Department of Energy & Climate Change

The Justification of Practices Involving Ionising Radiation Regulations 2004

The Secretary of State's decision as Justifying Authority on the Regulatory Justification of the UK Advanced Boiling Water Reactor (UK ABWR)

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Executive summary

This is the decision by the Secretary of State on an Application by the Nuclear Industry Association for a Regulatory Justification decision on Hitachi-GE Nuclear Energy, Ltd's UK Advanced Boiling Water Reactor (UK ABWR), which Horizon Nuclear Power propose to build and operate in the UK.

The decision follows consultations on the Application and on the Proposed Decision, which is for a class or type of practice defined as:

"The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the UK ABWR designed by Hitachi-GE Nuclear Energy, Ltd".

Regulatory justification is a process based on EU legislation which requires that before any new class or type of practice involving ionising radiation can be introduced in the UK, the Government must first assess it to determine whether the individual or societal benefit outweighs the health detriment it may cause.

The Secretary of State has set out the background to Regulatory Justification in Chapter 2 of this decision document and the evidence that he has taken into account in Chapters 4 to 9.

The decision, set out in Chapter 1, is that the class or type of practice is Justified under the Regulations.

The decision is taken by the making of regulations by way of statutory instrument and this has been laid in draft in both Houses of Parliament. The decision has taken into account responses to the consultations on the Application and on the Proposed Decision and other relevant developments.

Chapter 1 – Secretary of State's Decision

Decision

1.1. The Secretary of State's decision is that the class or type of practice being:

"*The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the UK ABWR designed by Hitachi-GE Nuclear Energy, Ltd*"

is Justified under the Justification of Practices Involving Ionising Radiation Regulations 2004.

1.2. In this Chapter, the Secretary of State summarises the reasons for his decision.

Benefits and Detriments – A summary

1.3. The Secretary of State considers that the UK ABWR is Justified by its individual and societal benefit in relation to the health detriments it may cause. The evidence about these benefits and detriments which the Secretary of State has taken into account in reaching his conclusion is summarised below and in Chapters 4 to 9, which includes references to material referred to in this summary.

1.4. In reaching his decision, the Secretary of State has had to consider and balance benefits and detriments in areas which are not obviously comparable in their substance and effect. The Secretary of State has not found that this has been an obstacle to his making a decision and considers that the benefits of the UK ABWR will outweigh any detriments.

1.5. The Secretary of State sees a clear need for the generation of electricity by the UK ABWR through the contribution it can make to securing the UK's energy supplies, helping the UK decarbonise and meet legal low-carbon obligations and benefiting the economy more widely. Both security of energy supply and the move towards low carbon electricity are issues of considerable national importance. A UK ABWR will be able to produce large quantities of low carbon electricity over an extended period, giving it the capacity to make a significant contribution to a secure, low carbon electricity supply in the UK.

1.6. The Secretary of State is confident that there will be important economic benefits for the UK in the event that companies decide to invest in new nuclear power stations. Beyond the direct investment and employment necessary for the construction and operation of any UK ABWR, the Secretary of State is satisfied that the UK economy can benefit through the development of a globally competitive nuclear supply chain and improvement in the quality of a skilled UK workforce.

1.7. Against this, although there is potential detriment to health, safety and the environment from the UK ABWR, this potential is small, well understood and guarded against by an established regulatory regime, which actively and effectively works to keep detriments within acceptable limits. The Secretary of State considers that the risk of health detriment from the building and operation of UK ABWRs in the UK is very low. As a proportion of the overall radiation to which members of the public are exposed from all

sources, including natural sources, the evidence he has reviewed suggests that the contribution from any UK ABWR would be small. The radiation dose which members of the public would receive from the normal operation of a UK ABWR on an annual basis would be below detectable risk levels in the context of overall radiation exposure. The inherent safety and security features of the design combined with the UK's strong and effective regulatory regime will ensure that gaseous and aqueous emissions will be kept to a minimum and the risk of release of radioactive or other harmful material will be reduced and mitigated. Any potential detriment to health which the UK ABWR could cause would therefore be very small, and satisfactorily minimised.

1.8. The Secretary of State is satisfied that the licensing and planning regime would ensure that potential environmental detriment caused by any proposed UK ABWR would be prevented or mitigated. The Secretary of State also considers that radioactive waste and spent fuel arising from any UK ABWR built in the UK could be effectively managed to ensure that the potential risks or detriments from its handling, storage, transport or disposal are within acceptable limits.

1.9. The Secretary of State is therefore satisfied that the benefits of building and operating the UK ABWR in the UK clearly outweigh the detriments.

Carbon Reduction – Chapter 4

1.10 Climate change is one of the gravest threats the world faces and urgent action at home and abroad is required. A series of reports from the Intergovernmental Panel on Climate Change (IPCC) warns of the widespread effects of climate change with consequences for human health, global food security and economic development. The Government is determined to use a wide range of levers to cut carbon emissions, de-carbonise the economy and support the creation of new green jobs and technologies. This will enable the UK to fulfil its ambitions for a low carbon economy, while also working towards an ambitious global climate deal that will limit emissions and create new international sources of funding for the purpose of climate change adaptation and mitigation.

1.11 The UK has legally binding targets under the Climate Change Act 2008 to cut emissions by at least 80% by 2050, and by at least 34% by 2020, with both targets being from a 1990 baseline. These are supported by the EU agreement in October 2014 to cut emissions by at least 40% by 2030, also from a 1990 baseline. By 2050 the UK may need to produce more electricity than it does today, in some scenarios perhaps as much as 50% more, but must do so largely without emitting greenhouse gases. The UK will therefore need to transform its system so that virtually all electricity will by 2050 come from low-carbon sources such as renewables, nuclear and fossil fuel plants fitted with carbon capture and storage technology. Even if demand for electricity does not increase, the UK will still need new electricity generation capacity to replace nuclear and other power stations as they close. To achieve carbon emissions reductions, new generating capacity would need to be low-carbon.

1.12 Nuclear power has long been the UK's most significant source of low carbon energy, and can have a role to play in our energy mix, alongside other low carbon technologies, including renewables and CCS. The Secretary of State has noted the evidence of the significant consequences associated with climate change and is of the opinion that he must give this due weight when considering the benefits and detriments associated with the UK ABWR.

1.13 The Secretary of State considers that meeting the UK's carbon reduction targets is very important and that the UK ABWR's ability to assist with this by producing low carbon electricity is a significant benefit.

Security of Supply/Economics – Chapter 5

1.14 The Secretary of State considers that a secure, low carbon energy supply is of the highest national importance. The reliable and affordable supply of electricity is essential to the daily lives of the population and the functioning of business. It is difficult to overstate the extent to which quality of life is dependent on adequate energy supplies. Both interruptions to supply and the increased costs which would result would have an adverse social and economic impact. It is estimated that due to plant closures and the need to replace and upgrade the UK's electricity infrastructure, the UK electricity sector will need around £100 billion of capital investment by 2020.

1.15 The Secretary of State believes that a diverse mix of low carbon technologies will help to deliver energy security. Within such a mix, the UK ABWR, which can produce large quantities of low carbon electricity over an extended period, could make a significant contribution.

1.16 The UK ABWR is capable of producing 1,350 MWe for a high proportion of its operating lifespan. Modern Boiling Water Reactors (BWRs) have a strong reliability record and the UK ABWR is expected to be capable of generating a large quantity of low carbon electricity at a high load factor over the course of its lifespan.

1.17 The Secretary of State is conscious that there are secure supplies of uranium, the fuel for the UK ABWR, and that these supplies are part of a stable global market. The reactor's fuel also forms a low proportion of the cost of generation so the cost of generating electricity from an UK ABWR is unlikely to fluctuate greatly even if the cost of uranium changes significantly.

