

Historical Branch Army Report: HBA 25/8

**Blood and Urine Monitoring Arrangements for British Army Participants in
Nuclear Tests and the Resulting Records Footprint: 1952-1967 and 1967-2025**



Cover photo from WO 227/127 at The National Archives.

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Blood and Urine Monitoring Arrangements for British Army

Participants in Nuclear Tests and the Resulting Records Footprint:

1952-1967 and 1967-2025

Introduction and Key Conclusions

1. In July 1956, a soldier reported to a medical officer who examined him as he was 'Going to Australia to watch an atom bomb explode!' A blood count and chest x-ray was done for him. Two days later his blood count returned from the laboratory with the interpretation 'red cells white cells normal'.¹

2. That soldier was one of approximately 7000 British Army personnel who were at British overground nuclear tests in the 1950s and related activity into the 1960s. This report accounts for the blood and occasional urine monitoring arrangements for nuclear test veterans (NTVs). The policies for medical monitoring are described to the extent the surviving Army records permit. A dip sample of 350 nuclear test veterans (5% of the participants) was carried out to determine how monitoring policies were applied and what evidence concerning nuclear testing is contained in individual service and medical records.

3. The key conclusions are:

- The interest in blood and urine monitoring for nuclear test veterans arose from their health concerns and generated the Lab Rats litigation strategy focused on anticipated deficiencies in MOD's records management.²
- The policies, orders, and practice showed that for the Hurricane, Totem, Mosaic, Buffalo, and Antler tests, blood counts and chest x-rays were required as a health screening measure before deployment. Initially they were not required for the majority going to Grapple at Christmas Island, which was the largest deployment. As the Grapple radiation risks changed and for medical-legal reasons, the numbers being screened increased and finally as the tests were ending, there was a decision to blood count and chest x-ray all service personnel deploying to Christmas Island.
- A dip sample of individual service and medical records of 350 nuclear test veterans was carried out. The results are an **approximate extrapolation** to the overall population of 7000 and it is estimated:
 - 2362 veterans should have had blood counts done as part of their pre-deployment screening for attending a nuclear test.
 - 1012 veterans had blood counts.

¹ Soldier's Service and Medical Record, blood count results dated July 1956.

² Boniface, Susie, *Exposed: The Secret History of Britain's Nuclear Experiments* (Pen and Sword, Yorkshire, 2024), passim and on the records point p.209. McCue Jury & Partners to MOD, 'Letter of Claim', 19 March 2024.

- 1353 veterans should have had blood counts but did not or the relevant records were not found. Explanations for this include:
 - A probable 484 who made a pension claim against MOD that resulted in their medical records being extracted for pensions purposes and not returned to their service and medical record.
 - 230 Army personnel on Hurricane who sailed ahead of the decision to blood count deploying personnel.
 - For 4638 veterans, the majority at Grapple during the firing phases, there was no policy requirement for a blood count.
 - For 440 veterans, the available records such as officer's annual reports are not suitable for determining if they should have had blood counts.
 - Less than 75 had or should have had supplementary monitoring such as additional blood counts or urine testing.
- The Atomic Weapons Research Establishment (AWRE) was responsible for 'health physics' concerning the potential impact on human health of radiation. That included individual testing, monitoring, and record keeping responsibilities for dosimetry. When dosimetry showed higher doses of radiation or an unusual incident occurred, that was the triggering mechanism for further blood counts, a small number of urine tests, and one thyroid monitoring program.
- Army records of further blood counts or other monitoring at nuclear tests were rare. This was due to pathological efforts being focused on those exposed to higher doses of radiation. Urine testing was exceedingly rare and records of that have been found for small numbers of Army personnel at Hurricane, Totem, and Grapple.
- The non-nuclear medical arrangements at the tests were the typical arrangements for a joint force operating overseas. There is evidence of normal medical procedures being recorded in individual medical records.
- Requirements to keep records did not mean there was a requirement to keep all records forever. The requirement for permanent preservation was more selective and somewhat subjective.
- In 1982 AWRE wrote that the records concerning individuals were 'sparse, of very varied quality, and often ambiguous or indeterminate.'³ Except for digitization of paper records which makes searching easier, nothing could have happened since then to improve the records picture.
- This report is comprehensive regarding the Army policies and procedures that were put in place for nuclear testing. The methodology checked the margins of the topic, which means it is unlikely there are other sources in official Army records that if located would significantly change the conclusions.
- This report draws on evidence from 5% of Army personnel at the tests. If the work was extended to a larger group of Army personnel, it is probable a similar and larger picture would emerge.

³ AWRE, 'Listing of Persons at UK Overseas Defence Nuclear Experimental Programmes' [blue book], 10 March 1982, p.ii.

Tasking

4. This report was produced in response to these research questions and parameters set by the Office of Veterans Affairs (OVA) in 2024. They tasked:

- 'History - What testing was conducted on UK veterans by whom and when?
- Record Keeping - What was the policy/instruction at the time for the retention of this medical information? To what extent was the information transferred to individual medical files and/or retained elsewhere?
- What happened to these records? What was the instruction for the retention of this material; some records are held on medical files, however, are there other test results, including anonymised data, held elsewhere? This will include any consideration of policy/decisions for destruction of blood and urine test results and the rationale for that direction.
- Searches for any remaining records - Depending on the outcome of the discovery exercise, the Department will need to consider what reasonable searches can be conducted to determine what blood and urine testing, including anonymised data, might be held.
- We would only be able to look at the testing of military personnel who were part of the UK Armed Forces. The Department should endeavor to provide details of what testing took place and then a definitive position on what test results may remain, or what happened to those results if the Department no longer holds them. If the discovery exercise provides a conclusion that material may still be held, then leads for the requisite searches across MOD holdings will need to be established. Questions may also be raised about members of the Royal Fleet Auxiliary and civilian ships' crews who supported the tests – records for these cohorts are not currently accessible to MOD.' ⁴

As the work progressed the task was amended and phased. The amended task for Phase 1 was too:

- Confirm surviving policy records (i.e. records that contain information about the policy of testing, as well as policies that informed what happened to medical records since they were created) have been searched;
- Be in a position to summarise the findings of these records and whether the policies were typically followed; and
- If the policies were not followed, explain the likely reasons why.⁵

Out of Scope Matters as Determined by Historical Branch (Army):

- UK involvement in US nuclear testing.

⁴ Email OVA to Minister for Veterans and People Office, 16 December 2024.

⁵ Email OVA to Historical Branches, 'NTV Update', 8 September 2025.

- The medical arrangements for foreign personnel, such as Australians, were not the subject of this report, but were included when it helped explain the arrangements for British Army personnel.
- A comprehensive search and review of secondary sources was not carried out due to the nature of the task, which drove a focus on primary sources of Army origin. Four books provided context for the research.⁶
- There was no attempt to access individuals' accounts or record memoirs and place those alongside official records. The only exception was AVM Oulton who commanded the first tranche of Grapple firings.⁷
- The Army general radiological work in the 1950s and 1960s had similarities and overlap with nuclear testing. Those arrangements are described at the policy level. Some service careers included general radiological work and nuclear tests. There was no focus on individuals who only did general radiological work.
- There was no comprehensive discovery of central defence DEFE records at the National Archives. As the Army was not the lead service for nuclear testing, some of the decisions that affected its personnel were taken elsewhere in the Armed Forces or by AWRE. This report contributes to a comprehensive defence wide account, but in the absence of parallel accounts from the RN, RAF, AWE, and the systematic discovery of DEFE records, it should be used with some caution until a comprehensive defence wide account is complete.

⁶ Arnold, Lorna, *A Very Special Relationship: British Atomic Weapons Trials in Australia* (HMSO, 1987). Arnold, Lorna, *Britain and the H-Bomb* (MOD/Palgrave, 2001). Boniface, Susie, *Exposed: The Secret History of Britain's Nuclear Experiments* (Pen and Sword, Yorkshire, 2024). Wilson, ITC et al, *History of the Corps of Royal Engineers* (The Institute of Royal Engineers, Chatham, 1986).

⁷ Oulton, Wilfrid, *Christmas Island Cracker: An Account of the British Thermo-Nuclear Bomb Tests 1957* (Thomas Harmsworth Publishing, 1987).

Overview of Army Capabilities and Knowledge Relating to Nuclear Testing

Army Pathology Capabilities and Arrangements

5. The Army pathology capability to do blood cell counts at scale developed in the 1940s and 1950s. Before 1945, the Royal Army Medical Corps (RAMC) used blood counts as part of the diagnosis of ill soldiers. By 1950, blood count technology was available for individual diagnosis and small-scale epidemiological studies. One study used blood counts to understand bronchitis affecting 42 soldiers.⁸ The blood count technology was available at Army hospitals and was used to screen some individuals deploying for some nuclear tests (see below for specifics in 'Arrangements for Nuclear Tests').

Contemporary Medical Analysis

For the purposes of nuclear tests consequences, the full blood count can just give a baseline which deviations in the future can be compared to.

Broadly it is used to suggest a diagnosis of infection, iron deficiency, vitamin B12 and folate deficiency as well as other focused immune conditions. All these are relatively irrelevant from a strictly nuclear testing point of view. I think if you have a normal full blood count, that does not necessarily mean you are in good health. A poor blood count could however support a supposition of poor health.

6. Urine testing was a very common medical examination in the 1950s. Soldiers had their urine scrutinised with visual results like 'clear' or 'cloudy' being recorded in their medical records on enlistment and discharge. More sophisticated pathology laboratory tests could be used to investigate specific illnesses. Typical urine tests can be distinguished from three instances of health physics urine testing done at the Hurricane, Totem, and Grapple nuclear tests (see below for specifics in 'Arrangements for Nuclear Tests').

7. Chest x-rays were a common medical examination in the 1950s as tuberculosis was a problem. There was a program to screen Army National Service men for tuberculosis on enlistment. Mass Miniature Radiography (MMR) was widely available and used by the Army.⁹ Chest x-rays were used as part of the pre-deployment screening for nuclear tests if soldiers had not been recently x-rayed for other purposes. For example, the Army personnel who were part Buffalo Induction Force tasked to

⁸ 'Gurkha Bronchitis', *Journal of the Royal Army Medical Corps*, October 1950, pp. 185-195.

⁹ 'Chest Abnormalities Detected by Mass Miniature Radiography', *Journal of the Royal Army Medical Corps*, April 1952, pp.224-229.

understand nuclear warfare should have had x-rays (see below for specifics in 'Arrangements for Nuclear Tests').

8. The Army's medical research capabilities were a combination of individual endeavors, pathology laboratories in Army hospitals, and centralised research by the RAMC at their College. The Department of Pathology at the Royal Army Medical College (Millbank) carried out pathology research including producing the Army Tumour Registry Reports. In 1957 they recorded the treatment of 211 malignant tumours. In 1962, there were 280 tumours. The most common were skin and breast cancers (Army families were included in the reporting). Leukemia was rare.¹⁰ A constraint on the research was poor quality record keeping. In 1954, they complained, 'Relevant details were incomplete in no less than 61% of the cases received. If any statistical work of value is to be forthcoming from the Registry it is imperative that every patient should be fully identified by number, name, and initials, and corps.'¹¹

Radiology within the Army

9. The position within the Army sat within increasing national awareness of industrial risks to health and the benefits of taking an epidemiological approach to medical research. By 1937, the prevalence of lung diseases among miners was researched. During the war, the health of ammunition factory workers was researched. As nuclear weapons, nuclear-powered electricity generation, and medical use of radiation developed, there was a growing awareness of the need for a bespoke approach regarding radiation. An official history stated, 'As research in the field of nuclear physics increased, so careful medical supervision of the workers exposed to radiation [was] instituted, and detailed records were kept of its effects.'¹²

10. Within the Army, the position evolved quickly as by February 1954 radioactive materials were being issued to Army units to enhance nuclear response training. The regulations in an Army Council Instruction concern training but were referenced for nuclear testing.¹³ The Instruction was updated the following year.¹⁴ Some individuals attended a nuclear test also had appointments requiring exposure to radioactive materials in a training context. For them, the records from nuclear testing may converge

¹⁰ Department of Pathology Annual Reports. RAMC archive box CI.HI.258

¹¹ Army Tumour Registry Report, 1954. RAMC archive box CI.HI.258.

¹² Green, F.K.H. (ed), *Medical History of the Second World War: Medical Research* (London, HMSO, 1953), p.297.

¹³ War Office, Army Council Instruction 109, 'Storage and Use of Radio-Active Sources Issued for Atomic Warfare Training', 17 February 1954.

¹⁴ War Office, Army Council Instruction 323, 'Storage and Use of Radio-Active Sources Issued for Atomic Warfare Training', 18 June 1955.

with records from more general nuclear health monitoring. Similarly, the Army Council Instructions were on occasion cited in individual medical records as the reference for doing blood counts for individuals about to attend nuclear tests. Therefore, the arrangements proscribed in the Army Council Instruction are relevant to this report and more generally they confirm the state of Army knowledge, policy, and record keeping requirements in a related and for some individuals overlapping areas. The Army Council Instruction required¹⁵:

- Army Form 20 (AF20) was used to record radiation doses (detected by a dosimeter) that were received during training.
- The data from AF20 was transferred onto AF21 'Personal Record of Exposure to Radio Activity'. The front of the card recorded dosimeter readings and the back of the card was a 'Record of Blood Examination'. The AF21 was then sent to the unit Medical Officer.
- For those regularly working with radioactive sources, a blood count was to be requested using FMed 12 (Request for Special Examination). The results were returned on FMed 7 (Out Patient Record) and placed in FMed 4 the individual's medical documents envelop.
- Additionally, a copy of the results was sent to the Army Directorates Personnel (ADPs) which were particular to each Corps, and to Director of Pathology in the War Office. It was directed then to be filed in central medical records. It is not known where those records are or if they survived.
- The ADPs were also to keep a record.
- Standards were set for acceptable blood count results that would allow the individual to proceed into radiological work. These were:

	Total white blood count (W.B.C.) in cmm	Total Polymorphonuclear (P.M.N.s) in cmm	Total lymphs in cmm	Abnormal cells
Average normal	4500-12100	2250-8200	1100-3800	Nil
Warning level	4500	3000	1000	Nil
Rejection level	3000	2000	750	Present

¹⁵ War Office, Army Council Instruction 323, 'Storage and Use of Radio-Active Sources Issued for Atomic Warfare Training', 18 June 1955.

11. The Army service that processed dosimeters responded to medical, industrial, and training exposure to radiation.¹⁶ In September 1957, the Director of Army Health set up a committee to advise on new structures to establish an Army Radiological Protection Service. The committee advised these functions were needed:

- An inspectorial and advisory function.
- A monitoring system for dosimeters / film badges.
- 'Individual and central system of recording radiation dosages and maintaining individual records.'
- 'Initial and routine medical examinations of personnel exposed to radiation including blood examinations.'
- 'All the above to be applied to all personnel exposed to radiations in the course of their occupation'.

12. In practice it was more ad hoc. The film badges were sent to the Army Electro and Returned Medical Equipment (AERMED) Dept at Woolwich where a RAMC Major was responsible for interpreting the films. He used a private densitometer 'he had built himself and which he kept in his home.' When he fell sick in 1960, medical officers in the War Office viewed the films against a light background and compared them with calibrated film.¹⁷ Given there were 25,000 films a year from the Army, they must have been viewing over 100 a day. The population that was being monitored in 1958 was radiographers, those working with luminous paint, and personnel handling radioactive training materials.¹⁸ There was no mention of absorbing records concerning nuclear testing. The initial Army arrangements were ad hoc and although dealing with similar issues to nuclear testing, they were running on a parallel track. They became more organized, in the 1960s, after Army participation in atmospheric firings had finished. The main 1961 driver for more focused efforts was preparing the Army to meet revised legal requirements that finally came into effect that year with the Ionising Radiations (Sealed Sources) Regulations (a statutory instrument of the Factories Acts).

13. The monitoring for radiological matters outside of nuclear testing, should have resulted in a records footprint for the individual but in 1961 there was a problem as:

There is at present no satisfactory system of central storage of records for analysis and statistical purposes. At present AMD 3 [Army Medical Directorate] hold files and records by virtue of [the Major's] attachment to that Directorate

¹⁶ 'The Army Health Organisation 1948-1958', *Journal of the Royal Army Medical Corps*, July 1958, pp.142-143.

¹⁷ WO32 / 19595, 'The Army Film Badge Service', 27 July 1961.

¹⁸ WO32 / 19595, Copy of 'Physical Supervision of Personnel Exposed to Radiation in X-Ray Departments', dated 31 March 1958.

recently. Film badges are stored at AERMED. Cumulative dose records for radiologists are kept at AMD 5 and REME, RAOC etc store their own.¹⁹

14. The interaction between general radiation work in the Army and nuclear testing is not consistent. The specific instructions for nuclear testing would be received by medical officers who may have had experience of dealing with similar issues due to their work on radiation and the rationale for blood counting individuals as a screening measure was common to general radiation work and nuclear testing. Some individuals had careers that covered both areas.

