The pathologists pandered to BNFL's needs: post mortem examinations were delayed to allow its employees to attend and on occasion bodies were re-opened in order that organs could be removed.

11 Neither the pathologists nor the mortuary technicians received any payment for providing the organs.

12 An extraordinary range of organs was removed for analysis. The liver was removed in all cases and one or both lungs in all but one. Vertebrae, sternum, ribs, mediastinum/lymph nodes, spleen, kidneys and femur were removed in the majority of cases. Other organs removed from time to time included the testes, brain, heart, patella and tongue. Advice on the organs to be taken was given, either generally or in individual cases, by the medical officer at Sellafield.

13 The majority of the post mortem examinations at which organs were removed for analysis at Sellafield were conducted by three consultant pathologists at WCH: Dr David Smith (20), Dr George Ghazala (15) and Dr Philip Whitehead (ten).

14 The formal post mortem reports submitted to the coroner seldom referred to the removal of organs for analysis. Dr Smith and Dr Whitehead each mentioned it twice, each listing the organs actually removed only once. In contrast, Dr Ghazala mentioned that organs had been removed in every report and listed the removed organs in 13 of his 15 cases.

15 The coroners, having been told over the telephone of the initial findings, often did not trouble to read the post mortem report. Where the report mentioned that organs had been removed and provided to Sellafield, the coroner's failure to read it meant that he remained in ignorance and the chance of his taking action to remedy the situation was lost. However, in other cases the coroner was aware that organs had been taken and chose not to intervene although it was obvious that the removal was unjustified.

16 Organs taken from a further 12 nuclear workers at other sites (Springfields, Capenhurst, Dounreay and Aldermaston) underwent radiochemical analysis at Sellafield. In ten, the removal and analysis were lawfully undertaken in the course of a proper coronial investigation or with the consent of the deceased's relatives; in the remaining two, there is insufficient evidence for the Inquiry to reach a conclusion.

17 The last post mortem at which organs were removed was in 1991; the analysis took place in 1993. No organs have been removed for radiochemical analysis since then. There is no single reason why the research came to an end.

18 The total "Sellafield cohort" was 76. Of those, organs from:

- 64 were analysed for Dr Schofield (53 former Sellafield workers and 11 from other sites);
- 11 were analysed for Dr Lawson (ten Sellafield and one elsewhere);
- one, a Sellafield worker, were analysed for Dr Andrej Slovak, Dr Lawson's successor as Sellafield CCMO.

19 The majority of the analytical work took place at Sellafield. Organs from the first three cases were analysed at Harwell and Woolwich. In the early 1970s, several organs from cases which had been analysed at Sellafield were sent to the National Radiological Protection Board (NRPB) to be analysed for verification of the Sellafield results. On occasion, when litigation was in prospect, parts of the organs were provided to representatives of the family so they could organise their own analysis.

20 The analytical process involved the complete destruction of the organ, which was reduced to ash in a furnace before being dissolved in acid. The laboratory staff did not know from whom the organs had been taken. Some analytical material and several small ashed samples remain at Sellafield.

21 The analytical work proved to be of scientific value. The results were used in epidemiological studies and in 1985 helped Professor Stephen Jones to validate his revision of the formula by which body content of plutonium was calculated from urinalysis data.

22 The data produced by the post mortem analysis of organs remain of potential value to researchers, whose work may be of benefit in the future.

23 Both the UKAEA and BNFL knew of Dr Schofield's post mortem work (which was later continued by Dr Lawson). Both companies appreciated the importance of such research on organs obtained at post mortem and encouraged it.

24 There was little or no managerial supervision of the research undertaken by Dr Schofield and Dr Lawson.

25 Dr Schofield and Dr Lawson made no attempts to conceal their research, which was published in peer-reviewed scientific journals and presented at international meetings. There is no suggestion that either considered his actions to be untoward but neither appears to have given any consideration to the ethical implications of his work.

26 There was no obligation on either the UKAEA or BNFL to establish that the pathologists from whom the organs had been obtained, independent medical professionals, were acting within the law. The same applies to Dr Schofield and Dr Lawson.

The United Kingdom Atomic Energy Authority

27 The UKAEA was founded in 1954 to run the UK's nascent atomic energy programme. The first seven cases in which radiochemical analysis was performed on organs removed from Sellafield workers took place while the site was operated by the UKAEA. After BNFL was formed in 1971, the UKAEA had little direct involvement in post mortem work. Organs were, however, removed from two former UKAEA employees, who had worked at Dounreay and Winfrith, and analysed at Sellafield; these cases are included in the 76-strong Sellafield cohort. In both, the removal and analysis of organs were for legitimate coronial purposes.

28 Early analytical work undertaken at UKAEA sites included:

- eight specimens of lung tissue were analysed at Sellafield in 1954–55;
- organs taken from approximately 22 men, ten who had worked at Springfields and 12 non-nuclear workers, were analysed at Springfields between 1954 and 1962: organs from another Springfields worker, who died in 1969, were analysed at Harwell;

- lymph nodes from 18 people in West Cumberland and from 100 in Newcastle were analysed at Sellafield in the mid-1960s;
- the strontium-90 studies (see paragraphs 68–78).

The identities of very few of these individuals can be determined.

29 In 1969, the medical officers of the UKAEA were advised by the Medical Defence Union that a pathologist did not require specific permission to remove organs at post mortem examination once permission had been given for the examination itself. That advice was wrong but it would have been reasonable for the medical officers to accept and rely upon it.

30 Between 1970 and 1984, organs were removed at post mortem from four workers at sites which were operated by the UKAEA and not transferred to BNFL. Analysis was performed in three of the four cases. All had died of a possibly radiation-linked condition and the removal and analysis took place for legitimate coronial purposes.

31 The UKAEA holds three ashed, acellular samples of human material. Two are from a former UKAEA employee; one was obtained in the course of the strontium-90 studies.

32 Between 1956 and 1982, the UKAEA was involved in approximately 20 scientific studies involving analysis of human tissue. Nearly all led to publication in peer-reviewed journals or by Her Majesty's Stationery Office (HMSO).

33 No comment is made on the obtaining of consent to the removal of tissue in any of those studies. It is likely that, in accordance with practice at the time, no such consent was obtained.

34 The work was carried out with a view to increasing understanding of the link between exposure and disease, either generally or in relation to specific individuals.

The trade unions

35 Most nuclear workers were members of a trade union. The unions funded solicitors to act on behalf of their members' families at inquests and in claims for damages for radiation-linked diseases.

36 On occasion, Mr Ian Robertson, a solicitor who represented some families of deceased members of the General and Municipal Workers' Union,

co-operated in arrangements for the removal of organs at post mortem examination and their analysis. He did so ostensibly on behalf of those families but in fact without instructions from them and without ascertaining their views on the removal of organs. The families were thereby deprived of the opportunity to object to the organs being removed. He ought not to have become involved without instruction, although he acted, under pressure of time, in what he perceived to be the families' best interests.

37 The unions knew that organs were removed and analysed in the course of proposed or actual litigation arising out of the death. They did not bring the matter to the families' attention but they were under no legal duty to do so.

38 The Compensation Scheme for Radiation-Linked Diseases has since 1982 provided for payments to be made to the families of radiation workers whose deaths might have been caused by radiation.

39 The rules of the Compensation Scheme have always provided for the use of data derived from organ analysis when they were available and such data have been used to assist in the determination of applications under the Compensation Scheme. The rules have never required data derived from organ analysis to be available and no organ was removed solely or primarily for the purpose of the Compensation Scheme.

The National Radiological Protection Board

40 The NRPB was created in 1970 to research into and to advise on the hazards of radiation.

41 The NRPB conducted a series of studies, known as the population studies, into levels of plutonium in the organs of randomly-selected members of public who had lived in West Cumbria (later, also South Cumbria), Oxford, Newcastle and Edinburgh. The studies were organised by Dr Donald Popplewell, Principal Scientific Officer.

42 Many pathologists in each area supplied organs removed at post mortem examination to the NRPB. Their reports almost always failed to mention that organs had been removed, although the harvest was often extensive: typically, one lung, up to half the liver and two ribs and often a femur, lumbar vertebrae, testes, sternum, kidney and spleen.

43 Small honoraria were paid to the mortuary technicians in respect of the extra work involved in supplying the organs.

44 After removal from the body, the organs were kept in freezers pending collection by an employee of the NRPB.

45 The NRPB's laboratory log books, which were assiduously kept, show that between May 1980 and November 1985, organs were received for the population studies from 100 post mortem examinations: 31 in West Cumbria, 23 in Edinburgh, 20 in Newcastle, 19 in Oxford and seven in South Cumbria. The post mortem report of one further case from West Cumbria records that organs were taken for the NRPB but it does not appear from the log books that they were received. All but one of the 77 English post mortem examinations were coronial; in Edinburgh, the organs were all taken from hospital post mortems. The coroners under whose authority the coronial post mortems were performed did not know that organs were removed for the population studies.

46 It was a requirement of the population studies that the individuals from whom organs were removed had not been radiation workers. By accident, seven nuclear workers were included in the studies and the higher levels of plutonium found in their organs caused some consternation.