1.18 The Secretary of State believes that, if nuclear power stations were not part of the UK's future energy mix, the UK could be exposed to an increased need to import fossil fuels and would face significantly higher costs in meeting the transition to a low carbon generation economy.

1.19 Government has made clear that the construction, operation and decommissioning of new nuclear power stations is a matter for energy companies. New nuclear power stations will benefit from any general measures introduced as part of the Government's reform of the electricity market to encourage investment in all forms of low-carbon generation, but there will be no support for new nuclear involving the UK ABWR or any other reactors unless similar support is provide to other types of low-carbon generation. This means that new nuclear operators will receive no levy, direct payment or market support for electricity supplied or capacity provided unless similar support is also made available more widely to other types of generation.

1.20 The Government has made specific arrangements for the financing of storage and disposal of nuclear waste, under which owners and operators of new nuclear power stations will be required to have an approved Funded Decommissioning Programme in place before construction of a new nuclear power station can begin. The Secretary of State is satisfied that these measures will ensure that the owners and operators of new nuclear power stations will set aside funds over the operating life of a nuclear power station to cover the full costs of decommissioning and their full share of waste management and disposal costs, and that they will protect the taxpayer from waste and decommissioning costs now and in the future.

1.21 Beyond the direct investment and employment created by the nuclear power stations themselves, the Secretary of State is satisfied that the UK economy will benefit from any investment in new nuclear power stations which companies decide to make, through the development of a globally competitive nuclear supply chain and an increasingly skilled UK workforce. The Secretary of State is satisfied that the actions being taken by the Government and industry mean that the UK is well placed to take the best possible advantage of this opportunity.

1.22 The Secretary of State accepts that there is a potential economic detriment that could arise as a result of an accident at a new nuclear power station, including costs to be met from public funds. However, the risk of this is minimised through the robust regulatory regime in place. Any economic impacts will be mitigated through well-established arrangements for third party compensation. The Secretary of State is satisfied that arrangements are and will continue to be in place to provide the insurance or other financial security required under the arrangements for third party compensation.

Radiological Health Detriment – Chapter 6

1.23 A potentially important risk associated with the UK ABWR, as with all nuclear power stations, is the potential for detriment which might be caused by the release of ionising radiation. However, this needs to be set in the context of overall levels of radiation. The overall average annual dose to a member of the public from all sources of radioactivity is 2.7 millisieverts (a measure of dose and abbreviated as mSv) per year. Of this, about 84% is from natural sources, about 16% from medical procedures and about 0.2% from all other sources, including existing nuclear power stations.

1.24 Release of radioactivity from nuclear power stations is strictly limited by regulation. By law, the radiation to which members of the public are exposed from all sources, excluding natural sources and medical procedures, is limited to 1 mSv per year.

1.25 The regulatory regime goes further than the legal 1 mSv limit. It requires operators to comply with the 1 mSv limit and to use Best Available Techniques (BAT) to ensure that doses are below the statutory limits and as low as reasonably achievable (ALARA). A recommendation from Public Health England (PHE) that the radiation to which members of the public are exposed from a proposed controlled source, such as a new nuclear power station, should be no more than 0.3 mSv per year, is given effect by a Direction to the environment regulators. PHE further recommends that dose constraints lower than this should be set where this is appropriate.

1.26 PHE has said that a dose of 1 mSv per year is equivalent to an additional risk of fatal cancer of one in twenty thousand (0.005%) per year, and that a risk at this level is not detectable among normal background levels of cancer risk.

1.27 The annual 'Radioactivity in Food and the Environment (RIFE)' report produced jointly by the Environment Agency, Food Standards Agency and others, confirms that radiation doses received by members of the public are below the statutory dose limit of 1 mSv per year.

1.28 Under UK law, all employers are responsible for protecting their employees, as well as the public, against exposure to ionising radiations. The maximum occupational dose limit which applies to people at work is 20 mSv per year. The UK nuclear industry monitors and regularly reports exposure levels for its employees which show that it works well within the legal dose limits, and applies additional stricter constraints on dose. The

Secretary of State is satisfied that employees of the nuclear industry are adequately protected.

1.29 The Secretary of State is aware of concerns about the findings of studies suggesting a link between nuclear power stations and a higher incidence of cancer. However, he is satisfied that the best evidence suggests that no such linkage has been demonstrated. In coming to this view he has given particular attention to the reports of the Committee on Medical Aspects of Radiation in the Environment (COMARE), a scientific advisory committee providing independent advice on all aspects of health risk to people exposed to natural and man-made radiation. In particular, its view is that there is no evidence for unusual aggregations of childhood cancers in populations living near nuclear power stations in the UK.

1.30 The Secretary of State is therefore satisfied that the regulatory regime will effectively limit and minimise the radiation dose and release of radioactivity from the UK ABWR to very low levels. He is also satisfied that because the regime applies during and beyond the operational life of the nuclear power station, effective limits on radiological emissions will remain in place until the UK ABWR has been fully decommissioned. He therefore considers that the health detriments associated with the operation of a UK ABWR will be very low.

1.31 The Secretary of State does not consider that practices taking place overseas should be taken into account in a Regulatory Justification assessment. However, he is aware of concerns about overseas practices in the context of uranium mining and has therefore considered the related health detriment and considers that it is limited.

Radioactive Waste – Chapter 7

1.32 The generation of electricity by any UK ABWR built in the UK would give rise to spent fuel, intermediate level waste (ILW), low level waste (LLW) and liquid and gaseous discharges, all of which contain differing levels of radioactivity. The Secretary of State recognises that the unnecessary introduction of ionising radiation into the environment is undesirable, and has considered the steps taken to limit the exposure of individuals to radiation from these sources.

1.33 Geological disposal is the means by which higher activity waste will be managed in the long term. This will be preceded by safe and secure interim storage until a GDF can receive waste.

1.34 The Secretary of State is aware that the UK ABWR is currently undergoing detailed Generic Design Assessment (GDA) by the nuclear regulators and that RWM's[1] disposability assessment of waste and spent fuel from the UK ABWR, which forms part of this, is not due to be completed until June 2015. However, based on RWM's and other expert technical advice, despite some differences in characteristics, he does not expect that waste and spent fuel from UK ABWRs would raise such different technical issues compared with nuclear waste from existing operating reactors as to require a different technical solution.

1.35 The Secretary of State has noted that the length of time for the safe and secure on-site interim storage of spent fuel is contingent on a number of factors, but remains satisfied

[1] Radioactive Waste Management Limited (RWM) is a wholly owned subsidiary of the Nuclear Decommissioning Authority (NDA) established in April 2014 and is responsible for implementing Government policy on geological disposal.

that interim storage of spent fuel and also ILW can and will be carried out in a way which causes a very low level of health detriment.

1.36 The Secretary of State is satisfied that a GDF would be able to, and would be required to, meet the strict dose limits and risk guidance level required by the UK regulatory regime. He has taken into account the fact that the Government is considering steps to ensure that any GDF built in the UK would be introduced into the regulatory regime in a staged manner with the involvement of the relevant regulators at an early stage. The Secretary of State is conscious that no GDF for spent fuel is yet operational anywhere in the world. However, in light of the findings of previously published disposability assessments and the progress being made in the implementation of geological disposal abroad, the Secretary of State is satisfied that it is technologically feasible to build a GDF which could contain both higher activity wastes arising from existing nuclear power stations and from any UK ABWR which might be built in the future, with only very low levels of health detriment.

1.37 The Secretary of State, having considered the Government's approach to the selection of a site for the implementation of geological disposal, is satisfied that there is a robust process in place to identify a suitable site and is confident that one will be identified and that a GDF (or more than one if necessary) will be built.

1.38 The Secretary of State is satisfied that the LLW originating from any new nuclear power stations would not vary greatly from that of existing nuclear power stations, and expects that LLW from new nuclear power stations would be handled in a manner similar to current practice and in line with Government policy on LLW.