15. The Army radiological work was distinctive to health physics associated with nuclear testing. The appointment of RAMC liaison officers to the Atomic Weapons Research Establishment (AWRE) and the Atomic Energy Research Establishment (AERE) suggests they were contributing to the capacity there and reporting back. Neither the RAMC reports of their pathology work or health physics reporting from nuclear tests provide any evidence of an Army owned health physics capability being used at nuclear tests.²⁰

Army Understanding of Nuclear Warfare

16. The existing knowledge the RAMC had concerning the use and dangers of radiation in medicine provided a backdrop for their thinking on nuclear warfare. In 1950 an RAMC officer consolidated what was in the public domain concerning atomic warfare and published it in the *Journal of the RAMC*.²¹ It indicated a baseline of Army medical knowledge before the UK's nuclear test program started. He explained the body was not uniformly vulnerable to damage by radiation. The most vulnerable parts were lymphocytes (a white blood cell) then erythroblasts (a red blood cell). Least vulnerable was muscle tissue. The longer-term effects were unknown but under investigation. He described:

A survey of the Japanese survivors is being conducted in order to follow up any possible genetic effects - this will require years of patient work and careful vital statistics. Haldane has stated that the total number of deaths from recessive mutations to be expected as the result of an atomic bomb explosion is a small

¹⁹ WO32 / 19595, 'Draft the Army Film Badge Service: Organisation and Administration', c. July 1961.

²⁰ Maj-Gen G.T.L. Archer, 'The Army Pathology Service 1948-1958', *Journal of the Royal Army Medical Corps*, July 1958, p.150.

²¹ 'Some Medical Aspects of Atomic Warfare', *Journal of the Royal Army Medical Corps*, May 1950, pp.246-258.

fraction of the numbers immediately killed and is spread out over thousands of generations.

17. He correctly stated that radiation caused a genetic effect. However, the linking mechanism between cause and effect was not known at that time. Later in their 1953 breakthrough paper on DNA, Watson and Crick suggested the pairing of the double-helix was a 'possible copying mechanism for the genetic material'.²² That was a tentative and correct conclusion that then allowed a subsequent step to determine that radiation interfered with the DNA copying mechanism. The RAMC analysis was correct that the longer-term effects of radiation on human health would have to be searched for with a stochastic effect, hence the requirement for 'careful vital statistics'.

18. He mentions some of the US nuclear tests but did not describe them in detail. The potential practical arrangements he identified for military personnel engaged in rescue work following a nuclear attack, were like the actual arrangements used in the British nuclear test program contamination surveys:

No [un]authorized personnel should enter a contaminated area. Those who must do so should not be retained in the area long enough to receive more than "military tolerance" dose of radiation. When in a contaminated area, eating, drinking and smoking must be prohibited, the wearing of protective clothing and respirators will be ordered whenever necessary and personnel will be monitored on leaving the area to check for removal of contamination.²³

19. He attended the Hurricane test two years later and then held several appointments concerning nuclear and radiological matters.

20. The structural arrangements for the Army's response to nuclear warfare were ad hoc and developed in the 1950s. In 1951 the RAMC organized the officers' study Exercise Medical Mushroom. The exercise report indicated the following organizations had these roles:

- The Joint School of Chemical Warfare addressed the use of tactical nuclear weapons and which types of uniform gave most protection from nuclear flash

²² [Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid | Nature](#)

²³ 'Some Medical Aspects of Atomic Warfare', *Journal of the Royal Army Medical Corps*, May 1950, pp.246-258.

burns. There was also a demonstration of field instruments used to detect radioactivity.

- The Royal Army Medical College had been researching treatment and protection from nuclear flash burns.
- The Field Training School demonstrated trenches and described their effectiveness regarding heat and gamma radiation.
- The Medical Research Council unit at Harwell Atomic Energy Authority described radiobiological research.

21. The assumption was that war in Europe would encompass conventional and nuclear means. Continuing conventional combat would depend on understanding nuclear weapons, mitigating the effects, and moving away from nuclear explosions to fight elsewhere.²⁴ That challenge was the motivation for the Army arranging the Indoctrination Force at the Buffalo nuclear test (see below in 'Arrangements for Specific Tests').

22. One matter of particular interest to the Army was the effect radiation had on an individual and their combat effectiveness. This was plotted against distances from a nuclear explosion. The following table was drawn up²⁵:

Distance from explosion (yards)	Dosage of immediate gamma radiation (roentgen)	Effects (whole body radiation)
700	10,000	Lethal dose
1000	2,000	Lethal dose
1300	700	Lethal dose in most cases
1400	400	50% will die
1600	200	100% sick – a few will die
1900	50	Mild radiation sickness in some cases
2400	10	Nil

23. The key point, and one that will be returned to later in this report, was that 10 R was viewed as a dosage that would have a nil [immediate] effect on the individual, albeit that it was a war context.

²⁴ Brigadier F.M. Richardson, 'Exercise "Medical Mushroom"', *Journal of the Royal Army Medical Corps*, June 1952, pp. 311-318.

²⁵ WO 32/13461, 'Defence Against the Atomic Bomb', draft dated 27 July 1951.

24. During the nuclear tests, exposure to radiation was recorded using a measurement of R or RADs which stood for 'radiation absorbed dose'. Another measurement was REM which stood for 'roentgen equivalent man'. RADS and REMS were near identical measurements. In the context of nuclear tests, the most important aspect of radiation was measuring gamma rays as those could potentially harm internal organs. Gamma rays are like x-rays in terms of radiological behaviour. Currently, radiation exposure is measured using sieverts. A more granular measure is a millisievert (mSv) with 1000 mSvs in a sievert. Therefore, measurements of radiation at nuclear tests can be benchmarked against contemporary medical, industrial, and geological radiation.²⁶

Current Radiation Sources, Effects, and Measurements		
Radiation Source	Rad	mSv
Chest x-ray	0.0014	0.014
UK average annual radiation dose	0.27	2.7
Average annual radon dose to people in Cornwall	0.69	6.9
Rad and mSv equivalent	1	10
CT (computed tomography) scan of the whole spine	1	10
Annual exposure limit for nuclear industry employees	2	20
Level at which changes in blood cells can be readily observed	10	100
Acute radiation effects including nausea and a reduction in white blood cell count	100	1000

Historical Radiation Sources, Effects, and Measurements		
Radiation Source	Rad	mSv
Chest x-ray in 1950s	0.0032	0.032
Hurricane test normal permitted daily working rate	0.1	1
Hurricane test lower integrated dose	3	30
Hurricane test higher integrated dose that prompted supplementary monitoring	10	100
Highest known dose for Army personnel	13.02	130.2
Nuclear Explosion causing mild radiation sickness in some cases	50	500

²⁶ UKHSA 'Ionising radiation: dose comparisons', 18 March 2011. Arnold, *A Very Special*, pp.290-303.

Arrangements for Nuclear Tests

Number of Army Participants in the Tests

25. The total figure for British Armed Forces and ARWE staff who participated in the tests was over 21,357. That figure was from the Nuclear Weapon Test Participants Study (NWTPS) list which was used for epidemiological research into the health outcomes of nuclear test veterans. The research was carried out by the National Radiological Protection Board (NRPB) and their successor organization, the UK Health Security Agency (UKHSA). Over 5794 British Army personnel were present when a nuclear weapon was tested and / or they participated in the clear up phase. The largest group of soldiers were Royal Engineers. The 5794 figure was supplied by the UKHSA in 2025 and matches the figure used in 2003 for the NRPB study. The 5794 figure includes people who attended several tests and the extracted NWTPS data showed there were 7462 individual Army attendances at tests.²⁷ This report used the 5794 figure to maintain compatibility with NRPB/UKHSA analysis including numbers at a particular test and dosimeter readings distribution in the Service population.

26. The 21,357 and 5794 figures are underestimates. In 2003, the NRPB estimated the 21,357-figure covered 85% of test participants. Therefore, there was a shortfall of 15% of personnel who attended a test but were not recorded on the NWTPS list. The shortfall arose from gaps when the NWTPS listing was compiled in the 1980s and continued as more veterans were not added to the NWTPS list. The non-listing of additional veterans protected the integrity of the epidemiological studies which required a static population. Recent figures generated when deciding if applicants should receive the Nuclear Test Medal corroborate the scale of shortfall. Between November 2022 and February 2025, 1524 Army personnel were awarded the Nuclear Test Medal. Of those 1216 were on the NWTPS list and 308 or 20% were not on the NWTPS list. The 20% had test participation confirmed from other records. Taking account of those shortfalls, the total Army participation in the tests was approximately 7000. The Army only deployed men to nuclear tests.

27. The largest Army presence of 1438 at a particular test was the Grapple Z tests with four firings in August and September 1958. That year the overall size of the regular

²⁷ Muirhead, CR et al, 'Mortality and Cancer Incidence 1952-1998...' NRPB January 2003. Email MOD Medal Office) to Historical Branch (ArmY) 03/03/2025. The Blue books which AWE compiled in the early 1980s are the first known comprehensive list of test participants.

Army was 325,000.²⁸ Less than 0.5% of the Army participated in that test. Other Army activity that decade included extending National Service, re-equipping after WW2, positioning in West Germany and NATO alignment, significant combat in Korea and Suez, and colonial actions such as Malaya and Kenya.

Nuclear Testing Overview

28. The British government tested 21 nuclear bombs between 1952 and 1958. All the tests were on the surface or airbursts. Additionally, there were a series of minor tests that did not involve a nuclear explosion and tested nuclear materials and associated technologies. Those minor tests took place at Emu Field and Maralinga and are described after Antler which was the final firing at Maralinga. Thereafter, the UK participated in US testing conducted at Christmas Island in 1962 and the long-term test series in Nevada, USA. The change from UK testing to cooperative testing with the USA was enabled by a change in US policy and the 1958 UK-US agreement for 'Cooperation for the Uses of Atomic Energy for Mutual Defence Purposes'. A **timeline** for nuclear testing is at **Annex A**.

29. The main role of the Army was engineering support to build and maintain test infrastructure including runways, accommodation, and specialist test facilities. The Army also supplied specialist officers to assist the civilian scientists in developing atomic weapons. The higher-level organization above the Army was joint task forces which had a single service, RN or RAF, lead. Above that were the HMG structures for nuclear work. Those HMG structures evolved in the 1940s and 50s. The Ministry of Supply was responsible for nuclear weapons development and civil uses of nuclear power. The civil function evolved into the UK Atomic Energy Authority (UKAEA) which was established in 1954. The nuclear weapon program was discretely described as High Explosive Research and the initial work developed with staff based at Fort Halstead Kent and Woolwich London. They were led by Dr William Penney. That developed into the Atomic Weapons Research Establishment (AWRE) and in 1950 they established themselves at Aldermaston near Reading. In 1987 its name changed to the Atomic Weapons Establishment (AWE). The arrangements for each test are described below.

Medical Laydown for Nuclear Tests

30. The medical laydown for nuclear tests consisted of routine medicine and health physics. They shared staff, facilities, and activities. The tri-service components for routine medicine were temporarily assigned and deployed under the lead service for a particular test. At Grapple, for example, individual medical records show the treatment

²⁸ Hansard (Commons) vol 583, 'Army Estimates', 6 March 1958.

for infective illnesses like tonsillitis and diarrhoea and environmental complaints such as coral sores. The AWRE health physics teams had greater continuity, and individuals from that team being assigned to particular tests.²⁹ The table below illustrates the medical activities:

Medical Activities Associated with Nuclear Tests		
Routine Medicine		
	Health Physics	
• Treatment of injuries and illnesses. • Chest x-ray.	• Blood counts. • Urine tests.	• Dosimeters.

31. Whilst blood counts and urine tests were used in both routine medicine and health physics, in the context of nuclear testing, the blood counts were more likely to be associated with screening and urine tests with health physics. Dosimeter readings above a threshold triggered the use of additional blood tests during or after attendance at a nuclear test.

32. The arrangements for tests had common elements and unique features. The hazards for the individual arose from and changed according to the size of the bomb, where it was located when it detonated, and geographic and meteorological conditions. The hazards also varied with the individual's function at the test and if that exposed them to radiation. Most had little or no exposure to radiation.³⁰ The arrangements for each test are described below, in chronological order.

Hurricane

Location	Monte Bello Islands northwest of mainland Australia.
Lead service and Force Commander	RN, RAdm AD Torlesse
Date and type of firing	3 October 1952 detonation of atomic bomb placed in HMS Plym.
Approx number of Army personnel	206
Approx number of Service and HMG personnel	1398

²⁹ Arnold, *H-Bomb*, pp. 79-80.

³⁰ Arnold, Lorna, *A Very Special Relationship* (HMSO, 1987), Appendix H. Arnold, Lorna, *Britain and the H-Bomb* (MOD, 2001), Appendix 4.

33. The Hurricane test was important as it established benchmarks for subsequent tests that were emulated, amended, or departed from. Formal planning started in March 1951 when the Hurricane Executive was established with RAdm Torlesse as overall force commander. By May the Executive had established the command and control arrangements.³¹

34. The naval commander was responsible:

(b) For the command of all HM Ships comprising the trial Force and of all those embarked therein. The term “command” includes all measures for collective discipline, welfare, administration, security and health; but as regards the last he shall be advised on radioactivity hazards by a specially appointed Safety Officer.

(c) That subject to his responsibilities in paragraph (b), the trial is conducted to meet the technical requirements of the Ministry of Supply.

35. The Ministry of Supply was responsible for ‘arranging the appointment and training of the Safety Officer’ and ‘For the provision of radiological safety apparatus, for supplying the Safety Officer with such data as he may require and, subject to his direction, for the safety of individuals.’

36. The War Office ensured the Army element to carried out the reconnaissance, planning, and construction of ‘buildings, installations, piers, cables, roads and tracks as may be required.’

37. The pattern was repeated with the other tests, with the most significant part of Army activity being engineering support. The Royal Engineers formed 71 Field Squadron. Their plant and supplies were loaded onto HMS Zeebrugge at Marchwood, shore leave was granted, and they sailed from Portsmouth on 19 February 1952. This was ahead of the main task force to allow them to reach Monte-Bello in the Pacific and carry out their engineering tasks before the main force arrived.³² Their departure was before Order 160 ‘Exposure to Radiation’³³ requiring pre-deployment ‘appropriate medical tests’ was issued on 26 July 1952. Their sailing was ahead of HMS Tracker the health control ship and health physics laboratory and where a RAF Medical Officer was carrying out blood counts. Due to their early deployment, the Royal Engineers did not

³¹ Merlin 01126 Hurricane Trial Orders.

³² Merlin 01126 Hurricane Trial Orders.

³³ Merlin 011126.

have blood counts done in the UK or when sailing. The first point it could have been done was the two-month window when HMS Tracker arrived at Monte-Bello and before the firing which took place on 3 October.

38. The procedures evolved again and the pre-firing set of orders that added in radiation exposure limits were issued on 14 September 1952:

OPERATION "HURRICANE" – TRIAL ORDERS

Order No.1101 – Medical Arrangements for Dealing with Radiological Hazards.
Blood Counts.

1. Everyone who may be exposed to radiation in excess of the normal working rate is to have a total and differential white count done between the beginning of September 1952 and the time of possible exposure.
2. Anyone whose records show that he has been exposed to radiation to the extent of more than 10 roentgens in all, or than 5 roentgens in any one week, is to have the counts repeated.

Exposure Records.

3. These are to be worked out by Health Control and copies of the figures obtained are to be sent daily to the Naval Commander, Technical Director, Safety Advisor and Staff Medical Officer.
4. At the end of the Operation the total exposure is to be recorded in each person's medical history document, and for Naval and Army personnel, in his pay book as well.
5. In the case of Naval and Army personnel the Naval Commander will forward exposure records to Commanding Officers as appropriate. Commanding Officers are responsible for the action in paragraph 4 above and for ensuring that individuals have access to their exposure record should they wish to see it.³⁴

39. The 'normal working rate' mentioned in paragraph 1 was 0.1r per day.³⁵ The key point was that the use of blood counts was predictive depending on the anticipated role at the test, and that any further blood counts were driven by actual exposure to radiation above 5 roentgens in a week. In practice, nobody had been exposed to sufficient radiation to require the additional blood count envisaged in Order 1101. Lorna Arnold's figures in her authorized history showed there were 1275 UK military or civilian

³⁴ HBA NTV litigation record barcode 5007355 / pdf 05007355. Thanks to AWE for drawing attention to Trial Order.