47 Material obtained for the population studies was sometimes used in the course of other work at the NRPB. In the course of that other research, organs were taken at four further post mortem examinations in Oxford in 1985; organs were also received in 1990 from a fifth body, having been removed after dissection in the Oxford University Department of Anatomy.

48 No material derived from the organs used in the population studies is still in existence.

49 The results of the studies were published in considerable detail in peer-reviewed journals.

50 It was also a requirement of the population studies that the organs supplied be unaffected by disease. In consequence, they could have no bearing on the cause of death. They could not therefore be removed without consent, which was not obtained.

51 In 1985, a paper published by the Royal College of Pathologists which re-stated the existing law led to the realisation among pathologists that removing organs without consent was not lawful. The supply of organs for the population studies dried up.

52 The NRPB tried to put in place mechanisms for obtaining consent but all such attempts failed and the studies came to an end.

53 The NRPB ought to have ensured that Dr Popplewell was given adequate guidance on the legal and ethical foundation of the population studies; equally, Dr Popplewell, who although a well-respected scientist had little knowledge of the law, ought to have sought clarification from his employers.

54 The NRPB assumed that the pathologists who supplied the organs would be aware of the law governing their actions and would comply with it. This assumption was reasonable but mistaken.

55 The NRPB conducted separate studies on levels of plutonium in children and in fetus. The studies involved removal of organs from 16 children and 95 fetus. Ethical approval was obtained for each study and consent obtained where required by the law or by the local ethics committee.

56 The NRPB also provided an analytical service under contract, performing radiochemical analysis on organs supplied to it and offering expert interpretation of the results, often at coronial request. It acted entirely properly when undertaking this work.

The Atomic Weapons Establishment

57 The Atomic Weapons Establishment (AWE) was founded in 1950 to conduct research into nuclear weapons and to maintain the UK nuclear deterrent.

58 The organs of 20 former employees of the AWE and of a further two individuals employed by the Ministry of Defence were (or in one case might have been) removed with a view to radiochemical analysis although such analysis was not in fact undertaken in two cases. Loss of documents over time has made definitive conclusions as to the legality of the removal in some cases difficult to reach, but in 17 the analysis was performed either at legitimate coronial request or with the consent of the deceased's relatives.

59 In many cases, the impetus for the removal was legal action or the prospect of legal action brought by the employee's family.

60 Organs were also removed from 15 ex-servicemen who were or were at some time thought to be veterans of the UK's nuclear tests. In all those cases, the AWE's involvement was confined to giving advice on the likelihood of the individual having been exposed to harmful radiation in the course of the tests.

61 Although there was some discussion of positive action to be taken (by way, for example, of maintaining a list of employees who had been exposed to

radiation and from whom organs might be removed at post mortem if the opportunity arose), the AWE's role was reactive, responding to deaths and claims only as and when they arose.

62 A small amount of research conducted by the AWE involved analysis of tissue taken at post mortem examination. It was, save for one study conducted in the early 1990s, done without appropriate consent. The deceased people from whom organs for the studies were taken were few in number and the amounts of tissue taken from the bodies were small.

Registries

63 Several proposals were made to establish a national registry in the UK: nuclear workers would agree before their death that organs could be removed in due course at post mortem examination for radiochemical analysis. None came to fruition.

64 A unique opportunity to investigate the effects of relatively high historic exposures to radiation and to put post mortem work on a legitimate footing was missed.

65 There were strong links between individuals in the UK nuclear industry and those who operated the United States Transuranium and Uranium Registries (USTUR), which has existed for many years. The proposed UK registry was modelled closely on the USTUR, which had been very successful in attracting registrants.

66 Data from 51 UK cases were sent to the USTUR. The names and medical details of the individuals from whom the organs had been taken were also sent, without the families' consent or even knowledge: this was a breach of confidence.

67 No tissue or organ removed at post mortem in the UK for radiochemical analysis was sent to the USTUR.

Strontium

68 Strontium-90 is produced only by nuclear fission. It is found in fallout from nuclear weapons testing. It is radioactive and in the body is concentrated in

bone. In the 1950s, there was concern that it might be absorbed in amounts which were harmful to health.

69 A long-running research project measured levels of strontium-90 in human bone obtained at post mortem. From 1955, it was run by the UKAEA; from 1957 to 1973, when it ended, it was overseen by a committee of the Medical Research Council (MRC), the Agricultural Research Council and the Development Commission.

70 The research consisted of several different studies: a large national survey and smaller, local surveys.

- The national survey involved analysis of bone from 3,394 individuals: in addition, bone was taken, but not analysed, from a further 132.
- The local surveys were conducted at Cambridge (76 individuals), Glasgow (2,052) and West London (418). A survey of bone taken from 91 fetus was also conducted in London.

71 In all, in addition to the 91 fetus, bone (femur or, later in the study, vertebrae) was collected for the UK strontium research from 6,072 individuals, mostly children under the age of six.

72 Although bone continued to be supplied to the MRC until at least 1972, any removed after 1970 was not analysed and was probably destroyed. No material derived from the bone used in the study is still in existence.

73 The results were published periodically, initially by the UKAEA and from 1959 by HMSO.

74 Consent was not obtained from families to the removal of bone for the strontium research.

75 In no case could the cause of death have been related to exposure to strontium; the removal of bone at coronial post mortem was never justified for coronial purposes.

76 Before the Human Tissue Act 1961 was passed, there were no relevant statutory provisions and it cannot be said that the bone was unlawfully removed. In the absence of consent, bone taken after that Act came into force was removed contrary to its provisions.

77 The pathologists who removed bone and supplied it to the MRC ought to have known after 1961 that consent was mandatory. They either did not know of the provisions or ignored them.

78 The MRC knew of and had investigated the potential problem with consent. The Government had sought its views on what became the Human Tissue

Act 1961, which was directly relevant to the MRC's work. The MRC did not issue guidance to its researchers. The MRC ought to have ensured that the bone used in its research had been lawfully supplied.

West Cumberland Hospital

79 The pathologists at WCH:

- supplied organs to Sellafield taken from 57 former nuclear workers;
- removed organs from 32 randomly-chosen individuals, all but one of which were collected by the NRPB;
- supplied 18 thyroid glands to the AWE in 1968;
- provided 40 fetus to the NRPB.

80 The pathology department at WCH, and in particular the mortuary, languished over many years in a state of neglect, operating in a managerial vacuum.

81 The pathologists complied with requests for organs and delegated the task of supply and organisation to the mortuary technicians.

82 Absence of managerial scrutiny meant that abuses were not noted and halted.

83 The provision of organs to BNFL survived major reorganisations of the National Health Service, changes in management at WCH, the onset of trust status and new governance arrangements. It did so because the mortuary was never considered a priority and was largely left to run itself.

The families

84 Communication with the families was very poor.

- They were generally unaware of what post mortem examination entailed and their permission to remove organs for research or litigation was not sought.
- Few knew at the time that organs had been removed for analysis and those that did were unaware of the extent of the harvest.

Pathologists

85 All the pathologists who gave evidence to the Inquiry had been profoundly ignorant of the law under which they had performed post mortem examinations. The relevant legislation was made available to all doctors, accompanied by clear guidance from the Department of Health, in 1961, 1975 and 1977.

86 In consequence of this ignorance, pathologists erroneously believed that:

- permission to perform a hospital post mortem, unless expressly restricted in some way, gave them *carte blanche* to remove tissue and organs for whatever purpose they saw fit;
- authority from the coroner to perform a coronial post mortem conferred the same freedom to remove material even if they did not consider that it could be related to the cause of death;
- there was no true distinction between the extent of investigation permitted at hospital and at coronial post mortem examinations: that is, they failed to appreciate the more limited nature of a coronial post mortem, which is confined to establishing the cause of death.

As a result, they often removed organs at both coronial and hospital post mortem examinations, without consent and hence in breach of the provisions of the Human Tissue Act 1961.

87 The pathologists' ignorance arose from deficiencies in medical education and training.

88 When completing their formal reports to the coroner, pathologists seldom recorded who had attended the post mortem examination or whether (and which) organs had been removed from the body.

Coroners

89 Coroners did not communicate with families, who were left in the dark. There was no attempt to explain to them why the coroner had ordered a post mortem or what it would entail.

90 Coroners often failed to read post mortem reports. As a result, when the reports indicated organs had been inappropriately removed, they remained in ignorance and took no action to address the mischief.

91 Coroners who did know that organs which did not bear upon the cause of death had been taken for analysis without their consent failed to act.

92 Coroners ignored the constraint that the law permitted them to request radiochemical analysis, which was a special examination, only if they had decided to hold an inquest.

93 Coroners asked BNFL to prepare analytical reports and used the information to guide them when determining whether the death was the result of an industrial disease. They ignored the potential conflict of interest in asking the deceased's employer to comment on the likelihood of the death having been caused by the deceased's employment.

94 Coroners did not ensure that the results of organ analysis were made available to them; in particular, on several occasions inquests were held and the results of the analysis, performed at the request of the coroner, were not adduced in evidence.