1.39 Liquid and gaseous discharges from nuclear power stations give rise to emissions of radioactivity into the environment. In relation to these discharges the Secretary of State is satisfied that the regulatory regime is sufficiently robust to ensure that doses arising from such discharges will remain within limits and will be as low as reasonably achievable (ALARA).

1.40 The existing regulatory regime, which limits by law the radiation to which people can be exposed from nuclear installations, would apply to the management and disposal of radioactive waste from any UK ABWR and from its decommissioning, as well as to activities during its operation. The Secretary of State is confident that this will ensure that the management and disposal of radioactive waste will give rise to only very low levels of health detriment.

1.41 The Secretary of State is satisfied that the regulatory regime will act to ensure that the release of radiation from the radioactive waste from any UK ABWR remains within regulatory dose limits. In coming to this conclusion, the Secretary of State has given particular weight to the arrangements already in place to deal with waste from existing nuclear power stations, the effectiveness and transparency of the existing regulatory regime, and to the extensive powers that the regulators have to enforce compliance.

1.42 The Secretary of State is of the opinion that, whilst there would be a potential health detriment from the management and disposal of radioactive waste arising from the generation of electricity from any UK ABWR built in the UK, the health detriment from such radioactive waste would be very small and would remain very small up to and beyond disposal.

Environmental Detriment – Chapter 8

1.43 The Secretary of State recognises that the construction, operation and decommissioning of a UK ABWR, as a significant infrastructure project, will involve potential detriment to the environment which must be addressed.

1.44 The Nuclear National Policy Statement published in July 2011 provides the policy basis for development consent decisions on proposals to build new nuclear power stations. In making his proposed Regulatory Justification decision, the Secretary of State has considered in detail some of the issues also covered in the NPS and its associated Appraisal of Sustainability (AoS) and Habitats Regulations Assessment (HRA), including radiological health detriment, radioactive waste, security of supply and climate change. In the case of other issues covered in the NPS, including biodiversity, landscape and visual impact, air quality, water quality and flood risk, these can by their nature only be fully addressed at a site-specific level in connection with individual applications to build nuclear power stations and not as part of the high-level Regulatory Justification decision-making process.

1.45 The Secretary of State has considered the arrangements for processing applications for development consent for new nuclear power stations. In considering and advising the Secretary of State on applications, the Planning Inspectorate (PINS) must generally act in accordance with the NPS and its supporting documents. These contain policy aimed at minimising and mitigating harm to the environment that could arise from the construction and operation of a UK ABWR. When considering an application, the Secretary of State will also have the benefit of an Environmental Statement which details all the potential impacts of the development on the environment. The Secretary of State will be able to attach conditions to a decision to mitigate damage to the environment from developments or aspects of developments which might otherwise not be environmentally acceptable.

1.46 The Secretary of State can also decide not to grant consent where it judges that the adverse impact of a development, which could include the adverse environmental impact, outweighs its benefits. In cases where a development might cause environmental harm which could not be fully mitigated or avoided, this allows the Secretary of State to take a decision, in light of the particular circumstances of the application, about whether the benefits of that development justify the environmental detriment it would cause.

1.47 The examination of an application for new nuclear development and the decisions as to whether or not to grant development consent will be taken in consultation with the nuclear regulators, who will be responsible for the site licence and environmental permits for the project and on-going regulation in the event that development consent is granted. The Secretary of State believes that this will provide effective regulation of the environmental impact of any development. The Secretary of State is satisfied that the planning regime for nationally significant infrastructure set up under the Planning Act 2008 allows environmental considerations to be identified and addressed at an early state of the planning process, including through consultation with the regulators and the public, so that unsuitable proposals can be prevented and potential adverse impacts mitigated to the extent possible.

1.48 On balance, the Secretary of State considers that potential environmental detriments arising from the construction, operation and decommissioning of the UK ABWR are likely to be avoided or adequately mitigated and that a decision to allow environmental detriment that cannot be avoided or mitigated will include a consideration of whether the benefits of the development outweigh the harm.

Safety, Security and Safeguards – Chapter 9

1.49 The risk of detriment from an accident or security incident at an infrastructure project is something that must be taken into account, including for nuclear power stations. The Secretary of State acknowledges that the release of large quantities of radioactive material into the environment from such incidents could lead to significant adverse health detriment.

1.50 However, this potential detriment already exists for current nuclear power stations, and the risk of such incidents should be seen in the context of the regulatory regime which is designed to prevent accidents and protect against terrorist attack. The Secretary of State has therefore considered the advice of regulators and other advisory bodies on the measures in place. In particular, the Secretary of State notes that no events have occurred relating to a civil nuclear power station in the UK with significant off-site consequences or where all the safety barriers inherent in the design were breached.

1.51 The Secretary of State notes that the regulators are undertaking a more detailed assessment of the UK ABWR as part of the GDA process and that before permitting the start of construction the ONR would have to be satisfied that the operators have taken all reasonably practicable steps to reduce the risk of accidents and their radiological consequences.

1.52 The Office for Nuclear Regulation (ONR) is responsible for regulating security within the civil nuclear industry. ONR regulates in accordance with the Nuclear Industries Security Regulations 2003 (as amended) (NISR) which are intended to ensure that nuclear materials, nuclear facilities and sensitive nuclear information are protected from malicious acts including theft, sabotage and terrorism. Under NISR duty holders are required to produce and comply with security plans designed to deal with the assessed threat to the UK nuclear industry. ONR approves security arrangements monitors compliance and takes enforcement action where considered appropriate

1.53 The Secretary of State has confidence that the GDA and licensing processes will ensure that the regulators are satisfied with the safety and environmental implications of the UK ABWR before site-specific proposals are approved for construction and operation in the UK. The Secretary of State is satisfied that the UK's effective and robust regulatory framework will ensure that industry minimises and manages safety and security risks during and beyond the operational life of any UK ABWR, and that this is supported by the nuclear industry's strong safety and security record in the UK. The effectiveness and efficiency of the regulatory regime is kept under continuous review and improvements are made where necessary.

1.54 The Secretary of State also notes that the Government and industry have an emergency preparedness framework in place to mitigate health effects in the unlikely event of any accidental release of radiation into the environment.

1.55 The Secretary of State acknowledges concerns about the possibility of diversion of nuclear material and the proliferation of nuclear weapons. ONR Safeguards ensures that the UK complies with its international safeguards obligations, including those under the Euratom Treaty and the UK/Euratom/International Atomic Energy Agency (IAEA) safeguards agreement.

1.56 Under this regime, the operator of any UK ABWR would be subject to the same stringent safeguards provisions as existing operators, including inspection and verification by the international safeguards inspectorates of the European Commission and, should they choose, the IAEA. The Secretary of State believes that there is therefore no reason to

think that the building of UK ABWRs in the UK would result in any significant rise in proliferation risk from the current low levels.

1.57 In summary, the Secretary of State is conscious of the extent of damage and health detriment that a release of radioactive material from a UK ABWR would have. However, he has confidence in the regulatory regimes for safety and security of civil nuclear installations and materials in the UK. The regulatory bodies are all independent, experienced and held in high regard around the world. He is also conscious that the UK ABWR includes inherent safety and security features, based on years of international experience with nuclear power stations and which will be subject to approval by the UK regulators. He therefore considers that the likelihood of an accident or other incident occurring at a UK ABWR giving rise to a release of radioactive material is very small.

Secretary of State's Decision

1.58 The Secretary of State believes that the significant potential benefits which he has set out in this document outweigh the potential detriments, which will in any case be minimised by an effective regulatory regime.