³⁵ Arnold, *A Very Special Relationship*, p.41.

personnel at the test. Of those 25 recorded exposures above 3R but none had recorded exposure above 5R that would have engaged a post-test blood count. Arnold's figures align with AWE data where there are no instances of Army personnel receiving over 5R.³⁶

40. Once the force had deployed the overall health physics arrangements were that AWRE was responsible for dosimetry and the Royal Navy was responsible for doing blood counts for those subject to higher doses of radiation. The post-trial medical report stated:

The main medical concern during Phase III [just after the firing] was radiological hazards. In an operation of this kind, carried out near the limits of human knowledge, the possibility of accidents must be allowed for however carefully radiological safety precautions are applied. If anyone had been exposed to a dangerous amount of radiation it was proposed to transfer him to Perth before the serious symptoms made their appearance. For a less serious case it was still desirable to have some indication whether any measurable damage had been done. For this purpose the lymphocyte count was selected as the most sensitive available. Everyone who might be subject to ionizing radiation had a total and differential blood count beforehand, as near to the time of the firing of the weapon as possible. Afterwards, it was proposed to repeat the count if anyone received more than 5 roentgens in any one week or 10 roentgens during the whole operation. Experience has shown that the effects of smaller doses can only be detected by statistical means, if at all. Intensive blood counting began early in September and nearly 300 counts were done during the month. It may be of interest to mention that one worker who took his apparatus to a shore camp was able, working unassisted, to do thirty total counts and prepare slides in five hours. It is considered now that in a similar operation in the future, if the medical staff were at all hard pressed, little would be lost if this preliminary blood counting were omitted. The manner of recording the amount of radiation received by individuals was as follows:-

Health Control in TRACKER recorded the amount of radiation received by individuals as measured by their film badges. The results were reported daily to Naval Commander, Technical Director, Safety Adviser and Staff Medical Officer. The Naval Commander passed the information to appropriate Commanding Officers for recording the total exposure in pay books and medical history documents at the end of the operation.³⁷

³⁶ AWE, Blue Book 'General Description and Statistics', 21 May 1982, p. A1. Arnold, *A Very Special*, p.302.

³⁷ HBA copy of ADM239/434, 'Operation Hurricane Report by the Naval Commander', 1953, p.62.

41. The service personnel and medical records for personnel who participated in the Hurricane test were recalled and inspected. Those records confirm the following points:

Service and Medical Records Summary from Hurricane

- There was a high degree of secrecy associated with the testing. The service record entry for soldiers at the test typically stated 'HM Ships' or 'HM Ships Australia'. After the test, two officers received personally addressed orders reminding them of secrecy.
- One soldier had a pre-deployment medical and his was done on 7 March 1952.
- A degree of extrapolation is needed with the records. For example, a soldier had an inoculation for yellow fever on 11 February 1952 and sailed on 18 February. The inoculation must have been for the nuclear test deployment, but it was not stated as such in his medical record.
- Royal Engineer Sapper died during the deployment. He was driving a bulldozer, misjudged a slope, and it overturned and crushed him. He was buried in Onslow cemetery Australia.
- Some conventional medical records associated with being at the test were located. For example, a soldier had a hernia and another was treated for boils on his back and alopecia, a skin/scalp condition.
- The AWE dosimetry records were cross referenced to service and medical records. For most there was no recorded exposure to radiation. Of those who were exposed to radiation:
 - For a soldier, AWE recorded 2R but no record of radiation can be found in his service medical records.
 - For a soldier AWE recorded 1.670R but no record of that can be found in his medical records. It was recorded that his medical records were sent to the War Pensions Directorate at Norcross on 22 June 1993. Therefore, his medical records are no longer in his service records.
 - A soldier is described below with regard to urine testing.

Urine Testing at Hurricane

42. Some emergency monitoring included urine testing. The Radiological Hazard Division report stated:

The highest concentration to which any individual was exposed was approx. 15 uc/cc for approx. twenty mins. In terms of tolerance such an inhalation is negligible, though it was sufficiently great to result in the detection of fission products in urine samples (see BE report). The exposure quoted occurred in the

case of three radiological surveyors who had disobeyed instructions to wear respirators.³⁸

43. The report did not name the three individuals but since some individuals named in the Contamination Survey team report were Army officers, further searches of MERLIN records database (described below) were carried out using the search term combination of 'urine' within 10 words of 'Trimouille' (an island part of the Monte-Bello chain). That search identified a naval officer who stated he was one of the individuals who had been in the party that had their urine tested. The context was a 1992 war pension claim as he was suffering from bowel cancer which he attributed to being at a nuclear test.³⁹ When making the claim, he identified a soldier who also had his urine tested. The claim resulted in extensive correspondence and evidence collation and although the focus was on the naval officer, it revealed he was alongside three soldiers who were flown back to the UK for supplementary testing at the Department of Medical Physics at Leeds General Infirmary. In combination, the service record for a soldier, the AWE Blue Book entry for them, and the claims file for naval officer showed the following:

Service and Medical Record for a soldier

- Born 1914.
- Enlisted as a soldier in 1932.
- Captured by the Japanese in 1942 and released in 1945.
- Commissioned as an officer in 1951.
- After the respirator removal incident, it is probable his urine was tested at Monte-Bello. He flew back to the UK shortly after. On 25 November 1952 he was sent a SECRET and URGENT order to report in civilian clothes to the Royal Infirmary Leeds for a follow-up medical exam.
- The Leeds examination report was not found in his service medical records. However, a copy of it for him and the three other individuals was located in the 2000s during litigation preparations, probably from the Royal Infirmary or Royal Navy records for their officer. That report stated that a body potassium method of measuring historical exposure to radiation had been used. It is probable that the method was so specialist that AWRE lacked the capacity to do it themselves. The Leeds Doctor stated that the 'excess activities are very small and in only two [out of the four] cases are they statistically significant.'

³⁸ Merlin 01000326, scan of 'Operation Hurricane Report of the Radiological Hazard Division', 15 May 1953, para 9.3.2. The reference to the 'BE Report' is probably a reference to 'A First Essay to Assess the Biological Effects of the Atomic Weapon Fired in October 1952', c.1953. Located in HBA scan of DEFE 16/192.

³⁹ MERLIN.

- When discharged in 1956, his discharge medical report stated he had suffered from a hernia at Monte-Bello in 1952.
- His service record contained a FMed 4 envelope where medical records are typically held. The FMed 4 was almost empty. The only content was a slip of paper dated March 1956, and as he was about to leave the Army, that stated that the FMed 1 form that was typically completed on enlistment was 'not available'. Medical records associated with his presence at a nuclear test were not located including his treatment for the hernia, probable urine testing, and the further test in the UK at Leeds.
- In January 1953, he was sent an order from the 'Controller of Atomic Energy', and required a receipt back to a Colonel in the Army Adjutant General's office, reminding him of the secrecy requirements relating to atomic testing including the time of the explosion, areas of contamination, instrumentation used, and other matters.
- The contemporary radiation exposure records were organized day-by-day and he was on those listings.
- The AWE Blue Book entry for him records that he was exposed to a total of 3090 millirem (3R) of radiation at Monte-Bello.⁴⁰
- He died in 1985.

Totem

Operation Name	Totem
Location	Emu Field, mainland Australia.
Lead service and Force Commander	No single service lead. Coordinated by AWRE staff.
Date and type of firing	Test 1, 15 October 1953. Test 2, 27 October 1953. Atomic bombs mounted on towers.
Approx number of Army personnel	11
Approx number of Service and HMG personnel	106

44. The Hurricane firing could not provide all the information needed for the UK to become nuclear power. More information was needed from smaller yield plutonium bombs. The Royal Navy lacked the ships to return to Monte Bello, so the Australian government was approached regarding having a test on mainland Australia. They settled on Emu Field some 300 miles northwest of Woomera. The Australians were

⁴⁰ AWE, Blue Book 'Listing of Persons: UK Army, 1982 , p.54.

substantially more interested in radiation hazards of a mainland firing than had been the case with Monte Bello. They also provided more practical help, a factor which explained the small size of the UK party. The UK group was led by AWRE with CA Adams, the trial technical director leading the test until Penney arrived days before the first firing.⁴¹

45. The Army role was limited, and the AWRE 'Totem Administration' report explained the Army officers already at AWRE were augmented with five additional five officers. The engineering tasks were carried out by the Australian Army not British Royal Engineers.

46. The medical arrangements for AWRE trials staff, AWRE military staff, and augmentees were intended to be common:

As a general rule and Totem was no exception, trial conditions are such that only persons who are medically fit are allowed to participate. This principle, safeguards both the individual and the Ministry against complications and possible financial losses what might arise in the future....

Inoculations, X-rays, blood counts, and examinations presented no difficulty at Harwell and Aldermaston where the necessary facilities were available and such requirements are day to day routine....

Medical examinations for staff seconded from other Ministries were carried out mainly at Woolwich, but where long distances were involved medicals were arranged locally.

Duplicate medical history sheets were passed to AO [Administration Officer] by the CMO [Chief Medical Officer] for use if required, by the Medical Officer on site. At the conclusion of the trial all medical documents were passed back to the CMO.⁴²

47. As an adjunct to the nuclear testing, the Australian Army arranged for one of their Centurian tanks to be placed 250 yards from the explosion. It was manned by dummies with dosimeter film badges. A British RAMC pathology officer arranged a test that exposed medical equipment to radiation including placing a first aid kit in the tank. His

⁴¹ Arnold, *A Very Special Relationship*, pp.58-61.

⁴² HBA copy of DEFE 16/27, AWRE 'Totem Administration', 11 June 1954, p.8.

report focused on the radiological effects on the medical equipment but at the end he wrote:

It was considered prior to the explosion of the weapons that it might be of value to examine urine and faeces of selected personnel of selected personnel with the view to determining whether fission products which might be accidentally taken into the body were detectable by simple methods. Accordingly specimens of urine and faeces were obtained before and after exposure in the contaminated area, from certain of the U.K. Staff. No significant increase in activity was found in any of the urines examined in the S.U. liquid counter. [A Doctor] at the Medical Research Council team at AERE Harwell, who examined the faeces was also unable to detect any increase in activity. This finding was not unexpected, as due to the type of “fall-out” occurring with these explosions, the hazard from ingestion and inhalation of fission products was minimal.⁴³

48. The report does not state how many UK personnel were tested or who they were. However, it is probable that the medical records for a soldier who was monitored were located and they are set out below:

Service and Medical Record for a soldier

- Born 1915.
- The medical records are in a FMed 4 envelope and subsequently jacketed with an Army Pensions Office cover.
- Before posting to Australia, he was certified medically and dentally fit for tropical service.
- In July 1953 two blood counts were done for him just prior to deployment.
- There is typed slip recording ‘Radiation Dosages – Operation Totem’ which records totals of gamma dose of 6.0 and and beta dose of 7.02.
- There is an FMed 5 Attendance and Treatment Card for Australia July-November 1953 that records, ‘No treatment. Received total of 13.02 Roentgen of B/Y radiation during atomic tests in Australia. Record states no symptoms – no treatment. Remained perfectly fit.
- A blood count was done in April 1958. That was probably not associated with his nuclear test experience.
- Chest x-rays were done during the 1957-1959 period. That was probably not associated with his nuclear test experience.
- After leaving the Army he died in 1992.

Contemporary Medical Analysis

⁴³ HBA copy of DEFE 16/27, AWRE ‘Totem Administration’, 11 June 1954, (Medical Annex).

- April 1958. Normal counts and normal examined film
- Mid July 1953. White cell count low 4,400 cmm.
- Later in July 1953. Recovered normal counts: white cell count 7,500 cmm
- No obvious effects of radiation on blood counts and documented to remain well.

49. The medical records for that soldier suggest the medical procedures stated by AWRE were followed. Another feature of the Totem tests was that it was the first time the RAF, at their request, carried out cloud sniffing of the atomic cloud. The AWE historian Lorna Arnold stated the Canberra aircrew returned with radiation exposure readings between 10 and 20 R (roentgens) and their blood and urine was analysed which showed no trace of fission products. The aircrew readings were similar to the 13 R recorded for the soldier. Arnold's analysis confirmed the capacity to do blood and urine testing was available at TOTEM.⁴⁴

50. No War Office records connected with TOTEM have been identified during this research, which would be expected due to the limited Army participation in the test.

Mosaic

Location	Monte Bello Islands off north west of mainland Australia.
Lead service and Force Commander	RN, Captain
Date and type of firing	16 May 1956 and 19 June 1956 detonation of atomic bombs mounted on towers.
Approx number of Army personnel	72
Approx number of Service and HMG personnel	1383

51. The Mosaic tests were an interim step between the atomic bombs that had already been tested and the hydrogen or thermonuclear bomb. The governance and command and control arrangements relating to Mosaic were set by the newly renamed Atomic Weapons Trials Executive and planning started in spring 1955. The Executive was chaired by the Ministry of Supply and the single services, AWRE, the Commonwealth Relations Office, and an Australian Government representative

⁴⁴ Arnold, *A Very Special Relationship*, pp.58-61.

attended. The Army was represented by a Colonel.⁴⁵ The Executive provided oversight of Mosaic and dealt with the concurrent planning for Buffalo (see below) that was also scheduled for 1956.

52. The Royal Navy was the lead service. The main Army task was engineering support and a Major made a planning visit to Monte Bello. On his return he was promoted to Lt Col and appointed Officer Commanding of an ad hoc Independent Troop 25 Field Engineers. The troop drew on personnel from 25 Field Engineer Regiment that was based at Maidstone and a wider trawl of the Royal Engineers filled gaps that could not be met from 25 Engineer Regiment. The troop was formed in October 1955. Other than force generation, the Royal Engineers account was silent on other administrative matters including medical. Their focus was almost exclusively on the engineering task and the people, equipment, and stores needed for that. They were particularly amused by a malfunctioning monorail unit that was sold to them over lunch with the supplier Road Machines (West Drayton) Ltd.⁴⁶

53. The 'Radiological Group Report' for the test records dosimetry. There is no mention of any blood or urine testing taking place. However, it is possible that if the model from Hurricane was being followed, that blood counts were done using ship medical facilities. With regard radiation they wrote, 'The general level of radiation exposure was satisfactorily low: approximately 5% of the personnel received doses in excess of 0.05 r.'⁴⁷ They listed the personnel who received in excess of 0.05r which included the following Army personnel:

Radiation Exposure of Army Personnel at Mosaic		
Name	Unit	Dose, r
	HMS Alert (although assigned to a ship, he was an Army officer)	1.30
	AWRE	7.35
	Royal Engineers	0.30
	Royal Engineers	0.06
	AWRE	3.95

⁴⁵ HBA copy of Adm 296/5, Atomic Weapons Trials Executive minutes 5 October 1955.

⁴⁶ WO 320/4, Operational Commander, 'Mosaic Monte Bello Atomic Tests – 1956', Chapter 4 Royal Engineers Planning pp.33-42.

⁴⁷ HBA copy of DEFE 16/89, 'Radiological Group Report', 15 April 1957, p.16.

54. The Army personnel who had been most exposed to radiation had both been seconded to AWRE and were part of the radiological survey team checking for contamination after the firing. Their service and medical records showed:

A soldier

- Born 1919.
- The records regarding his attendance at the nuclear test was correspondence to award him a 'hard lying allowance' which was in his service record. His officer's annual report for 1956 confirms he was at the test but does not describe his activities there.
- In October 1956 and soon after his return from Monte Bello he was diagnosed with a minor pyogenic skin infection.
- He retired from the Regular Army in 1960 but continued to serve in the Territorial Army.
- In March 1962, the Army Pensions Office returned his F Med 4 envelope.
- In November 1967, the Army Senior Military Representative at AWRE wrote to MOD and submitted an update to the records for him. This was added to his FMed 4 envelope as a retrospective entry on Army Form A21 'Personnel Record of Exposure to Radioactivity and of Medical Examination.' It records the exposure as being 7350 mrem 'y' which matches the 7.35r recorded at the time. There is also an entry of 32,500 mrem B. The A21 form states 'this record must be preserved for a period of thirty years'. The A21 form had boxes for radiation exposure and blood counts. That AWRE only supplied the radiation record in 1967, suggests they did not hold blood count records for him.

A soldier

- Born in 1931.
- B199a confirmed he was attached to Atomic Weapons Research Establishment in January 1956.
- In January 1956, his regiment received a Secret order to release him for the atomic trial. Generally posting orders were not secret.
- He received the 'hard lying allowance' for attending the nuclear test.
- His officer's annual report for 1956 confirms his attendance at the test and is silent about his activities there.
- As part of his pre-deployment medical AWRE sent him to the Royal Berkshire hospital Reading for dental extraction.
- There is no other record of medical treatment associated with his presence at Mosaic.