95 Coroners assisted BNFL, the NRPB and the MRC to obtain organs for their research, heedless of whether the necessary consent was obtained.

96 The relationship between the coroners, the pathologists and the Sellafield medical officers became too close. There were failures to adhere to professional standards.

Recommendations

Chapter 15

Recommendations

Chapter 15

Introduction

a Research involving the use of human tissue has been of fundamental importance in the development of medical knowledge and remains integral to the understanding and treatment of disease. It should continue; but it must be founded on consent.

b Since the events considered by the Inquiry, there have been several changes in the legislative provisions governing post mortem examination and the use of human tissue taken at such examination.

- The Human Tissue Act 2004 enshrined the requirement for consent and listed the uses of human tissue for which it must be obtained.
- The Act also created the Human Tissue Authority, which has issued codes of practice on matters including consent, post mortem examination, research and disposal of tissue.
- The Coroners (Amendment) Rules 2005 introduced significant changes to the way in which tissues and organs removed at coronial post mortem are to be dealt with.
- The Coroners and Justice Act 2009 has introduced further much-needed change to the coronial system: its relevant provisions are not yet in force and secondary legislation is anticipated.

c These changes in the law have addressed many of the Inquiry's concerns and should prevent recurrence of the events which led to its establishment. The Inquiry's view is that coronial and pathology practice should be standardised, effective management ensured and the framework created by the legislation and the Human Tissue Authority's codes of practice strengthened.

d Historically, post mortem examination has provided an important opportunity for research, education and audit of diagnosis and treatment. For many years, the number of hospital post mortems has been in decline. This is a cause for concern. Post mortem examination can:

- determine the cause of death;
- inform hospital mortality meetings;
- contribute to the education of medical students and clinicians;
- provide useful public health information;
- monitor trends in disease incidence;
- assist in the identification of new diseases;
- assist with the development and evaluation of new technology, therapies, procedures and interventions.

e Post mortem examination should lie at the centre of pathology practice. There is a compelling need to increase the rates of hospital post mortem examinations but whether it is possible to do so is unclear. It may be that the coronial post mortem can provide an alternative means whereby essential tissue for research can be obtained: of course, this could be done only if consent for the use of organs for research were to be obtained from the relatives. The Inquiry's recommendations are made both with the aim of facilitating yet enshrining consent and in the hope that the proper place of human tissue in research can be maintained and improved.

Coroners

Coroners

1 There should be a uniform coronial system across England and Wales providing a consistent and high standard of service. Idiosyncratic local practices and arrangements are not acceptable.

2 National standards for coroners should be defined, implemented, managed and properly audited.

3 Each coroner's performance should be appraised at regular intervals.

4 A job description should be established for the office of coroner. Coroners should be appointed to national recruitment standards.

5 There should be a formal induction programme for newly-appointed coroners and compulsory programmes of continuing professional development for those in post.

6 There should be a person or body with powers to order the retraining, disciplining or dismissal of coroners who fall short of appropriate standards.[1]

Coroner's officers

7 Each coroner should be supported by a fully trained coroner's officer.

1 The Inquiry's intention was that this should fall within the remit of the Chief Coroner, but in October 2010 the Government announced its intention to abolish that office in the Public Bodies Bill and to further consider the transfer of some of the Chief Coroner's functions to suitable alternative bodies

8 National standards for coroner's officers should be defined, implemented, managed and properly audited.

9 Each coroner's officer's performance should be appraised at regular intervals.

10 A job description should be established for coroner's officers and they should be appointed to national recruitment standards.

11 There should be a formal induction programme for newly-appointed coroner's officers and compulsory programmes of continuing professional development for those in post.

Pathology

12 Coroners should have access to appropriately experienced pathologists working in mortuaries run to the highest professional standards.

13 Coroners should read and respond appropriately to post mortem reports within 14 days of receipt.

Communication

14 Coroners should ensure that families are kept fully informed about the nature and progress of the coronial investigation.

15 Coroners should ensure that families are made aware of the existence and nature of bereavement and support services.

16 Coroners should offer to supply families with a copy of the post mortem report and, if asked to do so, provide a copy within 14 days.

17 Coroners should ensure that the views of families on the method of disposal of any tissue retained at post mortem are sought and, so far as reasonably practicable, complied with. The Coroners Rules should be amended accordingly.

Conflict of interest

18 Coroners should take account of potential conflicts of interest when selecting a pathologist or other individual from whom to obtain a post mortem or other report.

Post mortem examination

19 There should be guidance on the conduct of hospital and coronial post mortem examinations and on the differences between them. The Royal College of Pathologists may wish to update its current guidelines.

20 The report prepared by the pathologist following post mortem examination should record the names of those who were present.

Education

21 Pathologists undertaking or being trained to undertake post mortem examination, and other healthcare professionals involved with such examination, should be trained in the relevant law. The training should include the provisions of the Human Tissue Act 2004, the Coroners Act 1988, the Coroners Rules 1984 and the Coroners (Amendment) Rules 2005. It should be updated to include the provisions of the Coroners and Justice Act 2009 and any secondary legislation introduced under that Act.

22 Medical students should be trained in proper communication techniques and the need to consider sensitively all issues of consent.

23 Information on post mortem examination and procedures, including the potential for organ donation and research, should be made generally available and included in the national curriculum.

Research involving human tissue

24 The Inquiry endorses the Human Tissue Authority's Code of Practice on Research[2] and in particular the following paragraphs:

> *91. The work of the staff at the establishment undertaking research should be subject to a system of governance. This means that there should be clear reporting lines and accountability (particularly with regard to the individual researchers …), documented roles and responsibilities, a system of staff appraisal, and training and development.*

2 In October 2010 the Government announced that the Human Tissue Authority would be abolished and its functions transferred to other regulators: the Inquiry feels it imperative that any such regulators adopt the Codes of Practice on Research and Consent

93. There should be documented policies and procedures covering all aspects of activity relating to the storage of human tissue for research; for example, how to obtain consent. These should be up to date, subject to regular review and reflective of good practice.

98. Records should be kept that document consent and allow traceability to the tissue stored for research.

Use of extant data

25 Data derived from the work considered by the Inquiry should be made available for use, suitably anonymised, in appropriate research.

NHS and trust management

26 Trusts should ensure that mortuary and post mortem practice is subject to appropriate audit.

27 Trusts should be able to account for all activities undertaken in pathology departments which involve the handling, storage, examination or disposal of human tissue.

28 Those responsible for the management of pathology departments should receive training in relevant legislative provisions.

29 Protocols relating to post mortem examination and practice and the retention and use of human material should be available to all staff working in pathology departments.

30 Trusts should ensure that mortuaries are maintained in an appropriate condition.

31 Trusts should ensure that unauthorised persons are not permitted to enter the mortuary or attend post mortem examinations.

Consent

32 The Inquiry endorses the Human Tissue Authority's Code of Practice on Consent[3] and in particular the following paragraphs:

> *54. Anyone seeking consent for a hospital post mortem examination should be sufficiently experienced and well informed, with a thorough knowledge of the procedure. They should have been trained in dealing with bereavement, in explaining the purpose and procedures and they should have witnessed a post mortem examination.*
>
> *99. The way in which the options are discussed with the deceased person's family is extremely important. They should be approached with sensitivity and given:*
>
> *i. honest, clear, objective information*
>
> *ii. the opportunity to talk to someone of whom they feel able to ask questions*
>
> *iii. reasonable time to reach decisions (about a hospital post mortem and about any donation of organs or tissue)*
>
> *iv. privacy for discussion between family members, if applicable*
>
> *v. support if they need and want it, including the possibility of further advice or psychological support.*
>
> *102. Written consent should be obtained wherever possible for all … post mortem activities.*
>
> *105. When someone has died, healthcare professionals may wish to seek consent for more than one scheduled purpose. For example, if a post mortem examination is to be carried out, some tissue samples could also usefully be obtained for research purposes. In this case, it would be appropriate to seek the relevant consent to both activities. Anticipating and explaining the purpose for which tissue could be used will avoid the need for seeking consent on repeated occasions.*

33 The code of conduct should apply equally to the obtaining of consent for removal of tissue, for research, at coronial post mortem.

34 A national standard form of consent to hospital post mortem or to the removal of tissue for research or education should be introduced.

3 See note 2, above

Appendices

Appendix A: Redfern Inquiry, Terms of Reference

Ministerial Statement, 18 April 2007

The Secretary of State for Trade and Industry (Mr Alistair Darling): With your permission, Mr Speaker, I shall make a short statement on the examination of tissue taken from some individuals who had worked in the nuclear industry and who died between November 1962 and August 1991. Having regard to the feelings of the families of those concerned and because it is in the public interest, I want to provide the House with the information available from British Nuclear Fuels Ltd, which operates the Sellafield site where the examinations were carried out. I shall then set out how I intend to proceed with the matter.

Most of the employees concerned worked at Sellafield, but one individual worked at the Capenhurst nuclear site in Cheshire, and had transferred from Sellafield. There are data, but not medical records, at Sellafield relating to an employee at the Springfields nuclear site in Lancashire and to a further six at Aldermaston. BNFL, which holds the relevant medical records, tells me that to date it has been able to identify 65 cases in which tissue was taken from individuals and analysed for the radionuclide content of organs.