1.59 The Secretary of State has therefore decided that the class or type of practice being:

"*The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the UK ABWR designed by Hitachi-GE Nuclear Energy, Ltd*".

is Justified under the Justification of Practices Involving Ionising Radiation Regulations 2004.

Chapter 2 – Background, Regulation and Consultation

Legislative and Regulatory Background

2.1 Regulatory Justification is an initial, high-level process confined to the relevant class or type of practice under consideration. It is not a decision on whether to build new nuclear power stations. Nor is it an exercise in comparing the advantages of the different methods of producing energy or comparing different nuclear reactor designs. It is also a generic assessment, so issues relating to particular sites are not suitable for consideration under this process. A decision to build at a specific site would require the operator to apply for relevant regulatory and other permissions, when site specific issues would be considered.

2.2 Regulatory Justification is based on the internationally accepted principle of radiological protection that no practice involving exposure to ionising radiation should be adopted unless it produces sufficient benefits to the exposed individuals or to society in general to outweigh any health detriment it may cause. This principle is derived from the recommendations of the International Commission on Radiological Protection (ICRP), in particular, ICRP 60[2].

2.3 European Council Directive 96/29/Euratom ("the Basic Safety Standards Directive")[3] makes regulatory justification a requirement of EU law and requires that all new classes or types of practice resulting in exposure to ionising radiation are justified before being adopted with the intent to ensure that the individual or societal benefit outweighs the health detriment they may cause.

2.4 The Basic Safety Standards Directive was implemented in UK law in relation to Regulatory Justification by the Justification of Practices Involving Ionising Radiation Regulations 2004[4] ("the Regulations)". The Regulations prescribe the process for justifying new classes or types of practice. A class or type of practice is "new" if no practice in that class or type was carried out in the United Kingdom before 13 May 2000, and the class or type of practice has not previously been found to be Justified by the UK Justifying Authority[5].

2.5 This means that before carrying out a practice that is "new" the class or type of practice to which it belongs must go through a Regulatory Justification process. This process will involve an assessment of the individual or societal benefit associated with the class or

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[2] http://ani.sagepub.com/content/suppl/2013/06/25/21.1-3.DC1/P_060_JAICRP_21_1-3_1990_Recommendations_of_the_ICRP.pdf

[3] http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/9629_en.pdf

[4] http://www.legislation.gov.uk/uksi/2004/1769/contents/made

[5] The Basic Safety Standards Directive has been revised by a recast Directive (2013/59/Euratom) which comes into force on 6 February 2018. The recast Directive does not change the requirement for all new classes and types of practice to be justified before being adopted. The new Directive is at http://ec.europa.eu/energy/nuclear/radiation_protection/radiation_protection_en.htm

type of practice as against the health detriment it may cause. If the assessments find that the benefits outweigh the detriments then a Regulatory Justification decision will be made that the class or type of practice is Justified.

2.6 The Department for Environment, Food and Rural Affairs (Defra) published Guidance on the application and administration of the Regulations[6] . The Regulations have been the responsibility of the Department of Energy and Climate Change (DECC) since the creation of that Department in October 2008.

Health Detriment

2.7 As stated above, before any new class or type of practice involving ionising radiation can be introduced in the UK the Government must first assess it to determine whether the individual or societal benefits associated with the class or type of practice outweigh any health detriments it may cause.

2.8 The Basic Safety Standards Directive defines "health detriment" as "an estimate of the risk of reduction in length and quality of life occurring in a population following exposure to ionizing radiations. This includes loss arising from somatic effects, cancer and severe genetic disorder." A key feature of Regulatory Justification is the requirement for an assessment of the health detriment which might be caused by a class or type of practice.

2.9 Applicants seeking Regulatory Justification in relation to new nuclear power stations need to demonstrate to the satisfaction of the Justifying Authority that any health detriment from ionising radiation is outweighed by the benefits associated with the proposed class or type of practice.

Justification, Optimisation and Dose Limitation

2.10 Justification is the first step in the radiological protection regime recommended by the ICRP and the first of a number of regulatory tests that must be satisfied before a new type of nuclear power station can be built in the UK. Regulatory Justification is an initial, high-level assessment of the benefits and detriments of a class or type of practice. The Basic Safety Standards Directive requires it to be carried out before the class or type of practice is first adopted.

2.11 It is therefore not intended as a substitute for, or a duplication of, more detailed examinations by regulators of reactor designs and of the impact on specific sites of proposals to build nuclear power stations. These further examinations will need substantially more detailed information than is needed for the Regulatory Justification decision. A Regulatory Justification decision is a necessary step in order for new nuclear power stations to be built. By itself it does not amount to permission to build such a station and does not mean that the reactor design and the nuclear power station will pass through the subsequent processes successfully.

2.12 There are other ICRP principles (optimisation and limitation) relevant to the approval of nuclear power stations. These are applied after the Regulatory Justification process through further statutory regulatory processes: licensing, authorisations and planning

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6 http://webarchive.nationalarchives.gov.uk/20121217150421/http:/decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/nuclear/whitepaper08/actions/regjust/1_20090817172537_e_@@_justificationguidance.pdf

consents, which examine site-specific issues. These further processes ensure that the number of people exposed, the likelihood of incurring exposures and the magnitude of individual doses are kept as low as reasonably achievable and below statutory dose limits.

2.13 Optimisation of protection is a requirement to keep all exposures as low as reasonably achievable (ALARA), taking into account social and economic factors. Dose Limitation is the principle that the total dose to any individual from regulated sources in planned exposure situations (other than medical exposure of patients) should not exceed the appropriate recommended limits.

2.14 There will therefore be further regulatory and planning processes which will apply to reactor designs and nuclear power stations before, during and after construction and operation. These further processes will address more detailed issues about the design of the UK ABWR including issues relating to proposed siting at a particular location.

2.15 The ICRP has recommended that when considering whether or not a class or type of practice is justified, the decision maker should consider not only the practice itself, but all other practices that are integral to it. The Secretary of State has therefore considered the UK ABWR, and also considered, to the extent appropriate, other integral features such as waste handling and disposal.

2.16 Information about independent regulators and advisory bodies in the UK which have a role in the Optimisation and Dose Limitation processes is set out in Annex A (Roles of Independent Regulators and Advisory Bodies in the UK).

2.17 Although the regulators prescribe actions and conditions with which the operator of a nuclear power station must comply, in the UK it is the operator, not the regulators, who is legally responsible for ensuring their activities comply with the regulatory regime.

Nature of a Regulatory Justification Decision

2.18 A class or type of practice must be Justified before it is first adopted. The Justifying Authority is therefore likely to make his or her decision in advance of full information on the benefits and detriments of the practice which might emerge from operational experience.

2.19 In the case of this decision, for example, the Secretary of State has the benefit of the information provided by the Nuclear Industry Association in its Application to justify the UK ABWR advice from other Government bodies and responses to the consultations on the Application and Proposed Decision. However the Regulatory Justification decision must be made in advance of the completion of more detailed regulatory processes such as GDA, in advance of UK ABWRs and associated waste facilities being built in the UK and in advance of detailed information about the UK ABWR being available, although information about the ABWR, the generic design from which the UK ABWR derives, and which has already been in operation elsewhere, is available and is referred to in the Application. Such information about the UK ABWR will emerge at a later stage, including through further regulatory processes under Optimisation and Dose Limitation as set out above. These further processes, including site assessments, planning applications and assessment of the technical aspects of the designs, are in place in order to ensure a fully effective regulatory process.

2.20 Some responses to the consultation on the Application expressed a view that no Regulatory Justification decision should be made until significantly more information is known about the UK ABWR. The Secretary of State does not agree that he should not

make the decision or should delay it until all information about the UK ABWR is available. In making this decision now he is able to make informed assumptions about benefits and detriments based on the best information currently available, including information arising from operational experience of the ABWR and similar classes or types of practice, and based on the expert opinion of regulators and others. He is also making the decision in the knowledge that Justification is the first stage in the regulatory process and that there are further stages to the regulatory process which will continue after the decision has been made which in themselves provide additional and separate safeguards.