- In November 1957 a blood count was requested and recorded as he was handling radioactive training materials. At that point he was instructing at the School of Infantry.
- A rather extensive record of treatment from the 1960s was mostly for irritable bowel syndrome and was recorded in his FMed 4 records.
- Some hospital records were recovered from the Central Health Records Library. They mostly concern treatments for irritable bowel syndrome. A blood count was done in February 1980 but there is no indication it related to his presence at a nuclear test.
- He retired from the Army in 1981.

Buffalo

Location	Maralinga, mainland Australia
Lead service and Force Commander	RAF, Air Cdre CT Weir.
Date and type of firing	27 September 1956 atomic bomb mounted on a tower. 4 October 1956 bomb (with uranium core) on the ground. 11 October 1956 air dropped nuclear bomb using reduced yield Blue Danube. 22 October 1956 tower mounted bomb.
Approx number of Army personnel	194
Approx number of Service and HMG personnel	1285

55. The planning stage for Buffalo overlapped with Mosaic. The main differences arose from the Australian Government taking a far closer interest in Buffalo as it was taking place on the mainland and it was a more substantial operation than the previous mainland firing of Totem. It was the first use of Maralinga which was established as a semi-permanent test location. The building arrangements used the contractor Kwinana Construction Group and Australian Army engineers. This substantially reduced the need for Royal Engineers to support the test. As an air-dropped weapon was part of the test, the RAF were the lead service with Air Cdre Weir appointed as the service Commander.

56. The force generation for the Army was particular to Buffalo. Of the total of 194 Army personnel at the test, 168 were part of the Indoctrination Force. It had been intended to send more, but the Suez crisis disrupted the release of officers.⁴⁸ The

⁴⁸ HBA copy WO216/920, Commander I.F. Group, 'Buffalo Trials',

Indoctrination Force was an Army initiative to deepen its understanding of atomic warfare, and it was the only known example of the Army proposing and executing its own activity associated with the tests, rather than having a supporting role.

57. When making the decision, the Army recognized that participants in the tests could be exposed to radiation. The Executive Committee of the Army Council minutes for 18 November 1955 recorded, 'The Chairman said that it was clearly desirable to take the fullest possible advantage of the atomic trials in 1956. A number of technicians would be going to report on the equipment which it was intended to expose to the effects of atomic weapons, and they would incidentally themselves be subjected to the effects.'⁴⁹ The risk of radiation exposure was low enough to justify the gain in knowledge for how the Army would have to fight a conventional battle in nuclear conditions.

58. The orders for Army personnel stated, 'In the officers' own interest they will be subjected to a blood count as for workers with radioactive substances plus a chest X-ray. Both to be completed prior to leaving permanent duty station.'⁵⁰ The post-test report stated that a thorough job had been done for the Army element of test personnel:

All personnel were also subjected to a blood count and a chest X-ray in view of the probability of exposure to radiological hazards. In the event, the cumulative dose received by members of the War Office team was in all cases well within the acceptable peacetime limits. The blood count remains a necessary precaution, however, to protect the officer's pension rights in the event of his developing any disease in later life which might be attributable to his exposure to radiological hazards....

Medical documents of the members of the War Office were held by the Range Medical Officer for the duration of the trial and returned to the parent War Office branch on return to UK.⁵¹

59. In order to have survived, the record therefore would have gone from the Range Medical Officer, to the War Office, to the Regimental Medical Office, and placed in the officer's medical records.

⁴⁹ HBA copy WO163/618, ECAC minutes 18 November 1955.

⁵⁰ RAMC copy, copy of original order, Buffalo Trial: Indoctrinee Force Instruction No 1, 16 July 1956, para 14c.

⁵¹ HBA copy, WO32/17397, 'Operation Buffalo: War Office Administrative Report', 19 March 1957.

60. That report contained a medical annex by a RAMC doctor. He described how three weeks before the tests the Australian Government requested some 400-500 of their personnel at the test should have blood counts and chest X-rays done. This mirrored the arrangements for UK personnel. He also described the arrangements for Radiation Safety and stated 46 persons 'were given medical permission to be exposed to the higher integrated dose of 10r during the four shots; only one person was refused in view of his blood count. Most of those personnel were the RAF crew of the Canberra.'⁵² Since nobody reached the 10r higher integrated dose, it is probable that little or none was done. If the lower 3r dose was the threshold for monitoring, then that would only have engaged two Army personnel.⁵³ The records for a soldier showed:

A Soldier

- Born in 1922.
- He applied for a wartime commission.
- After the war he applied for a regular commission which was granted in 1946.
- He was earmarked for loan to the AWRE.
- In June 1956 he attended a four-day course on radiological survey at the Joint School of Chemical Warfare.
- His officer's annual report said that at Buffalo, 'He was one of six officers selected to carry out user trials on army radiac instruments, with additional duties in connection with the survey of radio-actively contaminated areas.'
- His medical records were enclosed in a FMed 4 envelope. They included a car crash with head injury in 1946. In 1953 he was re-examined and there was a diagnosis of 'post traumatic epilepsy'.
- There is no record of any blood counts, chest x-ray, radiation exposure, or conventional medical treatment from his time with AWRE and supporting the Buffalo trial. If it is assumed that some medical monitoring was carried out, the records of it cannot be found in his medical records.
- His discharge medical examination was carried out in November 1958 does not mention his attendance at the Buffalo test, but does mention other periods abroad which were Malaya, the middle east, and Germany (BAOR).

61. A more typical service and medical record from Buffalo showed:

⁵² HBA copy, WO32/17397, 'Operation Buffalo: War Office Administrative Report', 19 March 1957 (medical annex).

⁵³ AWRE (blue book) 'Listing of Persons at UK Overseas Defence Nuclear Experimental Programmes UK (Army), 10 March 1982.

A soldier

- Born 1913.
- He was commissioned in 1941.
- He continued his Army career after the war and was promoted to Major.
- His medical records record treatment for a urine infection in 1954 that resulted in blood counts and urine monitoring being done for him.
- Just prior to his deployment on Buffalo, a chest x-ray was arranged for him on in July 1956. Unusually this was done at a civilian hospital, the Manchester Chest Clinic.
- A blood count was done for him in July 1956. The nature and timing mean it was arranged in anticipation of Buffalo.
- A slip records:
'BUFFALO TRIALS RADIATION DOSE
Maj [XXXX]
TOTAL DOSE RECEIVED .52.r.'
- The dose recorded in his medical records matches the AWE Blue Book entry for him.
- There are no other medical records associated with Buffalo.
- There are documentation gaps in his service record.
- He died in 1980.

Antler and Minor Trials

	Antler (initially described as Sapphire and Volcano).
Location	Maralinga, mainland Australia
Lead service and Force Commander	RAF, Air Cdre WP Sutcliffe
Date and type of firing	14 September 1957 tower mounted. 25 September 1957 tower mounted. 9 October 1957 balloon suspended.
Approx number of Army personnel	135
Approx number of Service and HMG personnel	1548

Minor Trials Programmes	Various; Kittens, Tims, Rats, Vixen, Ayres, Hercules, and Brumby.
Location	Emu Fields and mostly Maralinga
Deployment and Return	September 1953 to August 1967
Lead service and Force Commander	AWE and various commanders
Programmes	Various component and safety experiments (without a firing) and clean up operations.
Approx number of Army personnel	174
Approx number of Service and HMG personnel	555

62. Planning for what became known as Antler started in 1956. The execution phase overlapped with the Grapple tests. The tests focused on lower yield and lightweight warheads that would be suitable for fitting to a ballistic missile. The test teams returned to Maralinga. During and after Antler there were minor trials that continued into the 1960s. There was little need for a large Royal Engineers deployment as the test infrastructure from Buffalo was still available and remedial works were managed by the Australian Department of Works.⁵⁴ The service element of the test team was led by Air Cdre WP Sutcliffe and the scientific lead was CA Adams.

63. Most Army personnel were in the Maralinga Range Support Unit (MRSU) which was a semi-permanent joint organization concerned with administrative support and long-term maintenance of the facility. The War Office administrative records for Maralinga are those of the London HQ managing a deployed unit and provide limited insight into what was happening on the ground. The War Office was not issuing movement orders to formed units. The MRSU was managed with individual augmentees who joined an assembly unit in the UK and then went to fill the variety of posts at Maralinga typically on a one year posting. For those people, it was noted in October 1957, 'Inoculations, blood count, chest X-ray must be carried out in good time before departure from the UK.'⁵⁵ The service records for individuals deploying to Maralinga in this period often show evidence of blood counts being done for them. For example:

A soldier

⁵⁴ Arnold, *A Very Special Relationship*, pp.172-3.

⁵⁵ WO 32/17278, 'Conversation refers', 18 October 1957.

- Born 1937.
- His civilian trade was a plumber and he was enlisted into the Royal Engineers as a national serviceman on 19 June 1958.
- In November 1958, a RAMC doctor requested a blood count for him. The results were returned stamped on the back of the request card and placed in his FMed4 medical record.
- A chest x-ray was done but it is not recorded if that was on enlistment or in connection with deploying to Maralinga.
- Minor medical treatments not connected with nuclear testing are recorded.
- On 4 December 1958 he deployed to Maralinga and returned to the UK on 19 September 1959.
- On completion of his national service he re-enlisted for the Regular Army and served on until 1963.

Contemporary Medical Analysis

- Normal counts and normal examined film. No further comment possible.

64. Another deployed on the same day and his records show a similar path:

A Soldier

- Born 1937.
- His civilian trade was a joiner and he enlisted into the Royal Engineers as a national serviceman in June 1958.
- In November a RAMC doctor requested a blood count for him and sent the sample to the [Leishman] pathology laboratory at the Cambridge Military Hospital Aldershot. The results were stamped on the back of the request card and placed in his FMed4 medical record.
- A chest x-ray was also requested.
- On 4 December 1958 he deployed to Maralinga and returned to the UK on 19 September 1959.
- At Maralinga a build up of ear wax was reported.
- He left the Army in 1960.

Contemporary Medical Analysis

- I have no concerns – the counts are normal and a blood film was done and reported as normal. No further deductions or comment possible.

65. The radiation records from Antler list personnel who were exposed to the lower integrated dose of 3R and therefore proscribed from further nuclear work for varying periods of time. There were 14 RAF personnel, 2 civilian scientists, and two Sergeants from the support unit. Their service is unstated, but a Sgt is not listed in the Army blue book, and another cannot be conclusively identified due to his common surname and lack of initials in the health physics report that mentions him.⁵⁶ The health physics report was written by a Major on secondment to AWRE.

Thyroid Monitoring

66. The Major described human thyroid monitoring done at Antler which included a soldier from the British Army. He had been clearing radioactive dust at Taranaki and it was recorded, 'The maximum whole body dose received by them was 0.18r. A thyroid count failed to reveal any measurable quantity of iodine-131. Everyone working in Taranaki wore a respirator when in the vicinity or downwind of the brushing operations.' He explained the thyroid monitoring included 31 participants, including a British Army soldier. A crystal was placed 23 cms from his neck and the results were recorded.⁵⁷ The thyroid monitoring technique pioneered at Antler is still in use.⁵⁸

67. Antler was the last firing on mainland Australia, albeit that minor trials and then the clean up continued at Maralinga for several years. The month after the final firing the health physics arrangements at Maralinga were updated and on 19 November 1957 the War Office issued a new instruction concerning 'UK Personnel for Duty at Maralinga'.⁵⁹ Due to radiation risks and the tropical climate, individuals had to be medically fit and with normal blood counts. The permitted range was the same as the more general fitness to work with radiological material that the Army had set in 1954 (see above 'Radiology with the Army'). The records for the individual including screening and any subsequent monitoring were to be placed in the individual's FMed 4 and duplicates kept in a central 'special register'. There is some evidence this was done with the evidence of screening tests being found in FMed 4s. The central special registers have not been located and were probably destroyed. There was a known gap between policy intention and implementation. In September 1958, the officer commanding the UK Army Element at the Maralinga range wrote to the War Office and copied the regimental records offices that arranged postings to Maralinga. He

⁵⁶ 'Operation Antler – Interim Report Section B Part 3 Health Physics', in HBA copy of DEFE 16/415.

⁵⁷ MERLIN, 05001019, AWRE Health Physics Group, 'Thyroid Counting', 1957.

⁵⁸ MJ Youngman, 'Practical Guidance on Thyroid Monitoring for Radioiodine Using Hand-held Instruments', UK Health Protection Agency, February 2013.

⁵⁹ DEFE 16/855, 'UK Personnel for Duty at Maralinga', 19 November 1957. That DEFE record is a compilation of records provided to the Australian Royal Commission.

complained, 'Some personnel, in particular RN personnel, are not having blood counts prior to embarkation (vide WOL 112/Misc/6048 PA1(b) dated 19 November 1957.'⁶⁰

68. In comparison with other tests, the records footprint for Antler is light. The only War Office records that were selected for permanent preservation were WO 320/3 that concerns target response and WO 32/17278 concerns Maralinga administrative records. That position was not unique to the Army and Arnold commented on gaps in records.⁶¹

Grapple

69. The Grapple tests took place at the pacific Christmas Island between May 1957 and September 1958. There were nine firings spread over four phases.

	Grapple
Location	Christmas Island, pacific.
Lead service and Force Commander	RAF, AVM W Oulton
Date and type of firing	15 May 1957 air dropped over Malden Island. 31 May 1957 air dropped over Malden Island. 19 June 1957 air dropped over Malden Island.
Approx number of Army personnel	638
Approx number of Service and HMG personnel	3515

	Grapple X
Location	Christmas Island, pacific.
Lead service and Force Commander	RAF, AVM W Oulton
Date and type of firing	8 November 1957 air dropped Christmas Island.
Approx number of Army personnel	625
Approx number of Service and HMG personnel	2340

⁶⁰ Service and Medical Record for a soldier containing CO to War Office letter 'Medical Examination' dated 19 November 1957.

⁶¹ Arnold, *A Very Special Relationship*, p.172.

	Grapple Y
Location	Christmas Island, pacific.
Lead service and Force Commander	RAF, AVM J Grandy
Date and type of firing	28 April 1958 air dropped over Christmas Island.
Approx number of Army personnel	1331
Approx number of Service and HMG personnel	3723

	Grapple Z
Location	Christmas Island, pacific.
Lead service and Force Commander	RAF, AVM J Grandy
Date and type of firing	22 August 1958 balloon suspended over land. 2 September 1958 aid dropped over Christmas Island. 11 September 1958 air dropped over Christmas Island. 23 September 1958 balloon suspended over land.
Approx number of Army personnel	1438
Approx number of Service and HMG personnel	4374

70. The RAF was the lead service for the Combined Task Force and the commanders were AVM Oulton and then AVM Grandy. The aim of the test was to work up to a weaponized hydrogen bomb that still functioned if it had been radiated by an adversary's first strike and to catch up with the USA and USSR before a test ban was introduced.

71. The Combined Task Force was based in the Air Ministry and when it deployed to Christmas Island, a rear HQ remained there. In 1960, command was transferred from the joint task force to RAF Transport Command as the task had become logistics back to the UK and handover to the USA who used Christmas Island for their tests in 1962. The Task Force Grapple HQ was disestablished.⁶²

⁶² WO 32/16391, 'Establishment... Cancellation', 3 May 1960.

72. On 16 December 1955, the Executive Committee of the Army Council approved the Army contribution to the Grapple planning team and earmarked 28 Field Engineer Regiment for deployment to Christmas Island.⁶³ The Army had an element within the Combined Task Force which for Grapple Z was headed by a Colonel. Additionally, there was the Army element located within AWRE and a team within the War Office responsible for the Army organization needed to support the Combined Task Force and other UK tests at Maralinga.⁶⁴

73. The Army components were:

- Royal Engineers.
- 51 Port Operating Squadron, a bakery, and 94 Company for transport, Royal Army Service Corps.
- The Army Postal Unit managing British Forces Post Office (BFPO) 170.
- Royal Signals.
- Royal Army Ordnance Corps handling special stores and operating a laundry.
- Royal Electrical and Mechanical Engineers maintaining vehicles and plant.⁶⁵

74. The arrangements for Grapple reflected those from previous tests. The Army tasks of engineering, maintenance, roads, port operating personnel, and airfield construction. Under the heading of 'domestic services' the RAF was responsible for medical arrangements. AWRE was to 'establish and operate Health Control Centres on Christmas Island and to give advice on the interpretation and implementation of the Grapple Radiological Safety Regulations'.⁶⁶

75. The orders from the War Office to Army units deploying to Grapple did not require blood counts but included a section on Inoculation and Vaccinations that required that:

⁶³ WO 32/16391, 'Army Staff for Operation Grapple (draft for ECAC approval)' December 1955.