It is important to tell the House the limited nature of the records that are held by BNFL. They are medical records, which show what analysis was done on organs removed following post mortem examination. Because they are medical records that dealt with the analysis carried out at Sellafield, they do not provide an audit trail that would show in every case who asked for such an examination, under what authority and for what purpose; nor do they disclose whether the appropriate consent from the next of kin was received. Some records contain more information than others, but at this stage it is simply not clear what procedures were followed in every case.

From the information that I have, I can tell the House that 23 such requests for further examination and analysis were made following a coroner's inquest. A further 33 requests appear to follow a coroner's post mortem. Three requests were made associated with legal proceedings, and one request was made by an individual prior to death. Therefore, it is assumed that in the majority of these cases requests were made to help establish the cause of death in the normal way. In many cases, that would be part

of the coroner's inquiry, but we cannot be sure of that because there is not an audit trail to establish that as a fact. A further single request was made following a biopsy of a living individual. In respect of a further four cases, I understand that the records do not record by what mechanism the request for the analysis was made. Clearly, it is important to establish why these requests were made and for what purpose. It is also clear that the data obtained from these examinations have been used in other studies that were subsequently published. One of the questions that therefore arise is whether it was appropriate to use the data gathered for that purpose.

It follows from what I have said that the records held by BNFL do not disclose whether the next of kin knew of the examinations and analysis. That needs to be established. Most cases appear to have followed a coroner's request. It is therefore possible that in some cases there was such knowledge, but it is not at all clear that even if the next of kin had known about the analysis they would have been aware that data gathered were then to be used as part of a wider research study. However, it will be necessary to examine the coroner's records to find out what exactly the position was.

BNFL tells me that it believes that the tissue would have been destroyed as part of the analytical process. It also believes that although there was storage of the tissue prior to the examination, any tissue that remained would have been destroyed. Certainly BNFL tells me that no such tissue exists today. However, it is not certain at this stage what procedures were followed.

The House will appreciate that some of these cases go back 45 years. It is simply not possible, therefore, to be sure whether procedures were carried out properly. As I have said, the information held by BNFL is necessarily limited and a fuller investigation is therefore necessary. I believe that it is necessary to establish why these examinations were carried out and whether the next of kin were informed and consented to the analysis. It is also necessary to establish whether any of the examinations were carried out following the correct and proper procedures, and whether the data obtained were used appropriately and with the necessary consents.

The families and the public will want to know the answers to all those questions. I have therefore asked Michael Redfern, QC, who conducted the Royal Liverpool Children's NHS Trust – Alder Hey – inquiry to investigate this matter. I have asked him to establish the facts, and to report to me. I will publish the full Terms of Reference shortly.

This is clearly a difficult situation, covering events that took place up to 45 years ago. None the less, we owe it to the families, as well as to the public, to find out what happened and why.

Terms of Reference

The Rt Hon Alistair Darling MP: Secretary of State for Trade and Industry

26 April 2007

Post mortem procedures (nuclear industry)

Further to my statement to the House on Wednesday 18 April (Hansard, Cols 301–302), I am now able to announce the Terms of Reference for the Inquiry that I have asked Mr Michael Redfern QC to carry out. They are as follows.

(a) Having regard to the provisions of the Human Tissue Act 1961, the Coroners Rules 1984, the Coroners Act 1988 and predecessor legislation, to enquire into the circumstances in which, between 1961 and 1992, organs/tissue were removed from 65 individuals, and were sent to and analysed at Sellafield.

(b) In particular, to establish so far as practicable:

(i) when, where, by whom and by what means the taking of organs/tissue was requested and authorised;

(ii) whether the taking of organs/tissue was based on informed consent by the family and/or surviving relatives;

(iii) the purpose to be achieved by the retention and analysis of the organs/tissue removed; the generic results of analysis; and the identity of all publications in which the results were presented and commented upon;

(iv) whether the families or surviving relatives were informed of the results of the analysis, or the identity of the relevant publications;

(v) when and by whom the retention, storage, transportation, analysis, reporting and disposal of the organs/tissue was authorised;

(vi) the circumstances in which the organs/tissue were retained, stored, transported, analysed, reported upon and disposed of;

(vii) the general purpose to be served by such retention, storage, analysis and publication of the results;

(viii) when this activity ceased, and the circumstances in which it ceased.

(c) To consider such other issues in connection with the above matters as the Secretary of State may direct.

(d) To report to the Secretary of State as soon as possible.

(e) To make recommendations.

Since my statement to the House, the UK Atomic Energy Authority (UKAEA) and the Atomic Weapons Establishment (AWE) have begun to examine their records to identify if tests on autopsy tissues were carried out at any of the sites for which they are, or have been responsible, other than Sellafield. The UKAEA tell me that they believe such work was carried out at Harwell, at least until the early 1980s, and possibly at other UKAEA sites, potentially involving work related to individuals who had not been employed at nuclear sites. The AWE believes that there could have been additional testing on their employees. In light of this information, and in line with what I told the House last week, I have therefore asked Michael Redfern QC to make this additional information part of his considerations.

Revised Terms of Reference

Business, Enterprise and Regulatory Reform

Post mortem procedures (nuclear industry)

The Secretary of State for Business, Enterprise and Regulatory Reform (Mr John Hutton): Further to the written ministerial statement by my Right Hon. Friend the then Secretary of State for Trade and Industry on Thursday 26 April 2007, *Official Report*, column 28WS, I wish to announce today slightly revised Terms of Reference for the Inquiry currently being carried out by Michael Redfern QC. The revised Terms of Reference are as follows:

(a) Having regard to the provisions of the Human Tissue Act 1961, the Coroners Rules 1984, the Coroners Act 1988 and predecessor legislation, to enquire into the circumstances in which, from 1955, organs/tissue were removed from individuals at NHS or other facilities, and sent to and analysed at nuclear laboratory facilities.

(b) In particular, to establish so far as practicable:

(i) when, where, by whom and by what means the taking of organs/tissue was requested and authorised;

(ii) whether the taking of organs/tissue was based on informed consent by the family and/or surviving relatives;

(iii) the purpose to be achieved by the retention and analysis of the organs/tissue removed; the generic results of analysis; and the identity of all publications in which the results were presented and commented upon;

(iv) whether the families or surviving relatives were informed of the results of the analysis, or the identity of the relevant publications;

(v) when, where and by whom the retention, storage, transportation, analysis, reporting and disposal of the organs/tissue was authorised;

(vi) the circumstances in which the organs/tissue were retained, stored, transported, analysed, reported upon and disposed;

(vii) the general purpose to be served by such retention, storage, analysis and publication of results;

(viii) when this activity ceased, and the circumstances in which it ceased.

(c) To consider such other issues in connection with the above matters as the Secretary of State may direct.

Appendix B: Inquiry procedures

1. Establishment and format of the Inquiry

The Inquiry will conduct its own investigations to enable it to answer to the fullest extent possible the questions raised by the then Secretary of State for Trade and Industry, Mr Alistair Darling, in the Inquiry's Terms of Reference (attached). The Secretary of State determined that the Inquiry should be confidential and its process inquisitorial.

Wherever possible the Inquiry will obtain consent from individuals and permission from organisations to access documents relevant to the Inquiry. The Secretary of State has requested and received guarantees from key nuclear industry stakeholders that the Inquiry would receive their full co-operation. Where the Inquiry does not receive co-operation, further powers will be sought from the Secretary of State as appropriate. Where informed consent from individuals is not possible, authority to access records is contained in a formal notification of the Patient Information Advisory Group dated 12 September 2007 under the provisions of section 60 of the Health and Social Care Act 2001.

The Inquiry's sponsor department is the Department for Business, Enterprise and Regulatory Reform.

The Inquiry will write a report of its conclusions and recommendations for the Secretary of State.

2. List of Issues

The Inquiry will publish a draft List of Issues arising from its initial investigations into the issues raised by the Terms of Reference. The Inquiry will invite constructive comments on this document within 14 days of publication. The Inquiry will then publish its List of Issues. If significant new information is received the Inquiry will publish an amended List of Issues if necessary.

3. Preliminary conferences

The Inquiry will hold preliminary conferences with the main stakeholder organisations. Part 1 of the preliminary conferences will consist of a single meeting attended by the main stakeholders at which the Chairman of the Inquiry will give an opening statement on documents gathered and required

and will invite questions. Part 2 of the preliminary conferences will consist of a series of meetings with each main stakeholder individually at which the stakeholder will provide a position statement on the documents in their possession and the relevance of those documents to the Terms of Reference. The Part 2 preliminary conferences will take place approximately 21 days after the Part 1 preliminary conference.

4. Families

The Inquiry wishes to receive evidence from the families of those who may have been subject to the removal of tissue linked to the nuclear industry. Those who believe that they may be affected will be assisted in providing evidence for the Inquiry and are asked to contact the Inquiry. The Inquiry is keen for families to form a support group to act as a single point of contact. The Inquiry will assist by meeting necessary costs including administration, printing, stationery, information technology and telephones.