2.21 It is also the case that if new and important evidence about the efficacy or consequences of the class or type of practice comes to light, then there is provision under regulation 10 of the Regulations for the Secretary of State to reassess any Regulatory Justification decision.

Government Responsibility

2.22 The Department of Energy and Climate Change (DECC) is the Department responsible for co-ordinating the Regulatory Justification process across Government and is the policy lead for the Regulations.

2.23 Under the Regulations, the Justifying Authority in the UK is either the Secretary of State responsible for that subject matter, or one of the devolved administrations (the Scottish Government, the Welsh Government and the Northern Ireland Executive) to the extent that they have competence in respect of the subject matter of a particular Regulatory Justification application.

2.24 The Concordat on the Implementation of the Justification of Practices Involving Ionising Radiation Regulations 2004[7] (the Concordat) governs the working relations between the Justifying Authorities in a way which respects the devolution settlements. The Concordat makes provision for the establishment of a Justification Liaison Group (the JLG), made up of DECC and the devolved administrations.

2.25 Before making a Regulatory Justification decision, the Justifying Authority is required to consult with the devolved administrations, and with statutory consultees: the Health and Safety Executive, the Office for Nuclear Regulation, the Food Standards Agency[8], Public Health England, the Environment Agency, the Scottish Environment Protection Agency, Natural Resources Wales and the Department of the Environment for Northern Ireland.

2.26 The Justification Co-ordination Committee (the JCC) was established to help co-ordinate the views of the JLG, the statutory consultees and other Government bodies. The JCC meetings are chaired by officials from DECC, and membership is made up of officials from the devolved administrations, the statutory consultees, the Department of Health and the Nuclear Decommissioning Authority.

2.27 The subject matter of this Application is nuclear energy, a matter which has not been devolved to any of the devolved administrations under the devolution settlements. Therefore, the Secretary of State is the sole Justifying Authority in this case and his decision is UK-wide. The consultation arrangements outlined above will apply in the case of this Application.

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[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/248909/concordat-justification.pdf

[8] Additionally, with effect from 2015, Food Standards Scotland.

New Nuclear Regulatory Justification

2.28 In May 2007, the Government published a technical consultation on a proposed process for Regulatory Justification of new nuclear power stations[9] as part of a public consultation on the role of nuclear power Responses to the consultation informed the development of this Regulatory Justification process and the development of guidance for applicants.

2.29 In January 2008, the Government published its White Paper on Nuclear Power[10] which confirmed the process it intended to follow for regulatory justification. In March 2008, the Government issued a call for regulatory justification applications for new nuclear power stations and guidance for applicants[11] . In June 2008, the Government received an Application from the NIA for a regulatory justification decision in relation to: 'the generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in light water cooled, water moderated thermal reactors using evolutionary designs'.

2.30 The Government published a public consultation on the Application in December 2008[12] , which ran until March 2009. In this consultation the Government set out its preliminary view that decisions by the Justifying Authority should be by reference to four classes or types of practice, based on four individual reactor designs: the ACR1000, the AP1000, the EPR and the ESBWR.

2.31 The Government published a further public consultation on Proposed Decisions by the Justifying Authority that two of these practices, the AP1000 and the EPR, should be justified, in November 2009[13], which ran until February 2010. The Justifying Authority published his final decisions that the AP1000 and EPR should be justified in October 2010[14] and after consideration by both Houses of Parliament, the decisions were brought into effect by the passing of regulations in November 2010[15].

2.32 This is the first Application for regulatory justification of a new nuclear reactor design since the 2008 Application.

The Application

2.33 In December 2013, the Secretary of State received an Application from the NIA for a Justification decision in relation to the following class or type of practice: "The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the UK ABWR designed by Hitachi-GE Nuclear Energy, Ltd (the "Application"). The Application

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[9] http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file39199.pdf

[10] http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file43006.pdf

[11] http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/nuclear/whitepaper08/actions/regjust/file45384.pdf

[12] http://webarchive.nationalarchives.gov.uk/20121217150421/http://www.decc.gov.uk/en/content/cms/consultations/nuclear/nuclear.aspx

[13] http://webarchive.nationalarchives.gov.uk/20121217150421/http://www.decc.gov.uk/en/content/cms/consultations/reg_just_cons/reg_just_cons.aspx

[14] https://www.gov.uk/government/publications/regulatory-justification-decisions-on-nuclear-reactors

[15] http://www.legislation.gov.uk/uksi/2010/2845/contents/made

http://www.legislation.gov.uk/uksi/2010/2844/contents/made

asks for a decision as to whether the proposed class or type of practice, as defined above, is new or existing and if it is new, whether it is justified.

2.34 The Application was considered by the JCC, which agreed that it should be published for consultation. This agreement was without prejudice to any response to consultation or other advice which members of the JCC might want to make in the future. The JCC in reviewing the Application also raised some points of clarification. The NIA updated the Application in response to these points and also to reflect events since the December submission. The amendments made to the Application are listed in its Annex 8. The updated Application was submitted in February 2014 and was published for consultation.

Summary of Questions

2.35 A public consultation on the Application was published in February 2014. The purpose of the consultation was to help inform the Secretary of State's consideration of the Application[16]. It asked the following questions.

Consultation Questions	
1.	**Do you agree with the Government's preliminary view that the class or type of practice set out in the application submitted by the Nuclear Industry Association:** **(a) qualifies as a new class or type of practice; and** **(b) is a suitable class or type of practice for a decision by the Secretary of State?** **If not, why not?**
2.	**Does the application contain sufficient information to enable the Justifying Authority to make an assessment of the class or type of practice in the application? If not, what further evidence is needed?**
3.	**Do you have any comments on the arguments or evidence in the NIA's application? Are there any additional arguments or evidence which the Justifying Authority should consider?**
4.	**Do you have any other comments on the Secretary of State's preliminary view of the class or type of practice, on the approach of the NIA, or any other options?**
5.	**As part of the further consultation on the draft decision document, the Secretary of State proposes to run public engagement events. Do you have any suggestions about the format of such events?**

[16] https://www.gov.uk/government/consultations/nuclear-industry-association-application-to-justify-the-advanced-boiling-water-reactor

Government's Response to the Consultation on the Application

2.36 The Government did not publish a separate response document to the consultation on the Application. It responded to the consultation by the following means.

2.37 Responses to Question 1 of the consultation on the Application, which relates to the definition of class or type of practice, were summarised in the Proposed Decision document and are repeated in paragraphs 2.45 – 2.53 below.

2.38 Responses to Questions 2 to 4 of the consultation on the Application, which relate to the evidence provided, were dealt with in Chapters 4 to 9 of the Proposed Decision document and are repeated in Chapters 4 to 9 of this final decision document.

2.39 Responses to Question 5 of the consultation on the Application, which relates to public engagement, were dealt with by an invitation in the consultation on the Proposed Decision to register an interest in attending a public engagement event. No such registrations of interest were received.