⁶⁴ WO 32/16393, 'Operation Grapple Z', 13 June 1958. WO32/16391 passim.

⁶⁵ HBA copy 'Report on the work of the Army Element Task Force Grapple Vol 1, June 1960, pp.42-3

⁶⁶ WO 32/16393, 'Operation Grapple Z', 13 June 1958.

All personnel will be inoculated against smallpox, typhoid group, and tetanus and will carry and have available for inspection the appropriate International and Service Certificate of vaccination/inoculation.⁶⁷

76. Those orders were issued on 8 August 1957 and applied to 605 Army personnel that would have reached Christmas Island that month and in time to support Grapple X. Similar wording applied regarding inoculations which were the only medical instructions issued for the following deployments:

- 38 Corps Engineers and consisting of 191 Army personnel ordered on 18 September 1957.
- 12 Independent Field Squadron and consisting of 166 Army personnel ordered on 13 December 1957 and confirmatory order on 20 January 1958.
- Royal Army Service Corps elements consisting of 42 personnel ordered on 10 January 1958.
- 94 Company Royal Army Service Corps 119 personnel given warning order on 11 April 1958 and move order on 26 April 1958.
- 36 Corps Engineer Regiment including 46 Field Park Squadron given move order on 20 August 1958.

77. The Army position of not doing blood counts for most of its personnel matched the position of the Royal Navy, RAF and the joint position of HQ Task Force Grapple. On 1 July 1958 AVM Grandy meet with R Pilgrim from AWRE and they discussed film badges and the linked issue of blood counts. The following day Grandy wrote to Pilgrim to record the discussion and confirm decisions. He explained that most personnel on Christmas Island did not have film badges or blood counts. The minority of personnel working in controlled areas where radiological exposure and contamination could occur did. For those personnel:

The policy has been to define these areas and control entry and exit thereto, admitting only personnel both service and civilian (AWRE) whose duty necessitates their working in these areas. These personnel have been given appropriate medical examinations (blood count) and are provided with film badges.⁶⁸

⁶⁷ WO32/16393, 'Operation Grapple Air Movement Instruction No 1', 8 August 1957.

⁶⁸ Merlin ES010648_007, Grandy to Pilgrim, letter 2 July 1958.

78. The issue that necessitated a change in policy was that the type of firings changed. The previous Grapple firings had been air dropped at New Malden or when at Christmas Island, the height at explosion meant little impact on Christmas Island. The next firing was due to take place on the isolated southeast end of the Island and suspending the bomb from balloons. Therefore, the firing could contaminate the ground below. The medical records reflected that change and some were screened. Eight individuals in the dip sample had blood counts done on Christmas Island in August and September.⁶⁹ Another factor was explained as, 'First consideration of a film badge was provoked by the lego-medical aspect of disability claims. A case is about to start and there may be some difficulty is disproving such claims.' That case concerned a serviceman who died from leukemia and whose records are discussed later. Regarding blood counts Grandy stated:

At the moment the vast majority of service personnel at Christmas Island are not medically examined (blood counts) either prior to or after serving on the Island. However, contamination levels have been calculated on the assumption that all serving at the Island could be regarded as occupational workers and this category of personnel at Aldermaston have medical tests (blood count). Those at the Island, other than AWRE however, do not.

79. The position was that all AWRE staff had blood counts, service personnel working in controlled areas did, and the majority of service personnel did not. Grandy explained he had agreed that 'it would be a wise precaution to institute a medical examination (blood count) for those Army and other personnel who are required to take part in rehabilitation work after balloon firings at the southeast end.' This extended the controlled areas to include the ground under the balloon firings.

80. Checks of individual service and medical records confirm the position that Grandy stated was correct and that most Army personnel did not have blood counts or urine tests before or at Christmas Island. For example:

A Soldier

- Born 1936.
- He was posted to Christmas Island and departed the UK on 20 June 1956. He departed Christmas Island on 26 August 1957.
- He had 56 days post-Grapple leave and left the Army.
- The Army Blue Book does not record any exposure to radiation.

⁶⁹ NTVs identifying numbers.

- Examination on enlistment recorded cloudy urine, no scars or tattoos, mild acne, and flat feet.
- A chest x-ray was done, which was typical for national servicemen.
- In May 1956, just before posting his inoculations were updated with a booster.
- Medical treatments on his way to Christmas Island were provided on the ship and included dealing with a scalded foot and a rash.
- His medical examination prior to discharge was done at 160 Wing RAF Hospital Christmas Island by a Sqn Ldr doctor with an unreadable signature. That recorded cloudy straw urine.
- There was no record of any blood counts being done for him.
- His record is representative of many who were at Christmas Island in that he was a national serviceman, he was not exposed to radiation, and no blood count was done for him.

81. On pre-deployment blood counts, Grandy and Pilgrim thought it was a good idea and wanted to do it. However, Grandy explained the RAF / Air Ministry Medical Branch were opposed and the views of the Navy and Army were unknown as they had not been consulted.⁷⁰ As a novel activity, it was unclear who had authority to decide. AWRE had most experience of dealing with radiation and a responsibility for health physics at the tests, the single services were responsible for their personnel, and Grandy did not feel he had authority to impose a solution even though it aligned with what AWRE recommended and did for their own personnel.

82. Grandy summoned AWRE and the single services to a meeting on 15 July 1958. The Army was represented by a Lt Col. The issue was a medico-legal one. Air Cdre Stamm argued that if a pre-deployment blood count showed as normal and then an individual developed leukemia, 'it might be difficult to refute the allegation that this was due to radiation received at Christmas Island.' The alternative was argued by a Dr from AWRE who 'was convinced on the other hand that a blood count was of value by not exposing to radiation people of poor health. He considered that it would prejudice the case if no blood count was taken and a person became ill later.'⁷¹ The meeting decided that all personnel going to the forward area of Grapple Z should have blood counts before the test. The question of all personnel being posted to Christmas Island was remitted to the Air Ministry in consultation with the other two services. One matter that the Grapple meeting did not consider was that for all those deploying to Maralinga, 'inoculations, blood count, chest X-ray must be carried out in good time before

⁷⁰ Merlin ES010648_007, Grandy to Pilgrim, letter 2 July 1958.

⁷¹ Merlin ES010648_004. Meeting Minutes held on 15 July 1958.

departure from the UK'.⁷² The inconsistency was not resolved until after the testing had finished. The inconsistency had its origin in the airdropping arrangements for Grapple and it was the prospect of balloon firings on Christmas Island that changed the risks being faced as the rehabilitation (decontamination) task was to be on the Island.

83. The Air Ministry took the action they had been given on 15 July and on 23 September 1958 wrote out explaining that blood tests would only be applied to those with a role in the controlled area at Christmas Island.⁷³ The same day the last Grapple Z firing took place. Unbeknown to those at Christmas Island, it was the last UK atmospheric firing.

84. On the island, the medical records for servicemen show there was a program of blood counts being done for screening purposes. From 12 to 17 August, eight servicemen who were on Christmas Island (and subsequently within the dip sample), had their blood counts done for the first time.⁷⁴ The results were not recorded on standard military medical stationery. They were recorded on civilian radiation worker stationery. The clock number heading was crossed out and replaced with their service number. The Grapple Z1 firing took place on 22 August 1958, within days of the blood counts being done.

85. The blood counts were a subset of the medical monitoring arrangements for the tests. Those on Christmas Island were categorized into three groups:⁷⁵ **Category A** personnel were scheduled to work in controlled areas. They were all issued with a film badge. On account of working in controlled areas, the soldiers who had not previously had blood counts done were processed in August. When the bomb was fired, they were in bunkers. A soldier for example had his blood count done in August 1958. The radiation safety plan for the Halliard firing muster lists him as Category A and due to be located at site C which was a controlled area. Radiation exposure records show he was exposed to 20 millirems or 0.2 Rad.

86. The **Category B** personnel were due to be in positions where less radiation risk was expected. 10% of them were issued with film badges. As they did not work in a controlled area, there was no policy to blood count them.

⁷² WO 32/16393. 'Conversation refers', 18 October 1957.

⁷³ Merlin ESO10648_001, Air Cdre Wilson to Principal Medical Officers, 'Radiological Safety Precautions at Christmas Island', 23 September 1958.

⁷⁴ NTV reference numbers.

⁷⁵ Merlin Safety_Regs04_081, HQ Task Force Grapple, 'Personnel Safety Plan', 3 September 1958.

87. Most personnel were **Category C**. They were located at the main camp when the firing took place. 1% of them were issued with film badges. As they did not work in a controlled area, there was no policy to blood count them.

88. The following month at an inquest where the absence of blood counts was noticed, the Army received or issued orders on 14 October tightening the requirements and **all** personnel going to Christmas Island were to have 'a full blood count, chest Xray and examination of the hands.'⁷⁶

89. That position was reflected in the force generation orders which continued after the firing of Grapple Z. At that point there was still the possibility of further tests and in March 1959 HQ Task Force Grapple wrote to the War Office and amended the draft move order for 17 Field Squadron and explained:

It is believed that there was an inter-service agreement about Radiological Safety precautions which necessitates blood counts, skin examinations and X-ray of chest. The War Office (PA1) or (AMD) [Army Medical Directorate] should be able to supply the details which should be added to your medical paragraph.⁷⁷

90. The amended wording on medical requirements in the draft movement order was updated to read:

All pers will be immunised against smallpox, typhoid group and tetanus. International Certificates are required for smallpox. Special med examinations in accordance Factories (Ionising Radiations) Special Regulations Part III para 21 are required – detailed instructions are being issued by TROOPERS (AG7).⁷⁸

91. The requirement for all Army personnel to have pre-deployment blood counts for Christmas Island was introduced after the major tests were finished (albeit that the conclusion of the tests was not certain in 1959).

⁷⁶ WO 32/16393, 'Medical Examination of Personnel to be Posted to Christmas Island'.

⁷⁷ WO32/16393. Maj to the War Office, 'Move Order 17 Fd Sqn...', dated 25 March 1959.

⁷⁸ WO 32/16393. Draft move order 7 April 1959.

92. The leukemia case concerned a soldier. His experiences were also described by Susie Boniface.⁷⁹ His service record was recalled and inspected. The medical elements of the service record are missing. However, a copy of his medical record was typed up and used in a pensions tribunal case.⁸⁰ It is probable that when the Ministry of Pensions and National Insurance was preparing for the tribunal, they kept the medical record which could not be found in 1984 and cannot be found in 2025. In combination the service record and pensions tribunal documents show the following:

A Soldier

- Born in 1937.
- Between leaving school and enlistment he worked as a fireman with British Railways.
- He enlisted for national service as a Royal Engineer in March 1956.
- He served with 39 Field Squadron and deployed to Christmas Island on 18 August 1957.
- He was present on the Island when Grapple X was fired on 8 November 1957.
- The Army Blue Book does not record any exposure to radiation for him.
- In January 1958 he reported to the RAF Hospital on Christmas Island tender swollen glands under his chin. The examining doctor suspected glandular fever or leukemia. A blood count results returned the following day as 'Blood films – many immature white cells. White blood cells 28,400 cmm. Haemoglobin 96. Erythrocyte sedimentation rate 7 mm. per hour.' Serum and blood films were sent back to RAF Halton in the UK for additional analysis.
- Later in January it was recorded, 'Has developed bone tenderness and his white cell count is now 48,800 per c.mm. In view of the rapid progress of his disease and difficulty of establishing the diagnosis here it is recommended that he be sent home immediately for further investigation and treatment.'
- He flew from Christmas Island and returned to the UK. He was diagnosed with acute lymphocytic leukaemia at the RAF Hospital Wroughton.
- He was transferred to Army hospitals.
- In February 1958 he was in remission and being prepared for discharge to civilian life.
- His treatment continued at the civilian Morriston Hospital Swansea and further blood counts were done. By May 1958 there was growing concern about his blood results. Urine tests were done that month.
- He received blood transfusions and died in June 1958.
- A full postmortem was done, and his right femur was removed and sent to the Radiobiological Research Unit at Harwell.

⁷⁹ Boniface, Susie, *Exposed: The Secret History of Britain's Nuclear Experiments* (Pen and Sword, 2024), pp.81-83.

⁸⁰ HBA copy of PIN 59/161.

- The coroner's inquest held in summer 1958 recorded that a Treasury Solicitor was representing the War Office and that the British Legion was representing the family.
- A serviceman from 29 Corps Engineer Regiment gave evidence and said the soldier had no orders to handle radioactive material and it was closely guarded. He stated that, 'The distance at which my men and I were from the explosion had been declared safe by the chief scientist, and by the task force commander.... At no time did [he] have to wear special clothing.'
- The government solicitor declined to answer a question regarding how far he was from the explosion and the Coroner upheld that.
- A doctor explained that in the case of Japan an increase in leukemia had been observed some '2 to 3 years after the explosions'.
- An Army doctor who treated him stated, 'If his leukemia did result from nuclear radio-activity from the bomb burst, it is the shortest time on record and the wrong type of leukemia.'
- The verdict was died from natural causes.
- An appeal was lodged on 1 October 1958, and further medical opinions and evidence were provided. The Ministry of Pensions and National Insurance asked the War Office some supplementary questions and received the following responses:
 - How far was the deceased from the explosion centre?
More than twenty-five miles (an answer they were unwilling to provide at the initial hearing).
 - What were the trends observed in the blood count sampling of personnel on the Island?
Blood sampling was not carried out.
 - If the deceased's blood was sampled, what were the findings before and after the explosion?
The deceased's blood was not sampled prior to his illness.
- The answer that his blood had not been sampled matches his medical records. However, the answer concerning the trends was correct for the majority but omitted the minority who did have blood counts.⁸¹
- There were other questions on radiation on Christmas Island and the general health of service personnel that the RAF hospital reported in detail with a breakdown of ailments and numbers affected.
- Due to the unusual nature of circumstances of the case, the Army Historical Branch requested a re-examination of the available records and this was sent to RAMS. Their response is below:

Contemporary Medical Analysis

- Reported symptoms, signs and blood counts throughout illness are all consistent with acute lymphocytic leukaemia (ALL).

⁸¹ Merlin ES010648_007, Grandy to Pilgrim, letter 2 July 1958.

- I note he was well until late December 1957 and was in Christmas Island from August 1957. There was a blast on 8 November 1957. The timing does not fit with a cause and effect relationship of radiation to leukaemia and is too quick for a blast induced mutation to cause an acute lymphocytic leukaemia. We assume that he had normal blood counts at the time of enlistment and on arrival in Christmas Island, as he was fit and well without symptoms. However, confirmation of this would not alter my assessment of his case, as it is likely he developed the ALL later in the year, unrelated to the blast exposure.

93. Orders were issued that all personnel going to Christmas Island were to have blood counts done. Evidence that the orders were implemented can be found in their service and medical records:

A Soldier

- Born 1926.
- He served at Christmas Island from 21 November 1958 to 22 November 1959. Therefore, he was not present at a nuclear firing.
- The results of a blood sample taken before deployment were counted by the Queen Alexandra Hospital on in November 1958 and recorded Hb 111% and white blood count as 7000.
- At Christmas Island he was treated for tonsillitis.
- He left the Army in 1969.

94. After the tests had finished, the position was summarized in March 1959 in correspondence and a report. The RAF had been doing the medical examinations at Christmas Island and:

Two cases of Leukaemia have occurred in service personnel who have visited Christmas Island. In both instances it has been possible to show that neither person had been exposed to any appreciable doses of radiation as the result of his visit to the island and he appeared to be in good health when the visit was made. Nevertheless the documentation of these cases has revealed that in neither instance had complete blood count examinations and X-ray examinations been carried out.

95. One of those cases was described above but since it is unlikely he went to a forward area, there was no requirement for blood counts for him. The other case was a naval officer.⁸²

96. The case prompted concerns among other test participants. A soldier attended the Buffalo test and after the leukaemia story broke, he spoke to a RAMC Dr who arranged two additional blood counts for him. The results were normal apart from the polymorphonuclear leucocytes which were low. The examining Dr wrote to a colleague at the War Office who replied and hoped that the gunner who had been worrying about his experiences at the Buffalo test, would be assured by the leukaemia verdict and that, 'if he had been exposed to any significant radiation this would have been noted and appropriate action taken.'⁸³ The correspondence revealed a divergence between the concerns of some test participants and the HMG position. That divergence has remained to the present day.