The sponsor department, the Department for Business, Enterprise and Regulatory Reform, will consider applications for funding of legal support for a group of families. Such applications should be made to the Chairman at or within 21 days of the preliminary conferences.

5. Documents

The Inquiry will request and review documents relevant to the Terms of Reference. Where any organisation or individual possesses documentation likely to be relevant to the Terms of Reference and the forthcoming List of Issues they should identify these to the Inquiry. Copies will be kept of all relevant documents and the originals will be returned to their source. Where organisations possess significant numbers of documents arrangements will be made for the Inquiry to review and copy documents on site and those organisations will be asked to provide appropriate facilities to facilitate this. When the review of documents identifies further documents likely to be of relevance those will be requested from the relevant organisations. If organisations believe that they have relevant documents (either identified by the Inquiry or identified by the organisation) but are unwilling to disclose them to the Inquiry they should identify the reasons for this in writing.

6. Witness statements

The Inquiry will identify individuals from whom it wishes to obtain witness statements. Those individuals will receive a written request to attend the Inquiry office (or by arrangement, another mutually convenient location) for a witness statement to be taken by a member of the Inquiry team. The written request will include a copy of the List of Issues and will identify the areas on the List of Issues on which the Inquiry wishes the witness to give evidence. Following the interview the Inquiry will send a draft witness statement to the witness for approval or amendment. There is no requirement for a witness to have legal assistance but a witness may be accompanied by a legal representative if desired.

7. Notices of potential criticism (the "Salmon process")

If, after witness statements have been gathered, it appears that an individual or organisation may be the subject of criticism in the final Report, the Inquiry team will write to that individual or organisation notifying them of the nature of the criticism being considered and the basis for that criticism.

8. Hearings

The Inquiry will ask all witnesses who receive notices of potential criticism and any other witnesses it sees fit to give oral evidence to the Inquiry. At such hearings, questions will be asked on behalf of the Inquiry by Counsel to the Inquiry and/or the Solicitor to the Inquiry. Evidence will be recorded and will be heard in private. All potential criticisms will be put to the witness in the course of questioning.

There is no requirement for a witness to have legal assistance but a witness may be accompanied by a legal representative if desired. The Inquiry will recall witnesses or give the opportunity for further written submissions if new potential criticisms arise from the evidence of later witnesses.

9. Seminars

The Inquiry will determine once further evidence has been gathered whether holding seminars would assist in meeting its Terms of Reference, with particular reference to the requirement for recommendations for the future.

10. Final Report

The Report will be provided to the Secretary of State who will decide whether it should be published.

11. Confidentiality

The Inquiry is a confidential process. The Inquiry's work inevitably means that some confidential information concerning individuals will be discussed with individuals or organisations giving evidence to the Inquiry. Where appropriate the Inquiry will require such organisations to sign confidentiality undertakings prior to providing a witness statement or giving oral evidence. Identifiable personal and confidential information will not be made public either during the Inquiry process, during publication of the Report or thereafter unless it is with the consent of the individual concerned. The Inquiry is registered under the Data Protection Act 1988. The Inquiry's storage facilities comply with the relevant ISO/BS7799 standards.

12. Contacting the Inquiry

The Inquiry can be contacted in the following ways:

By post:	The Redfern Inquiry into Human Tissue Analysis in UK Nuclear Facilities 7th Floor 1 Byrom Place Manchester M3 3HG
By email:	contact@theredferninquiry.co.uk
By telephone:	0161 837 1554
By fax:	0161 837 1569

The Inquiry website is: www.theredferninquiry.co.uk

Appendix C: Inquiry List of Issues

Introduction

Issues of background relevance to the Inquiry's Terms of Reference

A	B	C	
Who were and are the parties involved in the nuclear industry? Which of those parties existed during the period 1961–1992? Which nuclear facilities are and were owned and/operated by which party?	What were the statutory and other powers and functions, relevant to the Terms of Reference, of each of the parties during the period 1961–1992? Did any of the functions or roles of the parties change during the period 1961 to 1992 and if so how?		1
What category of operations were carried out on each site 1961–1992?	How did the ownership or operation of the sites change during the period 1961 to 1992?	Which parties now hold the records in relation to those sites?	2

Issue 1: Legal and ethical framework

What were the legal requirements and ethical guidelines concerning the retention and testing of organs following post mortem?

A	B	C	
What was the legal position governing the retention and testing of organs following post mortem before the introduction of the Human Tissue Act 1961?	What was the applicable primary legislation? • Coroners Act 1887 • Coroners (Amendment) Act 1926 • Coroners Act 1954 • Anatomy Act 1832 • Anatomy Act 1871 • Were there relevant regulations? • Coroners Rules 1953 • Coroners Rules 1956 Is there any other applicable legislation or regulations? Was there any relevant case law? Was there any guidance available on ethics? If so what did it say?	Who could give authority for the removal of organs and for what purposes? Was the situation different for coroners' post mortems and hospital post mortems? Was consent necessary? If so for what and from whom? How could consent be given (oral or written)? Was it necessary to keep a written record that consent was given? How long should any such records have been kept?	1

A	B	C	
Was there a requirement for consent for retention and testing of organs following post mortem following the introduction of the Human Tissue Act 1961?	What does the Act say? How was the Act circulated? Were any formal guidelines published and what did they say? To what degree were any guidelines circulated?	Who could give authority for the removal of organs and for what purposes? Was the situation different for coroners' post mortems and hospital post mortems? Was consent necessary? If so for what and from whom? How could consent be given (oral or written)? Was it necessary to keep a written record that consent was given? How long should any such records have been kept?	2

A	B	C	
Was there any other relevant legislation between 1961 and 1992?	• Coroners (Amendment) Rules 1974, 1977 and 1980 • Coroners (Amendment) (Savings) Rules 1980 • Coroners (Amendment) Rules 1983 • Coroners Act 1980 • Coroners Rules 1984 • Anatomy Act 1984 • Coroners Act 1988 Is there any other applicable legislation or regulations?	What effect on the above position did any such legislation have, if any?	3

A	B	C	
What professional guidance on the law relating to retention and testing of organs following post mortem was available?	To pathologists? To mortuary technicians and to mortuary managers? To coroners and to coroners' officers? To undertakers? To doctors involved in studies/programmes requiring retention and testing of organs following post mortem? In particular about the new Human Tissue Act 1961 but also subsequent relevant legislation?	• Literature/journals • Royal College of Pathologists • Home Office • Ministry of Health • Her Majesty's Inspector of Anatomy • Other sources? To what degree was each circulated?	4

A	B	C	
What ethical considerations arising from the retention and testing of organs following post mortem were identified?	Where is the ethical guidance to be found? • Literature/journals • Royal College of Pathologists • Home Office • Other sources? To what degree was each circulated? What was the nature of any research government apparatus which may have existed to cover studies/ programmes requiring retention and testing of organs following post mortem?	To what extent did these ethical considerations change over time? Did ethical considerations add anything to the law? To what extent did any equivalent research apparatus to cover studies/programmes requiring retention and testing of organs following post mortem exist within the occupational context?	5

Issue 2: Practical background prior to 1961

What was the custom and practice in the retention and testing of organs following post mortem prior to 1961?

A	B	C	
What evidence is available of the subjective understanding of individuals and relevant organisations of the legal requirements relating to the retention and testing of organs following post mortem prior to 1961?	Pathologists? Mortuary technicians and mortuary managers? Coroners and coroners' officers? Undertakers? Doctors involved in studies/programmes requiring retention and testing of organs following post mortem? Employees of stakeholder organisations? Ethics committees?		1

A	B	C	
To establish a benchmark through a sample of studies, projects or programmes prior to 1961 which included testing otherwise than at nuclear facilities on organs retained following post mortem or fetal material	In respect of each: • in what circumstances were the organs obtained? • what consideration was given to the issue of consent and by whom? • was consent obtained, from whom and for what?	What if any guidance was specifically sought by practitioners and what was provided? What was the response of practitioners to the guidance?	2
Which studies, projects or programmes prior to 1961 included retention and testing at nuclear facilities of organs retained following post mortem?	Which organisations were responsible? Who planned and ran the studies? In what circumstances were the organs obtained? What consideration was given to the issue of consent and by whom? What evidence is there of this? Was consent obtained, from whom and for what?	What if any guidance was specifically sought by practitioners and what was provided? What was the response of practitioners to the guidance?	3

Issue 3: Custom and practice 1961–1992

What was the custom and practice in programmes for the retention and testing of organs following post mortem and studies including the results of such analysis in the period 1961–1992?