2.40 We received 66 responses to the consultation, which are published on the Government's website[17].

Proposed Decision

2.41 A public consultation on the Secretary of State's Proposed Decision was published in July 2014 and ran until October 2014. The purpose of the consultation was to help inform the Secretary of State's final decision. It asked the following questions:

Consultation Questions	
1.	**Chapter 1 (The Secretary of State's Proposed Decision) sets out the Secretary of State's proposed decision that the class or type of practice is justified by its benefits in relation to the health detriment it may cause. Do you agree or disagree with the Secretary of State's proposed decision? Please state the reasons for your answer. Do you consider that there are any matters relevant to the proposed decision that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**
2.	**Chapter 4 (Carbon Reduction) sets out the evidence on the potential benefit through carbon reduction arising from the class or type of practice. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer. Do you consider that there are any matters relevant to the potential benefit through carbon reduction that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**

[17] https://www.gov.uk/government/consultations/consultation-on-the-secretary-of-states-proposed-decision-as-justifying-authority-on-the-regulatory-justification-of-the-uk-advanced-boiling-water-re

3.	**Chapter 5 (Security of Supply and other Economic Effects) sets out the evidence on the potential benefit through security of supply and other economic factors arising from the class or type of practice. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer. Do you consider that there are any matters relevant to the potential benefit through security of supply and other economic factors that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**
4.	**Chapter 6 (Radiological Health Detriment) sets out the evidence on the potential radiological health detriment arising from the class or type of practice. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer.** **Do you consider that there are any matters relevant to the potential radiological health detriment that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**
5.	**Chapter 7 (Radioactive Waste) sets out the evidence on the potential detriment caused by the radioactive waste arising from the class or type of practice. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer. Do you consider that there are any matters relevant to the potential detriment arising from the management and disposal of radioactive waste that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**
6.	**Chapter 8 (Environmental Detriment) sets out the evidence on the potential environmental detriment arising from the class or type of practice. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer. Do you consider that there are any matters relevant to the potential environmental detriment that are not referred to in this Chapter? If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.**
7.	**Chapter 9 (Safety, Security and Safeguards) sets out the evidence on the potential impact of the class or type of practice in terms of safety and security. It also sets out the Secretary of State's current views based on that information. Do you agree or disagree with the views presently held by the Secretary of State on these matters? Please state the reasons for your answer. Do you consider that there are any matters relevant to safety and security that are not referred to in this Chapter?**

	If so, please state what they are, and explain how and why they are relevant, and state what conclusions you think should be reached in light of these matters.
8.	**Are there any other points which you wish to make?**

Government Response to the Consultation on the Proposed Decision

2.42 The Government is not publishing a separate response document to the consultation on the Proposed Decision. Responses to the consultation Questions are summarised in Chapters 1 and 4–9 of this decision document.

2.43 The Government received 13 responses to the consultation, which are published on the Government's website[18].

Secretary of State's Decision

2.44 The Secretary of State has set out the evidence that he has taken into account in coming to his decision that the class or type of practice is Justified under the Regulations in Chapters 4 to 9. These include the material contained in the Application, responses to the consultations on the Application and the Proposed Decision, and other advice and information sought by the Secretary of State. The decision itself is set out in Chapter 1 of this Decision document.

Class of Type of Practice

2.45 The Regulatory Justification process applies to "classes or types of practice". "Class or type of practice" is not defined in the Basic Safety Standards Directive or Justification Regulations. The Directive defines "practice" as "a human activity that can increase the exposure of individuals to radiation from a radiation source and is managed as a planned exposure situation".

2.46 The Regulations provide that a person may apply to the Justifying Authority seeking a decision as to whether a particular class or type of practice is new for the purposes of the Regulations and if so, whether it is justified. A practice is a "new practice" for the purposes of regulation 4 of the Regulations if no practice in that class or type was carried out in the United Kingdom before 13 May 2000 and if the class or type of practice has not been previously found to be justified. If the class or type of practice is new then it must be justified before being introduced. If it is existing then no Regulatory Justification decision is required. A register of "existing practices" is maintained and is available on the DECC website[19].

2.47 In considering an application for Regulatory Justification, the Secretary of State must determine what the class or type of practice described in the application is; and determine whether it should be considered as a new or existing class or type of practice for the purposes of the Regulations.

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[18] https://www.gov.uk/guidance-for-operators-of-new-nuclear-power-stations

[19] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47939/1_20100318123942_e____justificationregister.pdf

2.48 Acting as Justifying Authority, the Secretary of State must then, if it is a new class or type of practice, determine whether or not the proposed class or type of practice is justified under the Regulations.

2.49 The NIA's Application is for a class or type of practice covering a single reactor design, the UK ABWR. This is consistent with the Secretary of State's decision following the NIA's previous Application, and public consultation, to treat each proposed reactor design as a separate and new class or type of practice[20].

2.50 The Secretary of State's preliminary view, therefore, was that the UK ABWR:

- is capable of being assessed as a class or type of practice;
- is a new class or type of practice and therefore requires a Regulatory Justification decision by the Secretary of State as Justifying Authority.

2.51 The Secretary of State's preliminary view on this matter was the subject of Question 1 in the consultation on the Application.

2.52 The Secretary of State, having received no responses which caused him to re-consider his preliminary view, concluded that the class or type of practice was a new class or type of practice and therefore required a Regulatory Justification decision by the Secretary of State as Justifying Authority.

2.53 The Secretary of State therefore determined that:

(a) the application by the Nuclear Industry Association for a Regulatory Justification decision in respect of the UK ABWR, submitted in December 2013, comprises an application for a class or type of practice as set out below:

"The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the UK ABWR designed by Hitachi-GE Nuclear Energy, Ltd".

and

(b) this class or type of practice qualifies as a new class or type of practice for the purposes of the Justification of Practices Involving Ionising Radiation Regulations 2004.

Other Issues

Reprocessing and Mixed Oxide Fuel

2.54 The Secretary of State's decision does not extend to the reprocessing of spent fuel from new nuclear power stations. In addition, the Secretary of State has only considered the benefits and detriments associated with the use of low enriched uranium as a fuel. He has not considered the effects of using mixed oxide fuel and his decision does not extend to the use of such fuel.

Overseas Practices

2.55 The Secretary of State has considered whether practices which are integral to the practice of generating electricity from new nuclear power stations, but which occur outside the UK, should be taken into account in making his decision.

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20 http://webarchive.nationalarchives.gov.uk/20121217150421/http://www.decc.gov.uk/en/content/cms/consultations/nuclear/nuclear.aspx

2.56 The recommendations of the ICRP and the Basic Safety Standards Directive require each country to assess the benefits and detriments of a class or type of practice carried on within its own borders, and to enforce the conclusions from such assessments. This is consistent with the Secretary of State's powers under the Regulations, which give no authority to acquire information outside the UK for the purposes of making a UK Justification decision.

2.57 However, although the Secretary of State does not consider that any examination of actions outside the UK is necessary, as he is aware of concerns raised about uranium mining; this is considered to the extent possible in Chapter 6 (Radiological Health Detriment).

Chapter 3: Overall Approach of the Application

Content of the Application

3.1 The Application seeks a decision under regulation 9(1) of the Justification of Practices Involving Ionising Radiation Regulations 2004 (the “Justification Regulations”) that the practice involving the UK ABWR design is justified.

3.2 The Application presents:

- a discussion of the potential benefits the practice could bring in terms of security of supply and carbon reduction;
- an assessment of the potential impacts of the proposed practice on the UK economy;
- identification of the potential radiological health detriments;
- identification of the potential detriments associated with the proposed practice other than those to do with radiological health; and
- a concluding section that compares the net benefit with the potential radiological health detriments.

3.3 The summary at the end of the Application concludes that the very significant net benefits to be gained from the class or type of practice (i.e. through security of supply and carbon reduction) would be very significant. The expectation that nuclear will remain a competitive form of electricity generation, particularly when compared with other low carbon generating technologies and the very low risk of a nuclear accident mean that the risk of significant economic detriment is very low.

3.4 When security of supply and carbon reduction benefits are taken into account, the adoption of the Proposed Practice is likely to be beneficial for the UK and although there were potential detriments, none had been identified which could, either alone or when combined with other detriments, be of sufficient scale to detract significantly from the major benefits to the UK that the Proposed Practice would bring. The Application concludes that the potential radiological health detriments would be small, and so are outweighed by the major net benefit of the Proposed Practice.