Urine Testing

97. Urine monitoring was a rare method but on 22 September 1958 there was an incident that prompted it. As a result, four individuals, had their urine tested. The samples were sent back to the UK and the Biological Sampling Section of AWRE returned results for tritium in urine which for a soldier was 0.007 uc/ml.⁸⁴ Considering the date of the incident and that it involved tritium, it is probable the four individuals were carrying out preparatory work using the 'Daffodil' tritium gas generator, which was used the following day as the gas boosting agent when Burgee or Grapple Z4 was fired.⁸⁵ Due to the specific nature of the incident, the urine testing for those four individuals was not evidence of a more extensive urine research or monitoring program. The medical and service records for a soldier were recalled and showed:

A Soldier

- Born 1926.
- Commissioned as an Army officer in 1950.
- He spent most of his career in technical and scientific postings.
- Attended 1st Nuclear Science course at Shrivenham. Two blood counts were done while he was on the course.

⁸² WO 32/17709. Letter and report, 4 March 1959.

⁸³ WO 32/17709, correspondence, 15 October 1958.

⁸⁴ Merlin, 'Grapples 19_014, AWRE 'Tritium in Urine', 17 October 1958.

⁸⁵ Arnold, *Britain and the H-Bomb*, p.189

- Army Form AF.21 recorded his exposure to radiation in 1957 and 1958 at nuclear tests. It also records the results of three blood counts were done and there were 'no abnormal cells.' There is no mention of the tritium urine test in his service medical record. It is one of the most complete health physics records for an individual.
- Two further blood counts were done in 1966 as he was 'exposed to ionizing radiation'.
- He retired from the Army in 1974.
- In 2008 he was identified as a nuclear test veteran litigation core participant.

Contemporary Medical Analysis

- This SP has a number of blood results available for comment.
- Between July 1956 and January 1958 there were no abnormalities seen with normal counts and normal examined films.
- He did have a mildly low neutrophil count in May 1966, measured at 3,700 cmm but there were no other abnormalities and the blood film did not note any abnormal appearing cells. The number had returned to normal in September 1966. This was no doubt a normal variation and not representative of a myelodysplasia or concerning abnormality.

Army Organisation Records and the Methodology to locate them

98. This section explains Army records footprint generated by nuclear testing, how searches for records were carried out, and when possible, explains how gaps arose.

99. When Grapple X was complete, there was a partial withdrawal from Christmas Island. The orders were signed off by Oulton and included a section on the first sifting of records:

Destruction of Classified Documents. All classified documents relating to the operation, which are NOT required by units or for return to the United Kingdom or elsewhere, are to be destroyed by burning in the presence of an officer before departure. Destruction certificates will be retained by units.⁸⁶

100. Units made their own decisions about what to burn and what to keep. It is probable that the Army units deciding that also made decisions for their predecessor units as well, since no previous orders concerning records management at Grapple have been located. There was no central point for receiving returned records as the War Office team that might have fulfilled that function was disbanded in 1960.⁸⁷ It was a comprehensive exercise and many years later when Oulton returned to the matter to write his memoirs he commented that, 'At the time of Operation 'Grapple', because of security anxieties, no personal diaries were kept and, for the same reason, even the official records of events were very sketchy.'⁸⁸ Gaps in official records were not unique to nuclear testing. Similar observations were made regarding the Korean and Falklands wars.⁸⁹

101. The legal framework regarding records management at that time was the Public Record Act 1877, the Emergency Laws (Miscellaneous Provisions) Act of 1953, and from 1958 the Public Records Act. Those acts gave permission for destruction or preservation of records, and a scheduling mechanism to give general guidance. The outcome of the decision on what should be kept had a legal basis, but the decision itself was made by departmental records officers using their judgement.

⁸⁶ WO 32/16393, 'Operation "Grapple-X" -The Withdrawal Phase', 13 November 1957.

⁸⁷ WO 32/17735.

⁸⁸ Wilfrid Oulton, *Christmas Island Cracker: An Account of the British Thermo-Nuclear Bomb Tests 1957* (London, Thomas Harmsworth Publishing, 1987), p.1.

⁸⁹ Farrar-Hockley, *The British Part in the Korean War vol 2* (HMSO, 1995), p.492. Freedman, Lawrence, *The Official History of the Falklands Campaign vol 2* (Routledge, 2007), p.xxiii.

102. A second sift took place within MOD when deciding what should be destroyed and what kept for permanent preservation. By the time of second sift, the Public Records Act 1958 was the legal framework. Little evidence of that decision making has survived, but occasionally the administrative records around selection and transfer to the National Archives were added into the primary record. For example, the War Office created a record 'Medical Aspect of Atomic Biological and Chemical Warfare (training of personnel)' which covered 1949 to 1958. Originally SECRET it was downgraded to RESTRICTED in 1964. In 1974, it was selected for permanent preservation and transferred to the Public Records Office. MOD expected it would enter the public domain at the 30 year point. The Public Record Office catalogued it as WO32/13461 and was released into the public domain in 1989.⁹⁰

103. The main categories of Army records from nuclear tests that were selected for permanent preservation were:

- War Office administration and liaison records.
- Unit Historical Records that were near contemporary records of events and typically submitted to the War Office on an annual basis.
- Activity reports such as the Royal Engineers describing their work at nuclear tests.
- Scientific and operational research reports such as target response reports.
- The Buffalo Indoctrination Force was a War Office directed activity and therefore had a larger Army records footprint than activities not directed by the War Office.

104. Those records were deposited in the public domain in the 1980s and 1990s.

Methodology for Searching Records at The National Archives

105. Army records concerning nuclear testing are a tiny number of the records that were deposited. 1.7 million War Office records from the period 1950 to 1967 were deposited in the National Archives. The majority of those relate to individual servicemen. They were searched using the terms below:

Search Terms		
Search Terms (ST) for same entity	Search Term Category	Comments
180 Engineer Regiment	Units and organisations	Royal Engineers Hurricane 1952-1953

⁹⁰ WO32/13461, preliminary pages.

• 71 Field Squadron	Units and organisations	Royal Engineers Hurricane 1952-1953
25 Engineer Regiment	Units and organisations	Royal Engineers Mosaic 1956. Deployed unit was ad hoc formation from 25 Engineer Regiment.
28 Field Engineer Regiment	Units and organisations	Royal Engineers Grapple June 1956-March 1957
• 12 Field Squadron	Units and organisations	Royal Engineers Grapple June 1956-March 1957
• 55 Field Squadron	Units and organisations	Royal Engineers Grapple June 1956-March 1957
• 64 Field Park Squadron	Units and organisations	Royal Engineers Grapple June 1956-March 1957
• 71 Field Squadron	Units and organisations	Royal Engineers Grapple June 1956-March 1957. Already searched under 180 Engineer Regiment.
25 Field Engineer Regiment	Units and organisations	Royal Engineers Grapple August 1957-February 1958
• 37 Field Squadron	Units and organisations	Royal Engineers Grapple August 1957-February 1958
• 39 Field Squadron	Units and organisations	Royal Engineers Grapple August 1957-February 1958
38 Corps Engineer Regiment	Units and organisations	Royal Engineers Grapple February 1958-November 1958
• 48 Field Squadron	Units and organisations	Royal Engineers Grapple February 1958-November 1958
• 59 Field Squadron	Units and organisations	Royal Engineers Grapple February 1958-November 1958
• 61 Field Squadron	Units and organisations	Royal Engineers Grapple February 1958-November 1958

63 Field Squadron	Units and organisations	Royal Engineers Grapple February 1958-November 1958
36 Corps Engineer Regiment	Units and organisations	Royal Engineers Grapple November 1958-November 1959
20 Field Squadron,	Units and organisations	Royal Engineers Grapple November 1958-November 1959
24 Field Squadron,	Units and organisations	Royal Engineers Grapple November 1958-November 1959
57 Field Squadron,	Units and organisations	Royal Engineers Grapple November 1958-November 1959
46 Field Park Squadron		
71 Field Squadron	Units and organisations	Royal Engineers Grapple March 1957-August 1957. Already searched with regimental deployment.
73 (Emu and and Maralinga) Squadron	Units and organisations	Royal Engineers August 1957-December 1957
73 (Christmas Island) Squadron	Units and organisations	Royal Engineers Grapple December 1957-July 1964
12 Independent Field Squadron	Units and organisations	Royal Engineers Grapple March 1958-March 1959
17 Independent Field Squadron	Units and organisations	Royal Engineers Grapple October 1959-May 1960
94 Company	Units and organisations	Royal Army Service Corps Grapple July 1958-June 1959
Troop 51 Port Squadron	Units and organisations	Royal Engineers June 1956-March 1960
AWRE, Atomic Weapons Research Establishment	Units and organisations	
Aldermaston	Units and organisations	AWRE

AERE, Atomic Energy Research Establishment	Units and organisations	
Harwell	Units and organisations	AERE
Leishman	Units and organisations	RAMC pathology laboratory
Blood	Medical term	
Blood count	Medical term	
Urine	Medical term	
Pathology	Medical term	
Medical records	Medical term	
Retention	Administrative term	
Health Physics	Medical term and nuclear term	
Dosimeter	Nuclear term	
Dosimetry	Nuclear term	
Atomic	Nuclear term	
Nuclear	Nuclear term	
Radiation	Nuclear term	
Radiological	Nuclear term	
Ionizing	Nuclear term	
Bello	Location	Monte Bello
Emu	Location	Emu Field
Maralinga	Location	
Christmas Island	Location	
Hurricane	Operation / test name	
Totem	Operation / test name	
Mosaic	Operation / test name	
Buffalo	Operation / test name	
Indoctrination		Term associated with Buffalo
Grapple	Operation /test name	
Antler, Sapphire, Volcano	Operation /test name	Sapphire and Volcano were used in planning phase but dropped out of use and Antler was used.
Kittens	Operation / test name	Minor test
Tims	Operation /test name	Minor test
Rats	Operation / test name	Minor test
Vixen	Operation / test name	Minor test
Ayres	Operation / test name	Minor test
Hercules	Operation / test name	Minor test
Brumby	Operation / test name	Minor test

Lighthouse	Operation / test name	Planned but not carried out.
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106. When those searches were carried out 1313 records responded to the search terms. Of those 1216 were dismissed as not relevant due to their title or contextual information. The operational name 'Brumby' for example also finds service records for individuals with that surname. Records were categorised as 'Probably not Relevant' or 'Potentially Relevant'. 97 records were selected as potentially relevant from their title and contextual information. Those were inspected to see if they were relevant to blood and urine monitoring of British Army personnel at British nuclear tests. Unit records within one year either side of test participation were categorized as 'Potentially Relevant'.

107. The search terms and hits were revalidated to ensure a comprehensive search was conducted. This identified two additional search terms which were 'Indoctrination' and 'Harwell'. The search term 'Buffalo' returned 16 hits. One of those was for WO 291/1526 titled 'Value of live indoctrination at a Nuclear Trial (Operation Buffalo)'. This suggested that 'Indoctrination' could be used as a search term to identify records associated with that activity, but not including 'Buffalo' in their title. That search only identified WO 291/1526 which was already known. Most hits concerned the indoctrination of UK prisoners of war during the Korean War. Therefore, 'Indoctrination' was a redundant search term (albeit one still in the TNA relevance spreadsheet). The same process was used for 'Harwell' to identify records of War Office Liaison with Atomic Energy Research Establishment. Those were identified by the search term 'Atomic', but the intention of using Harwell was to identify records generated if the War Office used their location and not the organization title in their correspondence with the Atomic Energy Research Establishment.

108. Other search terms were identified when records were inspected. For example, WO/32 17278 concerns 'Special Establishment for Maralinga Range'. That was identified when searching for 'Maralinga'. That record included a reference to 'Staff for Operation Lighthouse'. That Operation had not been seen before, so a search for War Office records using the term 'Lighthouse' was carried out. That did not return any War Office records, but catalogue entries at the National Archives showed a planned but not executed nuclear test.⁹¹ Similarly, when a pattern of pre-deployment blood counts being

⁹¹ WO 32/17278, 'Staff for Operation Lighthouse', 30 July 1958 and DEFE 16/488.

done at the Leishman Laboratory was observed in medical records, a search for 'Leishman' was added.

109. For some potentially relevant records such as WO 32/17735 which concerns 'War Office Documents: Retention Periods', additional catalogue browsing around that record was carried out to determine if a run of potentially relevant similar records had been catalogued in sequence and were therefore detectable by proximity. They were then assessed by the title for relevance:

Example of Browsing by Proximity		
TNA Reference Number	Title	Assessment
WO 32/17733	Request for access to records of a serviceman	Not relevant
WO 32/17734	Regular Army Enlistment and Service Regulations 1957-1959: Amendments	Not relevant
WO 32/17735	War Office Documents: Retention Periods	Already assessed as potentially relevant.
WO 32/17736	Royal Army Ordnance Corps: enlistment of Maltese fitters	Not relevant
WO 32/17737	Nothing listed	Not applicable

110. Proximity browsing was carried out around these records:

Proximity Browsing		
TNA Reference Number	Title and link	Assessment
WO 279/310	Notes on nuclear warfare for medical officers The National Archives	Nothing proximate and relevant
WO 195/12324	Biology Committee: inhalation dosimeter The National Archives	Nothing proximate and relevant
WO 188/2267	Liaison with Atomic Weapons Research Establishment (AWRE) Aldermaston The National Archives	Nothing proximate and relevant
WO 32/20459	Instructions regarding responsibility for health and safety in Master General of... The National Archives	This identified WO 32/20458 which had already been identified as potentially relevant when searching for 'radiation'. The other

		three records were not relevant.
WO 32/16391	Operation GRAPPLE (1957 Atomic trial): special establishment of HQ Task Force The National Archives	This identified WO 32/16392 and WO 32/16391 which had already been identified as potentially relevant when searching for 'Grapple'. The other two records were not relevant.

111. Since proximity browsing was not locating records that had not already been found with keyword searches, it was only used for the examples above.

112. For Army units, searches were done for units down to company / squadron size. For the Royal Engineers, these squadrons would consist of between 75 and 150 men with 100 being typical. There were several squadrons in an Engineer regiment. For example, 180 Engineer Regiment had 71 Field Squadron as a subunit. The unit records did not yield specific information about blood counts. Some contain more notable medical matters. For example, 20 Field Squadron were at Christmas Island after the tests and they recorded that a Sapper died of a rare heart disease on 18 July' [1959].⁹²

113. Once deployed, the unit records focused on their activity. Accounts of the firings are rare. 61 Field Squadron recorded:

The Weapon was exploded at 0900 hrs on 22 Aug 58. The Weapon was an 'A' type bomb and was exploded suspended from balloons. The evacuation of 'B' Camp took place early in the morning of 22 Aug 58 and the explosion was observed by the Squadron from the most forward observation area. Everything worked according to plan and the test was successful. Re-entry to 'B' Camp, which been slightly changed started immediately after the test and was completed by the end of the day.⁹³

114. The Army Operational Research Group (AORG) took an increasing interest in atomic warfare and their research reports were deposited in the National Archives in the

⁹² WO 305/777.

⁹³ WO 305/175, unit history, August 1958.

In WO 291/ series. Those reports sometimes included information derived for nuclear testing but no reports were relevant to blood and urine monitoring at nuclear tests.

115. Historical Branch (Army) only searched for records deposited by the Army or War Office. We **did not do** a catalogue search for records that had been deposited by other organizations such as central defence organisations (DEFE) and AWRE (ES). We did however use records DEFE records and AWRE records where we already held copies of them due to litigation. No claims are made for the completeness of that exploitation since we did not search for additional DEFE or ES records in a systematic way.

Corps Archives

116. Corps archives for the Royal Engineers at Gillingham and the Royal Army Medical Corps in Surrey (now in transit to Staffordshire) were visited. Those archives were selected because the Royal Engineers were the largest Army cohort at the tests. RAMC because the subject matter related to their expertise.

117. A RAMC Muniments Collection that was deposited at the Wellcome Institute was not inspected as the catalogue entry described the collection as personal papers and memoirs.

National Army Museum

118. In theory the National Army Museum should not hold official records concerning nuclear testing. In practice the distinction between official records and private records is not so clear cut. Donated records from former soldiers and officers created a possibility that the National Army Museum held records that were relevant. Therefore, a catalogue search was carried out using these terms, 'Grapple', 'Christmas Island', 'nuclear testing', and 'nuclear'. That did not return anything relevant. Additionally, a National Army Museum archivist confirmed they did not hold official records concerning nuclear testing that were awaiting their catalogue entry.⁹⁴ Therefore, no further searching was undertaken.

Historical Branch Army

119. Historical Branch Army holds 15 boxes of paper records concerning nuclear tests. The most useful content was copies of the AWRE blue books listing nuclear test participants and describing the records footprint in 1982. That listing allowed the dip sample to be constructed. Many records were recognized as being duplicates of records

⁹⁴ Email National Army Museum to Historical Branch (Army) 15 July 2025.

already in the public domain. The holdings of electronic records included previous Branch work concerning NTV disclosure for litigation. Also there was a copy of MERLIN which AWE created and contains a database of scanned records.