A	B	C	
Which laboratories in the UK were capable of testing for the presence of radionuclides in organs retained following post mortem and over what periods?	Laboratories at nuclear facilities? Other laboratories under the control of stakeholder organisations in the nuclear industry? Laboratories outside the nuclear industry?	Which parties owned and/or operated any sections of such laboratories/facilities? Which parties hold the records relating to such sections/laboratories? From where did the laboratories gain their primary material?	1
To establish a benchmark through a sample of studies, projects or programmes which included testing otherwise than at nuclear facilities on organs retained following post mortem or fetal material during the period 1961–1992	In respect of each: • in what circumstances were the organs obtained? • what consideration was given to the issue of consent and by whom? • was consent obtained, from whom and for what?	What if any guidance was specifically sought by practitioners and what was provided? What was the response of practitioners to the guidance?	2

A	B	C	
Which studies, projects or programmes included testing at nuclear facilities on organs retained following post mortem or fetal material during the period 1961–1992? In respect of each study, project or programme …	What was the nature of the study, project or programme?	Which organisation had overall responsibility for the study, project or programme? What was the purpose of the study, project or programme? Which individuals were involved in the design, approval, authorisation and running of the study, project or programme? Did those individuals have a conflict of interest? Where was the research carried out? Which other organisations were aware of the study, project or programme? What was the understanding of those involved in the design and running of the study, project or programme of the relevant legal requirements relating to retention and testing of organs? Did they seek guidance or advice? If consent was considered but there was felt to be no need to obtain consent, on what basis was that decision made? Was consent for the retention and testing of organs a legal requirement?	3

A	B	C	
		Was it practicable to include the need to consent in the study, project or programme? Was the possible need for consent reviewed in light of information which became available at a later date? What action was taken on the basis of any relevant new information on consent? Was ethical approval required? Was ethical approval sought or granted for the study, project or programme? By whom? To what extent was the study, project or programme made public outside medical and scientific literature? What consideration was there by stakeholders of publicity? Was there any public comment? In respect of fetal tissue, what was the effect of the Polkinghorne report (1989)? Did any individual or organisation profit financially from any project, programme, study or report or as a result of the taking, retention and transfer of organs?	

A	B	C	
	Were any projects or programmes of removal and analysis linked to any specific study?	What organisation had overall responsibility for the study? What was the name of the study? What was the purpose of the study? Which individuals were involved in the design, approval and running of the study? Did those individuals have a conflict of interest? What consideration was given at the design/planning stage to obtaining consent for the retention and testing of organs? What was the understanding of those involved in the design and running of the study of the relevant legal requirements relating to retention and testing of organs? What guidance or advice did they seek? Was consent for the retention and testing of organs a legal requirement? Was it practicable to include the need to consent in the design of the study?	4

A	B	C	
		Was the possible need for consent reviewed in light of information which became available at a later date? What action was taken on the basis of any relevant new information on consent? Was ethical approval required? Was ethical approval sought or granted for the study? By whom?	
	Were the results of the projects, programmes or studies published or otherwise circulated?	In which publications were the results circulated? Were the results independently validated? Were they peer reviewed? To whom were the results of the analysis provided? For what purpose(s) were the results of the analysis used?	5
What attempts were made to set up any national autopsy register/ database of workers exposed to radionuclides?	Why was the database seen as necessary? How far was any such project developed? If it was not successfully concluded, why not?		6

A	B	C	
Were any formal or informal arrangements put in place to identify and/or select individuals for organ retention and testing? Employees/ ex-employees of nuclear facilities? Controls? Fetal tissue? Placentae?	Employees of BNFL and/or UKAEA? Coroners? Pathologists? General practitioners? Trade unions? Others?	Was there a system under which individuals were identified and/or selected for organ retention and analysis? If so, what was the system of identification/selection and how did the system operate in each and every regard? What criteria were applied, by whom, with what degree of consultation and in what circumstances?	7
What formal or informal arrangements for obtaining, retention, transfer, analysis and disposal of organs existed between individuals and/ or organisations?	Employees of BNFL and/or UKAEA? Coroners? Pathologists? General practitioners? Trade unions? Legal advisers? Others?	Attendance at post mortem? Post mortem procedure? Selection of post mortem material? Transportation of organs? Analysis of organs? Reporting of post mortem results? Disposal of organs or residue?	8

Issue 4: Circumstances of retention 1961–1992

Which individuals were subject to the removal, retention and analysis of organs at nuclear facilities following post mortem between 1961 and 1992 and in what circumstances?

A	B	C	
Who was subject to retention?	In what circumstances were organs removed?	By whom were organs removed?	1
		At whose request and on whose authority were organs removed?	
		When, how, to whom and for what purpose was that authority given?	
		Who was present at the post mortem?	
		Was the removal linked to a coroner's post mortem?	
		Was the removal linked to a hospital post mortem?	
		Was there an inquest?	
		Which organs were removed?	
		By what means were they removed?	
		Was the amount and nature of the material removed that which was necessary for the purpose for which its removal had been authorised?	
		Who was aware that organs would be/had been removed?	
		Had a compensation claim been intimated?	

A	B	C	
	Was there any consent from the family (or advance consent from the individual)?	Is there any evidence to suggest that the individual consented in advance to removal and analysis of organs? Was consent from the family sought or obtained either directly or via their representatives? To what did the family consent? What information was given to the family to obtain their consent? What is the evidence of consent? Was it practicable to seek consent from either the individual prior to death or their family following death?	2
	In what circumstances were organs transported and stored?	What was done with the organs between removal and analysis? Where were the organs stored? How were the organs stored and over what period? How were the organs transported? By whom were the organs transported? At whose request were the organs transported and stored?	3

A	B	C	
	What analysis was carried out?	What processes were used to prepare the material for analysis and to analyse it? At whose request were the organs analysed? By whom was analysis carried out? Where was analysis carried out? What was the purpose of the analysis? What were the results of the analysis? Were the results independently validated?	4
	What were the arrangements for disposal of organs or residue after analysis?	What happened to any residue after analysis? Who requested or gave permission for disposal? Were the family of the deceased consulted regarding disposal? Should they have been? Was the disposal respectful? Is any tissue or residue still in existence?	5

A	B	C	
	What was done with the results of the analysis?	Who had control/authority over the provision of the results of the analysis? Were the results given to the coroner? Were either the results of the analysis or any report based upon it used for any other purpose than informing a coroner as to cause of death? If there was a compensation claim, were the results used in the claim and if so how? Were the results published as part of any study? If so which study and where was it published? Was the family informed of the results of the analysis or the identity of publications in which the results had been published?	6

A	B	C	
	Where results were provided to the coroner, what use was made of them?	In what format was the information given to the coroner (i.e. raw data or accompanied by a report)? When were the results/report given to the coroner (i.e. before or after any inquest or decision not to hold an inquest)? Did the coroner use the results/report to inform his (or a jury's) considerations as to cause of death? Who wrote any report presented to the coroner? Was the writer of any report independent of the other interested parties to the inquest? What standard paragraphs or templates were used in reports to the coroner on the results of analysis? At whose instigation did this take place and did this affect the accuracy or impartiality of the reports or prevent information being made available which might have a bearing on a coroner's or jury's decision on mode of death?	7

Issue 5: Practice since 1992

What has been the practice since 1992?

A	B	C	
Did the retention and analysis of organs at nuclear facilities following post mortem cease in 1992?	If the practice stopped, why was it?	Was the issue one of change or loss of resource, change of functions or change of need? Was any specific instruction given by or to any stakeholder organisation or individual to cease testing on organs obtained at post mortem? Was any concern raised at that time as to what had gone on before?	1
	If not then what programmes, projects or activities continued and for what purpose?	What consideration if any was given to the issue of consent for retention and testing of organs? What degree of consent was obtained for the use of the organs?	2

A	B	C	
Was there any review of previous practice at nuclear facilities following either i) the Bristol Royal Infirmary Inquiry or ii) the Alder Hey Inquiry or iii) the introduction of the Human Tissue Act 2004?	If so what were the findings? If not, why not? Are the findings of those inquiries and/or the requirements of the Act relevant to practice at nuclear facilities and if so, to what extent were such findings/ requirements communicated?	What action, if any, was taken as a result of any findings?	3
What would be the requirements for retention and analysis of organs following post mortem under the Human Tissue Act 2004?	If there remain any organs or residue covered by the Human Tissue Act 2004, is it held in compliance with the Act?		4

Appendix D: The Foskett Order

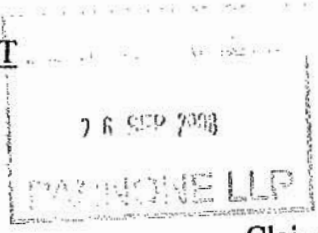
Claim no.HQ08X02996

IN THE HIGH COURT OF JUSTICE

QUEEN'S BENCH DIVISION

BEFORE THE HONOURABLE MR JUSTICE FOSKETT

BETWEEN:



DR N.J. LEWIS

Claimant

And

SECRETARY OF STATE FOR HEALTH

Defendant

And

MICHAEL REDFERN QC

Interested Party

ORDER

Upon hearing Mr Angus Moon one of her Majesty's Counsel for the Claimant and Mr Jeremy Roussak Counsel for the Defendant and the Interested Party

And upon reading the witness statements of Mr Alexander Leslie, the Claimant's Solicitor and Mr Stephen Jones, the Solicitor to the Redfern Inquiry

IT IS ORDERED AND DECLARED THAT:-

1. Disclosure of the medical records identified in the Particulars of Claim in this action by the Claimant and of the information contained therein to the Interested Party, subject to the conditions set out in the Schedule hereto, would be lawful in the public interest notwithstanding any obligation of confidence otherwise owed in respect of such documents and information.