3.5 The Application therefore concluded that the class or type of practice should be Justified under the Justification Regulations.

3.6 The Application includes Annexes which provide further technical detail and background information. In particular, Annex 1 provides an overview of the UK ABWR and explains that the UK ABWR derives from the generic design of the ABWR, and that the ABWR is the first operational Generation III+ reactor design to come into operation in the world, operating in Japan since 1996.

Chapter 4: Carbon Reduction

Introduction

4.1 Decarbonising the UK economy and meeting our legal low-carbon obligations are important objectives. The Secretary of State has therefore considered the potential of the UK ABWR to help achieve these objectives. This Chapter examines the content of the Application relating to the carbon reduction benefits claimed for the UK ABWR and responses to the consultations on the Application and the Proposed Decision. It then sets out the Secretary of State's present view on the importance of reducing the UK's carbon emissions and the contribution which new nuclear power stations can make to this.

Summary of the Application

4.2 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

4.3 The Application states that by providing large-scale generation of electricity with a low-carbon footprint, new nuclear power stations, including those based on UK ABWR technology, would deliver a substantial benefit to the UK's efforts to tackle global climate change.

4.4 The Application states that nuclear power stations produce very few carbon dioxide emissions directly from electricity generation. Nuclear power generation has carbon dioxide emissions associated with energy use during mining, extraction, enrichment, and the manufacture of its fuel and management of waste products. However, the lifetime carbon emissions of nuclear power stations are comparable to those of renewable resources, and significantly lower than those of electricity generated from fossil fuels. Over a 60-year lifetime, a series of new nuclear reactors providing the same amount of electricity as the UK's existing ones could save 1.5 billion tonnes of carbon dioxide compared with generating the same energy from the UK's current generation mix (excluding nuclear).

Summary of responses to the consultation on the Application

4.5 Some responses supported the position taken in the Application. Others questioned nuclear power's ability to contribute to reducing carbon emissions and argued that there would be greater and cheaper reductions in carbon emissions from renewable power and energy efficiency.

Summary of responses to the consultation on the Proposed Decision

4.6 Responses which commented on this issue supported the position taken in the Proposed Decision.

Responses of Statutory Consultees to the consultation on the Proposed Decision

Public Health England

4.7 Public Health England said that they were concerned about the potential health consequences of the effects of climate change and welcomed efforts to reduce carbon levels.

Secretary of State's View

4.8 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

4.9 Climate change is one of the gravest threats the world faces and urgent action at home and abroad is required. A series of reports from the Intergovernmental Panel on Climate Change (IPCC)[21] warns of the widespread effects of climate change with consequences for human health, global food security and economic development. The Government is determined to use a wide range of levers to cut carbon emissions, de-carbonise the economy and support the creation of new green jobs and technologies. This will enable the UK to fulfil its ambitions for a low carbon economy, while also working towards an ambitious global climate deal that will limit emissions and create new international sources of funding for the purpose of climate change adaptation and mitigation.

4.10 The UK has legally binding targets under the Climate Change Act 2008[22] to cut emissions by at least 80% by 2050, and by at least 34% by 2020, with both targets being from a 1990 baseline. These are supported by the EU agreement in October 2014 to cut emissions by at least 40% by 2030, also from a 1990 baseline. By 2050 the UK may need to produce more electricity than it does today, in some scenarios perhaps as much as 50% more, but must do so largely without emitting greenhouse gases. The UK will therefore need to transform its system so that virtually all electricity will by 2050 come from low-carbon sources such as renewables, nuclear and fossil fuel plants fitted with carbon capture and storage technology. Even if demand for electricity does not increase, the UK will still need new electricity generation capacity to replace nuclear and other power stations as they close. To achieve carbon emissions reductions, new generating capacity would need to be low-carbon.

4.11 The Government is taking practical action on many different fronts to cut emissions from electricity generation, to ensure a diverse energy mix and to ensure that the UK moves towards low carbon sources of electricity generation. As part of tackling these challenges, the UK is also investing in energy efficiency and measures to reduce overall demand for electricity.

4.12 The Secretary of State is satisfied that new nuclear power stations should be able to play a part in low carbon electricity generation.

4.13 Nuclear power has long been Britain's most significant source of low carbon energy, and can have a role to play in our energy mix, alongside other low carbon technologies, including renewables and carbon capture and storage (CCS).

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[21] https://www.ipcc.ch/report/ar5/wg2/

[22] http://www.legislation.gov.uk/ukpga/2008/27/contents

4.14 The Secretary of State has taken into account the findings of various independent reports that have examined the carbon emissions from nuclear power stations. Such reports, known as life cycle analyses, typically examine the emissions for the complete nuclear fuel cycle, from mining of uranium, through processing, electricity generating and finally disposal of the waste.

4.15 These reports were summarised by the Intergovernmental Panel on Climate Change (IPCC) in a synthesis of life cycle analyses[23]. The analyses show that nuclear has very low emissions when compared with fossil fuelled electricity generating technologies, and is comparable with renewable technologies, such as wind power.

4.16 The Secretary of State is satisfied that, throughout their lifecycle, the CO2 emissions from nuclear power stations are low.

Conclusion

4.16 The Secretary of State is conscious of the predicted impact of climate change on the UK.

4.17 Although Regulatory Justification is not an exercise in comparing the advantages of the different methods of producing energy, it is possible in assessing the carbon reduction benefit of nuclear power to compare its lifecycle carbon emissions against those of other technologies. Such comparisons show that nuclear, taking the whole fuel cycle into account, is a low carbon technology. There is no reason to believe that life-cycle CO2 from a UK ABWR would differ significantly from that from other nuclear power stations.

4.18 The UK is committed to international obligations to reduce the amount of carbon dioxide produced in the UK. The Secretary of State considers that reducing carbon emissions from the energy sector constitutes an important part of the UK's carbon reduction obligations.

4.19 The Secretary of State is aware of the significant threat associated with climate change, and is of the opinion that he must give this due weight when considering the impact of low carbon generation.

4.20 The Secretary of State considers that meeting the UK's carbon reduction targets is very important and that the UK ABWR's ability to assist with this by producing low carbon electricity is a significant benefit.

[23] http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch09.pdf - page 730 onwards

Chapter 5: Security of Supply and other Economic Effects

Introduction

5.1 Secure energy supplies are essential to the UK. The Secretary of State has therefore considered the potential of the UK ABWR to help achieve this security, and its more general potential economic effects. This Chapter considers the content of the Application relating to the effect on security of supply and other economic factors of the UK ABWR, and responses to the consultations on the Application and the Proposed Decision. It then sets out the Secretary of State's view on the advantage of investing in new nuclear power stations, including the benefit of increased security of energy supplies for the UK, and the other economic factors he has taken into account, including the potential economic impact of an accident at a new nuclear power station.

Summary of the Application

5.2 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

5.3 The Application states that the UK ABWR could be an important means of contributing to the generation of reliable, dependable, large-scale quantities of electricity as part of the UK's low-carbon energy mix, with one 1350MW UK ABWR unit capable of supplying electricity to over 2.5 million homes. The Application states that the UK ABWR, like other new nuclear power station designs, will help to ensure a diverse mix of technology and fuel sources, which will increase the resilience of the UK's energy system. They will reduce exposure to the risks of supply interruptions and of sudden and large spikes in electricity prices that can arise when a single technology or fuel dominates electricity generation.

5.4 The Application states that demand for electricity varies all the time but that a significant proportion of demand, known as "baseload", is required 24 hours a day. Nuclear power stations are suited to being baseload plant, as they are able to generate continuously in a reliable and predictable way and at high capacity, with fluctuations being handled by more responsive plants in the system which are faster to start/ramp up.