Government Archives and holdings from whom Army records were not extracted

120. The Institute of Naval Medicine (INM) stated they had not inherited records from Army organizations that may have had health physics responsibilities. They also confirmed they did not hold records from Army personnel.⁹⁵ The INM shares a site in Gosport with the Defence Radiation Protection Services (DRPS). The interaction between the two organizations was not researched. The records for individuals who were exposed to radiation in their service career are now held by the DRPS. They were given the name, service number, and date of birth for five nuclear test veterans:

121. No records concerning those individuals were found by DRPS. That would be expected given the unlikelihood of nuclear test records entering the radiological monitoring system established in the 1960s. DRPS said they could only confirm or deny if they held records for individual nuclear test veterans. They could not confirm that they did not hold records for nuclear test veterans. Responsibility for the DRPS moved to AWE in 2024. DRPS only hold electronic records. The paper records were tracked down to a closed collection at Restore known as the UHR 'DSTL Historic Radiation'. That consists of some 50,000 individual records and AWE is now responsible for it. The records for one nuclear test veteran were found within that collection. They did not concern nuclear testing as they related to 1960s radiological work. The UHR collection is a closed collection that only becomes visible after specific individual permissions are granted by DBS. The UHR collection is searchable by name and date of birth. The radiations records for a soldier were recalled from the UHR collection and were found to be radiation records from the 1970s. Those records were found during a search of RESTORE records for medical records. The soldier spent a month at Maralinga in 1964 for training purposes and which identified him as a nuclear test veteran. It is possible that the records of other nuclear test veterans are in the UHR collection. This collection is subject to ongoing discussion between AWE, RESTORE, and DBS Records.⁹⁶

⁹⁵ Email of 26/11/2024, INM to Historical Branch (Army).

⁹⁶

Email AWE to Historical Branch (Army), 24 November 2025.

122. DSTL could not locate scientific output based on the UHR collection. Their check of their reports database located an unconnected report which was a 1993 literature review titled 'A Review of the Genetic and Inherited Effects of Ionising Radiation'.⁹⁷

123. The existence of any other closed collections at RESTORE is a matter for DBS. It is believed there are 88 collections. Historical Branch Army has not been able to determine if other Army records are within those collections.

124. AWE confirmed that the collection of medical records deposited by them at the Restore warehouse Swadlingcote in 2011 contained records from AWE staff and contractors. A dip sample of 21 out of 600 boxes carried out by HBA only found AWE staff and contractor records.

125. The MOD secure archive in Portsmouth retained records concerning nuclear tests. None of those retained records originated with the Army. The Defence Business Support Records Review Team checked those records following tasking from OVA. Therefore, Historical Branch (Army) has not reviewed them.

126. The Office of Veterans Affairs sponsored an oral history project in 2024 and 2025 concerning the experiences of nuclear test veterans. Academic contractors were doing the interviewing and recorded the experiences of servicemen. The interviews have been deposited at the British Library:

Nuclear Test Veterans

127. In summary, records for Army veterans have been tracked down within Army archive deposits, the fact of Army records moving into tri-service collections is established, but as at December 2025, it has not been possible to systematically scrutinise closed collections held by RESTORE for records concerning nuclear testing.

Other Archives known to hold records but not reviewed due to the Army not being responsible for the records

128. British Nuclear Test Veterans Association central records are at University of Warwick Modern Records Centre (MSS.546). Other records from the Veterans Association local branches and records deposited by veterans are retained by branches.

129. The Imperial War Museum (IWM) holds documentation and accounts deposited by veterans. They interviewed veterans as part of an oral history project in the 1990s.

⁹⁷ Email DSTL to Historical Branch (Army) 25 November 2025.

Archive holding film that is unlikely to be relevant to blood and urine

130. The Imperial War Museum (IWM) hold this film produced by Army official photographers. The catalogue description does not indicate relevance to blood and urine testing.

[ROYAL ENGINEERS ON CHRISTMAS ISLAND \[Main Title\] | Imperial War Museums](#)

Service Personnel and Medical Records and the Methodology to Locate Them

131. Reconstructing the service and medical history an individual soldier who was at a nuclear test required drawing upon records from six separate collections:

Type of Record	Description
Individual's service and medical records.	Contemporary records collated around the individual by their unit and subject to long term preservation. Sometimes pensions records are mixed in. Now located at Swadlingcote, Derbyshire.
Individual's hospital records.	Contemporary records collated by treating hospital. Patchy record set managed by MOD Central Health Records Library located at Shoeburyness Essex.
Pension records	When pension claims were made, medical records were extracted from the service and medical records. Sometimes they were not returned and were deposited in a seperate collection at Swadlingcote.
Dosimeter readings.	Contemporary health physics records. Now located at AWE Aldermaston.
Merlin.	Collection of contemporary records concerning nuclear testing. Collection compiled and digitised by AWE in response to nuclear test veteran litigation.
Nuclear Weapon Test Participants Study (NWTPS)	Collection of individual details aggregated for statistical purposes to monitor the health outcomes for nuclear test veterans. Does not include contemporary service medical records. Digital only and held by the UK Health Security Agency. Covers about 80% of the NTV population.

132. The most common outcome is that records are found from several but not all of those collections. When the correct name, service number, and date of birth was available, some records were found for most individuals. When records could not be found this was due to lack of information or inaccurate information. For example, a soldier participated in the minor trials programme but there is no possibility of identifying him from that common surname alone. The Royal Engineers, more so than other Corps commissioned from the ranks which

resulted in an individual having two service numbers. Another example of not locating records was getting the records for a twin brother.

133. Characteristics of the initial records laydown shaped what could be recovered. For example, dosimeter readings showing 0 doses of radiation were not always recorded by AWRE. Similarly, if a blood count was done but not specifically recorded, or was lost, then it will not be retrievable.

134. Due to the nature of dealing with sensitive personal records, Historical Branch (Army) requested legal advice. For a small number of individuals, medical advice was obtained from Royal Army Medical Services (RAMS). Their report is in Annex B.

Dip Sample Methodology

135. To take account of the reality of the task which was a people centred issue and to determine how policy and orders concerning blood and urine testing were implemented, a dip sample of Army personnel who had participated in the tests was established. The target for what became known as Tranche 1 was to identify 140 NTV records.

136. As the project progressed, in June 2025, Alistair Carns, the Minister for Veterans and People directed that size of the dip sample should be expanded. Officials decided it should be expanded to cover 5% of the participants in the nuclear tests. With an Army test population of 7000, the dip sample needed to be expanded until it reached 350 confirmed participants. The expansion from 140 to 350 formed Tranche 2.

137. The dip sample was a mixture of individuals picked randomly from the Army Blue Book and the UK Health Security Agency NWTPS listing and individuals selected to determine points about medical policy and the records laydown. Individuals were selected for a variety of reasons including:

- Higher doses of radiation.
- Attending several tests.
- Buffalo Indoctrination force which was an Army initiative.
- Individual augmentees from smaller Army units. For example, the service record for a chaplain contained his posting order dated 9 October 1957 and a request from the War Office to Task Force Grapple, for monthly 'Returns and Reports' including a health summary.
- Individuals attending the smaller non-Grapple tests.

- RAMC officers on the assumption that the monitoring for them would be done carefully.
- NTV medal recipients who were not listed by on the NWTPS.

138. A second order effect with group selected was that it was weighted towards officers rather than soldiers and they tended to be older and also more likely to have been due to have blood counts. The dip sample was constructed to yield maximum understanding of medical procedures at the nuclear tests and no assessment of statistical representativeness was carried out.

139. The searches were sequenced. Obtaining the service and medical record first provided the date of birth. The date of birth improved the responsiveness of second stage searching for hospital records at the Central Health Records Library and pension records.

Dip Sample Revision

140. Evidence for urine testing at a nuclear test was not found in the initial Tranche 1 part of the dip sample. It was not evident at that point if that was due to the limitations in the dip sample or the rarity of the event. Therefore, in March 2025 a different approach was taken which was to research urine testing and find individuals who had been urine tested and add them to the dip sample. This identified two soldiers who had urine testing in very specific circumstances. That approach confirmed urine testing was a rare health physics procedure. Similarly, a soldier was selected due to his death from leukaemia and pensions litigation.

Dip Sample Comparison Group

141. The dip sample only included the service and medical records of nuclear test veterans. Therefore, if there was something particular about the nuclear test veteran cohort or the subsequent handling of their records, that could be hard to detect by only looking at nuclear test veterans. Anything particular about nuclear test veterans and their records would be more likely to show itself if a comparison was made with individuals on similar career trajectories who did not attend the nuclear tests. Therefore, a comparison group (CG) of 35 individuals who did not attend nuclear tests was constructed. The method for constructing the comparison group was identifying service personnel who served in the 1950s, weighting towards Royal Engineers, and individuals who deployed to the Far East. An example comparison is below:

A soldier NTV	A soldier (Comparison Group)
• Born 1939. • Enlisted Royal Engineers November 1956. • Standard medical examination on enlistment. Parents and siblings in good health. • Trained as a driver. • Posted to Christmas Island November 1957 to November 1958. No policy to blood count for that deployment. • Treated for coral sore on Christmas Island. • On Christmas Island for Grapple Y and Z firings. • Posted to Germany February to November 1959. • Left the Army in 1963. Medical examination on discharge. • Records stamped in 1984 by National Radiological Protection Board for study.	• Born 1935. • Enlisted Royal Engineers in June 1956. National Service engagement. Standard medical examination on enlistment. Mother and siblings in good health. • Employed as an administrator. • Posted to Singapore January 1967 to May 1958. • Left the Army in 1958 with Reserve liability until 1963. Medical examination on discharge. • Records stamped in 1984 by National Radiological Protection Board for study.

Service Records

142. The service records for soldiers were retrieved from RESTORE which is a contractor run secure archive in Swadlingcote Derbyshire. They were located by searching for name, service number, and if available date of birth. A minority of those records, for Royal Engineers, had already gone to the National Archives for processing, but not into the public domain. The records at the National Archives were viewed there and were not recalled for scanning.

143. Many of the service records also contained medical information associated with the serviceman. These were typically the records generated by or sent to the unit they were serving in. In addition to the service records, searches by name, service number, and date of birth also found pension records for a minority of soldiers once permissions had been granted to search in that closed collection.

144. The pattern for Army officers was slightly different to soldiers. Typically, there were two separate records for officers. One exclusively contained annual reports and some confirm participation in the nuclear tests or an understanding of nuclear warfare. The second was more general administrative records that usually contain medical records.

145. There is considerable variation in the amount of information in service records. The variations arose from:

- Length of service.
- Complexity of service. For example, a soldier who was promoted to an officer has more extensive records than a man who just served as a soldier or officer. Similarly, a man who transferred from the Regular Army into the Territorial Army had a larger record.
- There were variations arising from what different units and Corps kept.

Deployment Variations

146. In addition to those common to all variations, there were additional variations particular to nuclear testing deployments. Individuals were grouped into these cohorts:

- Individuals serving in a unit or ad hoc unit that was deployed as part of a formed group. The largest group of these were Royal Engineers.
- Individual deployments by the Army to support the atomic testing. That would include specialists such as doctors, chaplains, and signals officers.
- The Buffalo Induction Force were individually deployed to support an Army purpose at a nuclear test.
- Individuals (usually officers) seconded to the UK based Ministry of Supply / AWRE and who were then deployed by them to atomic tests.

147. Army records for all these cohorts were located. Apart from dosimetry, AWE cannot locate medical records for five Army officers who were seconded to AWRE at the time of nuclear testing⁹⁸:

Medical Records

148. Since 1951, the three Services had been using consistently described medical documentation. All three services understood that a FMed 10 was an 'In-patient Case Sheet'. The system was designed to be mostly administered by the single services but capable of working in a joint way when required. For something like nuclear test deployments, the substance of a common system must have eased medical

⁹⁸ Email AWE to Historical Branch (Army) 18 September 2025.

administration. For example, Army soldier deployed to Christmas Island from September 1959 to April 60. His pre-deployment screening with blood count and chest x-ray for reasons of 'radiological hazard' was done at the RN Medical Centre Chatham on 4 Sept 1959.

149. There was built in duplication to guard against loss of records. Records were kept with the soldier's unit in F Med 4s but if they were lost, the procedure was to 'make application to the War Office (AMD Stats) [Army Medical Directorate Statistics] for copies of all medical records held in the Central Medical Record Office. This reduced the risks as when soldiers went on long sea voyages, their medical records went with the ship.'⁹⁹

150. Medical records were kept by the unit the soldier was serving in. They are akin to GP records. When serving, the medical records would be kept by the Medical Office. They were added to the service record when the individual left the Army. Certain patterns were seen in medical records. Many of the requests for blood counts were processed by the Leishman Laboratory, Cambridge Military Hospital, Aldershot.

151. Medical records arising from in-patient treatment (akin to secondary health care records) are located at the Central Health Records Library (CHRL) in Shoeburyness. Of the 140 soldiers and officers in the initial dip sample, 18 had records at the CHRL. The CHRL does not hold paper records for soldiers and officers. After they had been digitised they were destroyed.

152. Army policy for the retention of medical records did not require permanent preservation of individual medical records. Clinical medical documents should have been kept for ten years for psychiatric reports, six years for outpatient records, and five years for tuberculous reports.¹⁰⁰ Reference to individual service medical records showed the patchy implementation of War Office policy.

Flow from Organisation Records to Service Medical Records

153. There was a flow of records from policy files to service medical records. Army Medical Directorate 8 was responsible for nuclear, chemical, and biological medical matters. One of their policy files 'Protection of the Army from Radioactivity' had a handwritten note reading, 'E.1 A Personal medical records -extracted and transferred to individuals personal file'. It is not stated when this took place, who they concern, how many soldiers it related too, or where the records went. Following the date ordering in the record (oldest at the back and newest at the front) it is likely the extracted records had been placed in the file in October 1958.¹⁰¹ There is no associated extracted record

⁹⁹ HBA copy of War Office, 'Medical Documentation 1956), p.15.

¹⁰⁰ War Office, 'Instructions for the Disposal of the Records', 5 June 1959, p.22.

¹⁰¹ WO 32/17709. File explanatory note.

held by the National Archive that for reasons of medical confidentiality is kept by them but not placed in the public domain.

Dosimetry

154. AWE located dosimetry records for Army population who were at the tests and issued with dosimeters. The focus on dosimetry is best explained by those records being the primary means of monitoring exposure to radiation, early recognition of long term value, the statutory basis for retaining similar records, and NRBP studies that from the 1984 onward took account of dosimetry. This report has not investigated dosimetry other than to note it is featured in the Army Blue Book and that some dosimetry / radiation exposure records appear in individual medical records.

155. A total of 13,950 personnel participated in the Op Grapple tests. Of these, AWRE had health physics dosimeter records for 994 personnel. Those figures were retrieved by an official historian before 2001. The 994 figure was acknowledged as an under-estimate 'as some lists of men wore radiation dosimeters, but for whom no dose was recorded, have been destroyed.'¹⁰² Assuming no further destruction of records place after 2001, the chances of finding a dosimeter reading for an individual who was at the Grapple tests are 1 in 14.

¹⁰² Arnold, pp. 241-2.

Activities that have disturbed the Records Footprint

Litigation and Records

156. Litigation over the years has resulted in revisiting the records footprint concerning nuclear testing. The case described at Grapple was contemporary with the testing and described above. Another early example of litigation occurred in 1967. A soldier from the Royal Army Education Corps (RAEC), was working as a reporter for a service newspaper, probably the locally produced *Mid-Pacific News*, and in 1957 he was on a ship some 25 miles away from the nuclear test on Christmas Island. He died of leukemia on 2 April 1963. Contesting the non-award of a pension, his widow took the case to the Pensions Appeal Tribunal. The case was reported in the *Sunday Times*.¹⁰³ his record was recalled and showed the following:

A soldier

- Born in 1933.
- He enlisted as a national serviceman on 4 December 1952 and joined the Royal Army Education Corps. He re-enlisted in the regular Army in 1953.
- His record of service confirms he was at Christmas Island from 20 June 1956 to 27 September 1957.
- He died from acute leukaemia of a mixed mono-myeloid type and pneumonia in April 1963.
- No medical records were in his service record. It is probable they were extracted for litigation purposes and not returned.
- Medical information was available during pensions tribunal litigation. A hospital consultant commented on dosimetry and observed that a blood count had not been done. That medical opinion was informed by AWE information and the inference is that for the absence of a blood count to be noticed, some medical information must have been provided.(PIN 15/4131).
- Records concerning him were consolidated for pensions litigation and again for nuclear test veteran litigation. They were barcoded and copied to MERLIN and referenced 'XX'. The medical record that was probably available to the pensions tribunal was a typed copy of records that had been extracted from his service medical record (the original cannot be located and is not in his service record). The copy showed that at Christmas Island he had dental treatment on

¹⁰³ 'What Killed Sergeant', *Sunday Times*, 19 March 1967. Cutting in HBA box 'Medical DPR Folder'. Some copies of *Mid-Pacific News* are contained in the Royal Engineers Archive Chatham, CHARE. 200205.1.16 Papers of Major.