2. Disclosure of the medical records identified in the Particulars of Claim in this action by the Interested Party and of the information contained therein to the Relevant Stakeholders, subject to the conditions set out in the Schedule hereto, would be lawful in the public interest notwithstanding any obligation of confidence otherwise owed in respect of such documents and information.

3. There shall be permission to any party to apply to the Court in connection with the implementation of this order, including the resolution of any question as to whether a particular record or document may be disclosed

pursuant to it and/or the terms as to confidentiality upon which it may be disclosed

4. There shall be no order as to costs.

SCHEDULE

(1) The documents referred to in the Particulars of Claim and disclosed by the Claimant shall be treated as confidential.

(2) Save with the prior leave of this Court or the written consent of the personal representative of the deceased to whom the document relates,

(a) nothing shall be published and no part of any document shall be read into the public record or otherwise put in the public domain which might, whether directly or indirectly, lead to identification of the deceased or his family;

(b) the Interested Party shall not disclose any document to any person other than current and former employees of the Relevant Stakeholder as defined in paragraph (3) below;

(c) no person to whom any document has been disclosed shall disclose the same to any other person;

(d) no information contained in any document which might, whether directly or indirectly, lead to identification of the deceased or his family shall be published in any report of the Redfern Inquiry.

(3) The "Relevant Stakeholder" means the Stakeholder (as referred to in paragraph 5 of the Particulars of Claim) the Occupational Health Department of which has possession, custody or control of medical records relating to deceased ex-employees. For the avoidance of doubt the Relevant Stakeholder so far as the Claimant is concerned is the Atomic Weapons Establishment.

Dated this 18th day of September 2008

Appendix E: List of witnesses

Each of the following individuals was interviewed by a member of the Inquiry's legal team, after which a witness statement was prepared, based on the interview. Those witnesses marked with an asterisk also gave oral evidence to the Inquiry during the course of the hearings between October 2008 and May 2009.

Abbreviations

The following abbreviations are used below:

AEU	Amalgamated Engineering Union
AWE	Atomic Weapons Establishment
BNFL	British Nuclear Fuels Limited
CCMO	Company Chief Medical Officer
CHC	Community Health Council
CMO	Chief Medical Officer
GMWU	General and Municipal Workers' Union
MRC	Medical Research Council
NRPB	National Radiological Protection Board
SL	Sellafield Limited
SMO	Senior Medical Officer
UKAEA	United Kingdom Atomic Energy Authority
USTUR	United States Transuranium and Uranium Registries
WCH	West Cumberland Hospital

Medical officers

Many of the organs removed at post mortem were analysed at the request of BNFL medical officers. The two doctors who had served as BNFL CCMO for most of the time during which organs were taken from nuclear workers were Dr Geoffrey Schofield and Dr Adam Lawson. Both had died by the time the Inquiry was instituted. Dr Schofield was appointed Medical Officer at BNFL

Sellafield in 1958. He was promoted to SMO in 1961, Company SMO in 1973, CMO in 1975 and CCMO in 1979. Dr Lawson was Medical Officer at Sellafield from 1962–65 and 1973–76 and SMO to 1985, when he succeeded Dr Schofield as BNFL CCMO.

***Norma Almond**	Daughter of Ronald Gee, former Springfields worker whose organs were analysed by the NRPB for HM Coroner for Blackpool. Mrs Almond's sister, Eileen Wrenshall, joined her in giving oral evidence to the Inquiry.
***Rosa Balfe**	Daughter of Gerard Grears, former Sellafield worker whose organs were analysed at Sellafield for Dr Schofield. Two of Mrs Balfe's brothers, Daniel and Gerard Grears, joined her in giving oral evidence to the Inquiry and a witness statement was taken from her brother, Desmond Grears.
***Kenneth Ball**	Business Manager, Clinical Support Services, WCH, 1995–2003; responsible for managing pathology services.
***Terence Baxter**	Former cleaner and porter, WCH; provided relief cover for the mortuary technicians, 1989–98; full-time mortuary technician since 1998.
Dr William Berrill (now deceased)	Consultant respiratory physician, WCH, 1978–2008.
***Dr Roger Berry**	Director of Health, Safety and Environmental Protection, BNFL, 1987–92.
***Dr Thomas Bird**	Consultant haematologist, WCH, 1980–85; also performed post mortems.
***Jane Bradley**	Former higher scientific officer, NRPB.
***Michael Brennan**	Son of Michael Brennan, former Sellafield worker whose organs were analysed at Sellafield for Dr Lawson.
Marie Burnham	Chief Executive Officer, North Cumbria Acute Hospitals NHS Trust, 2003–08.

***Charles Burrows**	Worked in the bioanalytical laboratories at Sellafield; involved in radiochemical analysis, 1978–88.
***William Chapman**	Mortuary technician, WCH, 1979–96.
***Shirley Chipperfield**	Director of Human Resources at WCH, 1996–2001.
***Angela Christie**	Daughter of Malcolm Pattinson, former Sellafield worker whose organs were analysed at Sellafield for Dr Schofield.
***Dr Roger Coates**	Worked for BNFL, 1975–2006; retired as Director of Environment, Health and Safety.
***David Coulston**	Director of Health and Safety, BNFL, 1992–2000, having previously worked for BNFL in dosimetry and health and safety; responsible for whole body monitoring, 1972–79.
Professor Sir Alan Craft	Professor of Child Health, Newcastle, since 1977; organiser of a research study considered by the Inquiry.
Dr Malcolm Dean	Head of Safety Division, AWE, 1982–93.
***Dr Michael Dunnill**	Consultant pathologist, Oxford, 1962–93.
William Eaves	Funeral director, Whitehaven.
John Edmonds	Employed by the GMWU and its successors, 1972–2003, initially as a national officer and latterly as General Secretary.
***Dr Christopher Elston**	Retired consultant pathologist.
***Pauline Fowler**	Stepdaughter of James Cavanagh, who worked at Sellafield and whose organs were analysed at the NRPB for its population studies.
***Nicholas Gardiner**	HM Coroner for Oxfordshire since 1981; previously Assistant Deputy and Deputy Coroner.
Leo Goldsworthy	Full-time official, AEU, 1974–84.

***John Grain**	Son of John Grain, former Capenhurst worker whose organs were analysed at Sellafield for HM Coroner for Birkenhead.
***Margaret Grain**	Widow of John Grain.
***Daniel Grears**	Son of Gerard Grears; see Rosa Balfe.
Desmond Grears	Son of Gerard Grears; see Rosa Balfe.
***Gerard Grears**	Son of Gerard Grears; see Rosa Balfe.
***Robert Grieve**	Worked in the bioanalytical laboratories at Sellafield; head of the personnel analysis team, 1984–87.
***George Ham**	Former higher scientific officer, NRPB.
***John Hay**	MRC administrative staff, 1960–93.
Professor Denis Henshaw	Professor of Human Radiation Effects, University of Bristol.
***Dr Stanley Higgins**	Son of Stanley Higgins, former Sellafield worker whose organs were analysed at Sellafield for Dr Schofield.
***Margaret Holmes**	Daughter of Edward McMullen, former Sellafield worker whose organs were analysed at Sellafield for Dr Schofield.
Erica Irlam	Secretary to the BNFL CCMO, 1972–90.
Jane Jefferies	Higher scientific officer, AWE, 1980–87.
***Dr Vijay Joglekar**	Consultant pathologist, Barrow-in-Furness, 1980–2007.
Sheila Jones	Assistant in the Sellafield Medical Department since 1974.
***Professor Stephen Jones**	Dosimetry Group Manager at Sellafield, 1982–83.
Professor Ronald Kathren	Professor of Health Physics, Washington State University; Director, USTUR, 1989–99.

Maureen Kersley	Widow of Christopher Kersley, former nuclear weapons test veteran whose organs were analysed by the NRPB for HM Coroner for Hereford and Worcester.
***Dr Barrie Lambert**	Former senior lecturer in radiation biology, St Bartholomew's Hospital Medical College; technical adviser to the GMWU and other trade unions.
Irene McAdam	Widow of James Connor, former Sellafield and Winfrith worker whose organs were analysed by the NRPB for HM Coroner for Dorset and at Sellafield for the family's solicitors.
***Dr David Macgregor**	CCMO, SL, since 2003.
Dr James McInroy	Undertook radiochemical analysis at Los Alamos National Laboratory, 1972–93.
***Duncan McLean**	Son of Robert McLean, former Sellafield worker whose organs were analysed at Sellafield for HM Coroner for West Cumbria.
***Robert Morrison**	Worked in the bioassay laboratory, UKAEA Harwell, 1965–2003, with overall responsibility from 1986.
Judith Oldfield	Daughter of John Simpson, former Sellafield worker whose organs were analysed at Sellafield for Dr Schofield.
Alan Parker	Analytical chemist at UKAEA; initially at Woolwich, 1950–67, thereafter at Harwell.
***Dr Donald Popplewell**	Group Leader, NRPB Biology Department; Principal Scientific Officer, 1972–94.
***Rev. Alan Postlethwaite**	Chairman, West Cumbria CHC, 1977–78.
Professor Nicholas Priest	Scientific officer, NRPB, 1974–86; member of Biomedical Research Department, UKAEA, 1986–95.
Colin Ray	Mortuary technician, Barrow-in-Furness, 1983–2003.