18 October 1956, requested new glasses on 2 May 1957, and a granuloma on his right index finger. There was no mention of blood counts.

- On discharge from the Army his urine specific gravity was recorded as 1010.
- His treatment after he left the Army does include blood counts when leukaemia was being diagnosed and treated. A count was done in October 1962. Thereafter numerous blood counts were done.
- The first pensions hearing and an appeal did not attribute his death to military service 'including service at Christmas Island'.

157. There have been other pensions claims, but the overall number is unknown as Defence Business Services lacks the mechanisms to aggregate its data and explain the overall numbers.¹⁰⁴

158. War Pensions claims resulted in service and medical records being sent to the Department of Health and Security or the War Pensions Directorate at Norcross in Lancashire. The National Radiological Protection Board authors found, 'All these missing and incomplete records were found to relate to individuals in the Army who had made claims (or appeals) before 1976 and enquires showed that before that date it had been the practice to allow records to be sent to DHSS without keeping a note of their removal or seeking their return.'¹⁰⁵ The records for nuclear test veterans confirm that practice but show it did not stop in 1976 but continued into the 1990s. The medical records for a soldier were sent to the War Pensions Directorate on 22 June 1993 and were not returned to the MOD archive. Some records were placed in the UTS collection of tri-service medical records and others were destroyed. The UTS collection was closed and therefore invisible until specific access permissions were granted. It should be noted that Norcross retaining medical records was not particular to nuclear test veterans and the same procedure applied to non-nuclear test veterans who made pensions claims.

A soldier who made a pensions claim

- Born 1932.
- Attended nuclear testing at Maralinga May to October 1957.
- There is no record of a blood count being done for him.

¹⁰⁴ Email DBS to HB(A) 18 March 2025.

¹⁰⁵ National Radiological Protection Board (SC Darby et al), 'Mortality and Cancer Incidence in UK Participants in UK Atmospheric Nuclear Weapon Tests and Experimental Programmes', January 1988, p.37-38.

- The medical record contains an entry for exposure to radiation of 0.47 R and is dated in November 1957. That is one month after he returned from Maralinga and probably reflects retrospective record keeping from the test.
- He continued to serve with tank units and was promoted to Warrant Officer.
- Left the Army in 1972.
- In 1991 he made a war pensions claim for deafness which he attributed to military service and observed the problem had started when he was a tank commander firing on a range in 1961.
- When his pension application was being processed the original medical records including the FMed 4 were requested by the War Pensions Directorate, part of the Department of Social Security, and placed in the record they used when processing the pensions claim. They remained in that record.
- A war pension was paid from 1991.
- Although the pension claim was unconnected with nuclear testing, the effect was to disrupt the records footprint concerning him, and increase the likelihood that medical records would not be located for him if a search was carried out.

A soldier who made a war pensions claim connected with nuclear testing

- Born 1915.
- Wartime enlistment in 1944.
- His service record confirmed he was with 'HM Ships' from 18 February 1952 to 15 January 1953.
- Whilst serving at Monte Bello he was exposed to radiation.
- In 2006 he made a claim for a war pension. The records arising from processing that claim included photo copies of his service medical records. The service medical records do not record treatment or monitoring concerning nuclear testing. They include other matters including sports injuries and treatment for bronchitis.
- He claimed that exposure to radiation that had caused stomach / rectal cancer, diabetes, and fluid retention. On 4 May 2006 AWE confirmed service at Hurricane test in 1952 and dosimetry recorded exposure to radiation of 3.45 R spread over 2 days. It was accepted that the cancer could have been caused by radiation and a pension was awarded in May 2006. The diabetes and fluid retention elements of the claim were rejected. A pension was paid to him and then a war widow's pension was paid after he died in 2010.

A soldier who made a pensions claim

- Born 1931.
- National Service enlistment in 1951.
- His service record confirmed he was with 'HM Ships' from 18 February 1952 to 14 January 1953.

- Whilst serving at Monte Bello he was exposed to radiation that was recorded as 1.670 R.
- On completing National Service he enlisted in the Territorial Army.
- He was discharged from the Territorial Army 1956 as 'services being no longer required'.
- On 27 May 1993 and 4 July 1993 he made a claim for a war pension for deafness which he attributed to radiation at the nuclear test and working in the building trade for over 40 years.
- The War Pensions Directorate requested his service medical records and the original records were sent to them on 22 June 1993. The medical records were placed in the record they used when processing the pensions claim. They remained in that record.
- When deciding about the pensions claim, the War Pensions Directorate accepted that exposure to gunfire could have contributed to hearing loss, but that the extent of the hearing loss of 1-5% was below a 20% threshold that would result in a successful claim.
- There is no evidence the War Pensions Directorate considered that deafness could have been attributed to radiation.

159. In the early 1980s there was an increasing concern about nuclear test veterans, this was partly driven by litigation and the HMG wish to demonstrate that the health outcomes for nuclear test veterans were not worse than those of their peers. MOD and AWE started a research project using 'blue books' as a way of consolidating information about topics and service personnel. The records for service personnel who attended nuclear tests were located by MOD Central Services (Records) and they stamped the ones they located with, 'Surveyed by CS(R) 2 for NRPB, 1984'. NRPB stands for National Radiological Protection Board. This identified individuals who were included in epidemiological studies.

160. One of the motivations for nuclear test veteran group litigation was that pensions tribunal cases were not finding causality between attending a test and subsequent illness. This prompted a group action that started in 2009. That group action had nine lead claimants. Of the nine, three were Royal Engineers who had served on Christmas Island. The High Court hearing concerning limitations was also a statement of the facts of the case and can be found at this link:

[AB & Ors v Ministry of Defence \[2009\] EWHC 1225 \(QB\) \(05 June 2009\) \(bailii.org\)](#)

161. The judgment of the court was searched for blood and urine references. There were 29 references to blood and one reference to urine. However, those references were not relevant to questions addressed in this report. The judgment was also

scrutinised to see if there were any additional sources of information concerning blood and urine monitoring nuclear testing that could be identified. None were found. Progress through the courts was based on the established facts and concerned legal issues and is therefore outside the remit of this report. There was no attempt to review the evidence base used in litigation, albeit that previous disclosure efforts have left copies of records with the Army Historical Branch.

162. During the litigation, a DSTL scientist advised MOD claims that he had anecdotal reports from a current and former AWE employee of 'records being destroyed in the early 80s'.¹⁰⁶

Australian Royal Commission

163. The Australian government had concerns about nuclear testing and in 1984 arranged for a Royal Commission to investigate and report. A substantial amount of evidence was collected. That was not searched as any information provided from British official sources should still be available for this study. Details of that Commission can be found below:

[British nuclear tests at Maralinga | naa.gov.au](http://naa.gov.au)

National Health Service Records

164. It is possible that copies of service medical records were provided to GPs or other medical authorities. Whilst it is possible that could have included information about nuclear testing, retrieval of such records has not been attempted as it would require the consent of the individual or their next-of-kin.

Chelsea Pensioners

165. After leaving the Army, a soldier became a Chelsea Pensioner. In 2003, MOD provided a copy of his service medical records to the Royal Hospital Chelsea. This raised the possibility that more records had been sent or that originals rather than copies were sent. To understand if this happened, a small number of records for individual pensioners already in the public domain were inspected to determine if official Army medical records flowed into their Chelsea Pensioner records. The catalogue entry at The National Archives is:

[Royal Hospital Chelsea: Personal Files of Deceased Pensioners | The National Archives](#)

¹⁰⁶ Email DSTL to MOD claims dated 23 November 2010. HBA copy.

166. An inspection of eleven pensioner records found one for a soldier¹⁰⁷ where it is possible there was a flow of information in 1944 from his service medical records into his civilian GP records and then into his Royal Hospital records. There was no evidence of that occurring for the other ten. There was evidence that pensioners received treatment from military providers, but that can be distinguished from treatment provided when they were serving. Therefore, the records for Chelsea Pensioners do not illuminate matters which are within the remit of this report. If there was a decision to review all the medical records for all the test veterans, including their post-service medical history, then they should be included.

Matter of note but outside the remit of the Army Historical Branch: Service records accessibility

167. Veterans, and if deceased next of kin, can access service and medical records by making a request to MOD. Nuclear test veterans have done so. If a veteran requested their 'service record' it would be sent to them. However, to obtain their medical records the request needs to be specific and ask for medical records. Similarly, hospital records from the Central Health Records Library would need a specific request.¹⁰⁸ It is possible that veterans requesting their 'service records' have concluded that their medical records were not available, when in fact they were. It is probable that the arrangements by which veterans obtained partial records contributed to the suspicions held by some of them. The extraction of medical records to process pensions claims had an amplifying effect on this issue.

¹⁰⁷ WO 324/97.

¹⁰⁸ Email Army Personnel Centre to Historical Branch Army, 21 March 2025.

Annex A: Timeline for Nuclear Tests and Subsequent Events

Timeline for Nuclear Tests and Subsequent Events		
Date	Event	Comment
16 July 1945	First US nuclear test.	
6 August 1945	First operational use with bombing of Hiroshima.	
29 October 1945	Political responsibility for UK atomic energy transferred to Ministry of Supply.	
8 January 1947	Cabinet decision to build British atomic bomb.	
May 1947	First meeting of UK atomic bomb planning staff.	
February 1951	British Chiefs of Staff agree to test atomic bomb in 1952.	
27 July 1951	War Office published 'Defence Against the Atomic Bomb'.	
26 July 1952	Orders for 'appropriate medical tests' issued for Hurricane personnel.	
3 October 1952	Hurricane 1 test. First British nuclear bomb test at Monte Bello islands.	
October 1952	Specialist testing for service personnel exposed to radiation.	
14 October 1953	Totem 1 test. British nuclear bomb test at Emu Field Australia.	
26 October 1953	Totem 2 test. British nuclear bomb test at Emu Field Australia.	
October 1953	RAMC officer arranges urine and faeces testing.	
February 1954	Army planning to use radiological materials starts.	
18 November 1955	Army ECAC authorised Buffalo indoctrinee force to investigate nuclear warfare.	
16 May 1956	Mosaic 1 test. British nuclear bomb test at Monte Bello islands.	
19 June 1956	Mosaic 2 test. British nuclear bomb test at Monte Bello islands.	
27 September 1956	Buffalo 1 test. British nuclear test at Maralinga Australia.	
4 October 1956	Buffalo 2 test. British nuclear test at Maralinga Australia.	
11 October 1956	Buffalo 3 test. British nuclear test at Maralinga Australia.	

21 October 1956	Buffalo 4 test. British nuclear test at Maralinga Australia.	
15 May 1957	Grapple 1 test. British nuclear test off Malden Island.	
31 May 1957	Grapple 2 test. British nuclear test off Malden Island.	
19 June 1957	Grapple 3 test. British nuclear test off Malden Island.	
14 September 1957	Antler 1 test. British nuclear test at Maralinga Australia.	
25 September 1957	Antler 2 test. British nuclear test at Maralinga Australia.	
9 October 1957	Antler 3 test. British nuclear test at Maralinga Australia.	Last UK firing on mainland Australia.
8 November 1957	Grapple X test. British nuclear test at Christmas Island.	
1 January 1958	Serviceman reports at Christmas Island with suspected leukaemia.	
28 April 1958	Grapple Y test. British nuclear test at Christmas Island.	
22 August 1958	Grapple Z 1 test. British nuclear test at Christmas Island.	
2 September 1958	Grapple Z 2 test. British nuclear test at Christmas Island.	
11 September 1958	Grapple Z 3 test. British nuclear test at Christmas Island.	
22 September 1958	Servicemen inhale tritium gas and have urine tested.	
23 September 1958	Grapple Z 4 test. British nuclear test at Christmas Island.	Last UK atmospheric firing.
14 October 1958	Order for all Army personnel going to Grapple to have blood counts.	
25 April 1962 - 11 July 1962	Operation Dominic. UK support to 25 US tests at Christmas Island.	
5 August 1963	USA, US, and USSR (the original parties) sign treaty 'Banning nuclear weapon tests in the atmosphere, in outer space and under water.' Thereafter signatories only did underground nuclear tests.	
26 November 1991	The last UK nuclear test (underground) takes place in USA.	
28 July 2023	Medal design for nuclear test veterans revealed and veterans invited to apply.	

7 November 2023	Government changes medal criteria so that veterans who supported US atmospheric tests can apply.	
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Annex B: Royal Army Medical Services Advisory Report

For the purposes of nuclear tests consequences, the full blood count can just give a baseline which deviations in the future can be compared to.

Broadly it is used to suggest a diagnosis of infection, iron deficiency, vitamin B12 and folate deficiency as well as other focused immune conditions. All these are relatively irrelevant from a strictly nuclear testing point of view.

I think if you have a normal full blood count, that does not necessarily mean you are in good health. A poor blood count could however support a supposition of poor health.

The white blood cell (leucocyte) count includes *polymorphonuclear* (PMN) leucocytes and lymphocytes. PMN cells can also be referred to as *granulocytes* and include neutrophils, basophils and eosinophils, but neutrophils make up the vast majority. Lymphocytes are recorded separately.

Radiation has the potential to affect white cell counts through two main mechanisms:

Firstly, at a sufficiently high dose, it rapidly causes severe reductions in blood counts. Indeed, radiation is used in this manner as a treatment for leukaemia in bone marrow transplant 'conditioning' regimens. Here, doses of radiation typically in the range of 10 – 12 Gy are delivered in a single dose or short course in order to effectively wipe out the vast majority of cells in the bone marrow, with the aim of removing leukaemic cells and allowing a suitable environment for an infused donor stem cell culture to replace it and ideally regenerate healthily going forward.

In this scenario, blood cell counts fall immediately and within a week or so, without transfusion support, would cause severe compromise in the individual.

Secondly, at lower doses, like other environmental and lifestyle factors, radiation can increase the risk of developing mutations, which can in turn lead to subsequent disease. From a haematology point of view, this includes conditions such as *myelodysplasia* whereby the genetic material is altered enough to produce cells, which under the microscope may appear abnormal. Molecular testing would offer confirmatory identification of mutations. Myelodysplasia can lead to leukaemia, with further mutations on already mutated cells causing further disarray, or leukaemia can develop de novo, due to a more significant mutation.

Myelodysplasia can result in low blood counts – including any of low platelets, neutrophils and red cells. (Confusingly an assessment of red cells is not best examined by the red cell count, but by measuring the total haemoglobin, which if affected is invariably

accompanied by a raised MCV, indicating the cells are larger than their healthier ancestors).

Radiation will cause mutations at the point of exposure but the deterioration in counts is not to be expected for 10 – 20 years. This is from data from exposure to CT scanning. Certainly, in this scenario low blood counts at a few months in, would not be considered to be linked to this process.

Indeed, leucocytes as immune cells will vary as a healthy response to immune or microbial triggers and sometimes in viral infections the neutrophil count in the blood measurements is recorded as low. There is some thought that the reason for this is that the cells in question are concentrated in the tissues where any infection is being fought. Assessing the cause and effect of a single factor in the development of later disease is of course difficult. Numerous lifestyle, environmental and inherited genetic factors can be at play and we know from data from treatment of malignancy that even with dedicated radiation treatment the impact of this in developing secondary cancers is around 5%.
[\[https://pmc.ncbi.nlm.nih.gov/articles/PMC6074073/\]](https://pmc.ncbi.nlm.nih.gov/articles/PMC6074073/)

To reasonably confidently attribute a radiation exposure to the development of a haematological cancer, I would not expect to see an issue with blood count numbers for some years post exposure.

Regarding the data available, the counts were measured and a blood film was examined. It is not clear whether this was done manually – by inspection and counting of blood cells under the microscope or by an automated method. The automated method is used now with examination under the microscope employed to confirm anything concerning. I note the platelet count was not reported on and this is likely because routine testing was not done until later.

I would argue that it is difficult to reliably attribute the effect of radiation exposure on the development of leukaemia or other blood cancers in individuals, despite monitoring. Numerous other factors and exposures endured throughout life complicate the landscape in those who develop leukaemia and indeed many healthy individuals not exposed to radiation or carcinogenic activity above the baseline population develop leukaemia seemingly out of the blue. However, in the case studies below, I believe that there is no positive evidence that radiation has caused undue harm. Surveillance for leukaemia or other blood cancers would have to be undertaken with intermittent e.g. yearly full blood counts over decades, when as I say multiple opportunities to be exposed to competing factors can be endured.