***Anthony Riddell**	Environmental and Medical Services Department, Sellafield, 1987–94; then researcher at Westlakes Research Institute.
***Dr Murray Roberts**	Medical Officer, Sellafield, 1971–73; Senior Medical Officer, Springfields, 1973–76; Medical Adviser, AWE, 1976–85.
Ruth Roberts	Widow of Kenneth Roberts, former Sellafield worker whose organs were analysed at Sellafield for HM Coroner for West Cumbria.
***Ian Robertson**	Solicitor at Crutes Solicitors, 1968–2001; partner from 1969.
William Ross	Consultant radiotherapist, Newcastle, 1955–87.
George Sallit	Superintendent of Personal Safety, AWE, 1992–2004; previously responsible for operational health physics from 1987; Head of Health and Safety, AWE, 2004–07.
Dr Ian Schofield	Consultant neurophysiologist, Newcastle; son of Dr Geoffrey Schofield.
***Dr David Scott**	Consultant pathologist, Newcastle, 1975–96.
***Dr Jyotsna Shrimankar**	Consultant pathologist, Newcastle, 1984–96.
***Dr David Smith**	Consultant pathologist, WCH, 1967–98.
***Colin Southward**	Son of Geoffrey Southward, former Sellafield worker whose organs were analysed for Dr Schofield at Sellafield and at the NRPB.
***Dr Rex Strong**	Former Head of Dosimetry Services at Sellafield.
***John Taylor**	HM Coroner for West Cumbria, 1995–2009; Assistant Deputy Coroner, 1979–84; Deputy Coroner, 1984–94.
Anne Thompson	BNFL occupational health nurse, Lillyhall, 1977–99.
***Sir Bernard Tomlinson**	Professor of Pathology, Newcastle, 1951–85.

***Eric Urquhart**	Chairman, West Cumbria CHC, 1978–81; Vice Chairman, West Cumbria Health Authority, 1981–85, Chairman, 1985–91; Chairman, West Cumbria Healthcare NHS Trust, 1992–2001.
***Brian Wallace**	Medical Systems Manager, Sellafield, 1982–91.
John Ward	Solicitor, Treasury Solicitor's Department, 1976–89.
***Dr Nicholas West**	Consultant haematologist, WCH, since 1985.
Ian Whitaker	Senior House Officer, orthopaedics, WCH, 1982–83.
***Dr Philip Whitehead**	Consultant pathologist, WCH, 1970–79.
***John Wilson**	Son of James Wilson, former Springfields worker whose organs were analysed by the NRPB for HM Coroner for Greater Manchester. Mr Wilson's brother William joined him in giving oral evidence to the Inquiry.
***William Wilson**	Son of James Wilson; see John Wilson.
***Dr Robin Wood**	UKAEA Medical Officer, Dounreay, 1981–84 and Risley to 1986; BNFL SMO, Sellafield, 1986–96; UKAEA CMO, Harwell, 1996–2005.
***Nigel Woodcock**	Unit General Manager, WCH, 1990–93; Chief Executive, West Cumbria Healthcare NHS Trust, 1993–2000.
***Jennifer Woodhouse**	Health Physics Department, Sellafield, 1969–82.
***Eileen Wrenshall**	Daughter of Ronald Gee; see Norma Almond.

Other witnesses

The Inquiry saw attendance notes, prepared by their own solicitors, from Dr Eric Barker, former Medical Officer, BNFL Capenhurst; and Dr John Eakins and Dr Arthur Lally, former analysts, UKAEA Harwell. All were elderly and the Inquiry saw no reason to pursue their evidence further.

The Inquiry made contact with a further nine witnesses, including Dr Andrej Slovak, former BNFL CCMO; it was thought unlikely that their evidence would be of assistance and no statements were taken.

Witness statements were obtained from seven pathologists, in addition to those listed above, who had provided organs for the UK strontium studies. All were elderly and their memories of the details of the studies had, understandably, faded. None was invited to give oral evidence.

Expert evidence

The Inquiry was greatly assisted by those organisations and witnesses listed below who gave invaluable evidence in an expert or advisory capacity.

***Professor Ian Barnes**	National Clinical Lead for Pathology, Department of Health.
***Margaret Brazier QC OBE**	Professor of Law, University of Manchester; Chair of the Retained Organs Commission, 2001–04.
***Steve Ebdon-Jackson**	Head of Medical Exposure, Health Protection Agency.
***Dr Christopher Foster**	Professor of Pathology, University of Liverpool.
***Dr Anthony Freemont**	Professor of Pathology, University of Manchester.
***Dr John Harris**	Professor of Bioethics, University of Manchester.
***Peter Lemmey**	Former Director of Policy and Strategy, Human Tissue Authority.
***Dr Sandy Mather**	Director of Regulation, Human Tissue Authority.

***Nigel Meadows**	HM Coroner for Greater Manchester (Central).
***André Rebello**	HM Coroner for Liverpool; Secretary of the Coroners' Society of England and Wales.
***Dr David Simister**	Principal Inspector with HM Nuclear Installations Inspectorate, Bootle.

The Inquiry also obtained background information on an informal basis from several other individuals and organisations.

Appendix F: List of legal representatives

Parties and their legal representatives before the Inquiry

Counsel to the Inquiry

Jeremy Roussak of St John's Buildings, Manchester

Solicitor to the Inquiry

Stephen Jones, assisted by Christopher Gawne and Ashley Dee, of Pannone LLP, Manchester

Stakeholders/interested parties	Representatives
The Atomic Weapons Establishment (AWE) and Ministry of Defence (MoD)	Nicholas Franklin, General Counsel and Company Secretary, AWE, Aldermaston; Edward Holder, Director General Legal Services, MoD
The families	Kate Oldfield, of Davis Blank Furniss, Manchester
The Health Protection Agency (HPA)	Thomas Bjørn, Head of Legal Affairs, HPA, London
North Cumbria University Hospitals NHS Trust	Nicola Richardson and Tim Smith, of Ward Hadaway, Newcastle
Sellafield Limited (SL)	David Hart QC and Angus McCullough, instructed by Jonathan Isted, of Freshfields Bruckhaus Deringer LLP, London
The trade unions (the GMB and UNITE)	Philip Ballard, of Thompsons, Newcastle
The United Kingdom Atomic Energy Authority (UKAEA)	Chris Jackson, of Burges Salmon LLP, Bristol

Individual witnesses	Representatives
Dr Roger Berry David Coulston Robert Grieve Erica Irlam Professor Stephen Jones Dr Rex Strong Anne Thompson Brian Wallace Dr Robin Wood Jennifer Woodhouse	Assisted by Jonathan Isted, of Freshfields Bruckhaus Deringer LLP, London[1]
Jane Bradley George Ham Dr Donald Popplewell	Thomas Bjørn, Head of Legal Affairs, HPA, London
Marie Burnham Shirley Chipperfield	Nicola Richardson and Tim Smith, of Ward Hadaway, Newcastle
William Chapman	Jo Pennycook, of Shoosmiths, Basingstoke
Dr Malcolm Dean Jane Jefferies George Sallit John Ward	Roland Phillips and Anthony Lawton, of the Treasury Solicitor's Department
Dr Michael Dunnill	Peter Fitzpatrick, of Nabarro LLP, London

1 Sellafield Limited agreed to provide legal assistance to current and former employees through Jonathan Isted, provided no conflict of interest arose between their evidence and Sellafield Limited; no such conflict did arise

Dr Vijay Joglekar Dr David Scott Dr David Smith Professor Sir Bernard Tomlinson	Michael Ryan and James Rowley, of Ryan Solicitors, Manchester
Sheila Jones Anthony Riddell	Nicholas Holroyd, of Russell Jones & Walker, Manchester
Dr David Macgregor	Simon Dinnick, of the Medical and Dental Defence Union of Scotland
Robert Morrison	Assisted by Chris Jackson, of Burges Salmon LLP, Bristol[2]
Dr Murray Roberts	Simon Eastwood, of Eastwoods, London
Ian Robertson	Assisted by Barlow Lyde & Gilbert LLP, London, instructed by Crutes LLP, Ian Robertson's former firm
Dr Jyotsna Shrimankar	Catherine Williams, of RadcliffesLeBrasseur, Leeds
John Taylor	Jonathan Farnworth, of Cumbria County Council, Carlisle
Dr Philip Whitehead	Alex Leslie, of RadcliffesLeBrasseur, London

2 The UKAEA agreed to provide legal assistance to current and former employees through Chris Jackson, provided no conflict of interest arose between their evidence and the UKAEA; no such conflict did arise

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