5.5 The Application states that nuclear power stations are relatively invulnerable to fluctuations in the availability of fuel. Risks of fuel supply interruption are considered to be minimal. Modern nuclear reactors will only be re-fuelled every 12 to 24 months, and could continue to operate for several months (with slowly declining maximum output) even if a refuelling could not take place as scheduled.

5.6 The Application states that the UK ABWR, like other new nuclear power stations, could be expected to benefit from worldwide operating experience to enable it to deliver high levels of performance, with a high load factor (the ratio of the actual energy output over a period of time, to the amount of energy the plant would have produced if operating continuously at full capacity) with very small unplanned losses.

5.7 The Application includes an overview of the operating experience of the Japanese ABWRs and other worldwide operating BWRs to provide an indication of the performance and reliability that could be achieved by the UK ABWR. The Application states that in the period 2001 – 2005, ABWRs operating in Japan achieved an average load factor of about 80%, but that in the period 2006 – 2010 this fell to only about 45%. The Application attributes this fall to factors that are not expected to arise in the UK : e.g. shutdowns for inspection and reinforcement following earthquakes and following deployment of a new turbine design unrelated to the UK- ABWR reactor design. The Application also states that under normal operation, Japanese BWRs generally have lower load factors than European BWRs, because of the longer outages for inspection and a shorter fuel cycle required by Japanese regulations.

5.8 The Application points to US and European BWR performance as a more appropriate benchmark for a UK operator than the Japanese experience and states that the UK ABWR design would be able to take advantage of the large pool of experience built up worldwide with other BWR reactors, other boiling water reactors and light water reactors. The UK would be able to benefit from many thousands of years of reactor operating experience worldwide.

5.9 In its economic assessment, the Application states that it does not rely on demonstrating an economic benefit to conclude that the proposed practice is justified. However, the Application states that use of the UK ABWR would not be expected to result in unreasonable or unacceptable costs being incurred by UK taxpayers or electricity consumers based on analysis that shows that nuclear should be cost competitive with other low carbon generation.

5.10 The Application states that if a severe nuclear accident occurred in the UK then there could be an economic detriment to the UK economy. However, the UK has strong regulatory and corporate governance arrangements focused on safety, which make the likelihood of such accidents occurring very low.

5.11 Although not seeking to rely on the economic benefits to demonstrate that the proposed practice is justified, the Application summarises that there would also, as with other major infrastructure projects, be significant socio-economic benefits to the local economy resulting from a new nuclear power plant through direct employment, through providing services to the power station and from the wider economic effect, as well as more widely by providing work for the supply chain..

Summary of the responses to the consultation on the Application

5.12 Some responses supported the position taken in the Application, and referred to a paper by the National Nuclear Laboratory which found that although BWR technology had historically not been a significant feature of the UK nuclear industry, much of the underpinning technology for BWRs and PWRs was similar and there would be substantial opportunities for the UK supply chain from the development of BWRs[24].

5.13 Other responses questioned the value of nuclear energy as a secure source of supply. They argued that the strike prices negotiated for new nuclear power stations would be a subsidy and that funds allocated to new nuclear power stations would deny funding to

[24] "Boiling Water Reactor Technology – International Status and UK Experience", National Nuclear Laboratory Position Paper http://www.nnl.co.uk/media/63558/bwr_position_paper_-_final_-_web.pdf

renewables and energy efficiency. They argued that this would particularly be the case with the ABWR, which had been ineffective in Japan and would therefore be particularly poor value.

5.14 Developments in grid technology would mean that nuclear would lose any advantage in terms of providing baseload electricity. Some responses said that Wylfa A had been of no benefit to the area and a second nuclear power station using the UK ABWR would be the same.

5.15 Some responses said that the liability regime for accidents at nuclear power stations caps the liability of the operator and that this represents a subsidy as nuclear power stations would not be built without this coverage. Risks of serious accident persist and the Government and taxpayer may be called upon to provide liability cover above the operators' cap and that those liabilities and lost economic and health wellbeing can be sizable even compared with the benefits of a nuclear power programme.

Summary of responses to the consultation on the Proposed Decision

5.16 Responses which commented on this issue supported the position taken in the Proposed Decision.

Secretary of State's view

5.17 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

5.18 The Secretary of State believes that investment in new nuclear power stations will increase the UK's energy security, and, by reducing reliance on energy sources with volatile prices, such as fossil fuels, would be likely to reduce the volatility of the wholesale electricity price, to the gain of consumers and the wider economy.

5.19 The reliable and affordable supply of electricity is essential to the daily lives of the population of the UK, and the functioning of business around the country. It is difficult to overstate the extent to which quality of life is dependent on adequate energy supplies. Interruptions to supply, and the increased costs which would result, would have an adverse social and economic impact.

Investment in secure electricity supplies

5.20 It is estimated that due to plant closures and the need to replace and upgrade the UK's electricity infrastructure, the UK electricity sector will need around £100 billion of capital investment by 2020.

5.21 The UK electricity market needs to be reformed to attract the investment needed to replace the UK's ageing energy infrastructure and meet the projected future increases in electricity demand[25] from the electrification of sectors such as transport and heat.

5.22 Electricity Market Reform (EMR) is the Government's initiative to make sure the UK remains a leading destination for investment in low-carbon electricity.

5.23 The EMR Delivery Plan[26] states that the Government's objectives for the electricity market are to keep the lights on, decarbonise electricity generation and ensure energy

[25] Carbon Plan https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf page 70

bills remain affordable. It sets out the Government's commitment to creating a sustainable pathway for the decarbonisation of our electricity system through a new generation of secure, low-carbon electricity sources, including new nuclear power and provides a package of measures to incentivise up to £100 billion of capital investment needed up to 2020.

5.24 EMR is designed to facilitate this vital investment by providing two new mechanisms: the Contract for Difference (CfD) and the Capacity Market. CfDs will support low-carbon generation by giving eligible generators increased price certainty through a long-term contract that pays the generator the difference between a measure of the market price for electricity (the 'reference price') and a measure of the long-term price needed to bring forward investment in a given technology (the 'strike price').

5.25 The Government's aim is for low-carbon technologies to compete on price with other forms of generation. We have clearly stated our intention to move to a competitive price discovery process for all low-carbon technologies as soon as practicable. We aim to build competition into the allocation arrangements for these technologies where this is feasible, although in the period of this Delivery Plan it seems likely that prices for these technologies will be determined on a case by case basis as projects are identified for support.

5.26 Government has made clear that the construction, operation and decommissioning of new nuclear power stations is a matter for energy companies. New nuclear power stations will benefit from any general measures introduced as part of the Government's reform of the electricity market to encourage investment in all forms of low-carbon generation, but there will be no support for new nuclear involving the UK ABWR or any other reactors unless similar support is provide to other types of low-carbon generation. This means that new nuclear operators will receive no levy, direct payment or market support for electricity supplied or capacity provided unless similar support is also made available more widely to other types of generation.

5.27 It is for investors to determine whether the financing characteristics of nuclear power provide sufficiently attractive returns. Energy companies have announced plans to develop around 16 GW of new nuclear capacity.

5.28 New nuclear power stations could be in operation for 60 years or more and can make a significant contribution to secure energy supplies. Nuclear is a proven technology that is able to provide continuous low carbon generation, which will help to reduce the UK's dependence on imports of fossil fuels. BWRs have a strong reliability record and the UK ABWR is expected to be capable of generating a large quantity of low carbon electricity at a high load factor over the course of its lifespan.

5.29 The Secretary of State notes that several responses to the consultation on the Application referred to the low load factor achieved by ABWRs in Japan in 2006 – 2010, said that the Applicant had not explained this and argued that this made the ABWR unsuitable for use in the UK. In fact, as noted in paragraph 5.7 above, the Application does explain the special factors involved. The Secretary of State is satisfied that with

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26 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/268221/181213_2013_EMR_Delivery_Plan_FINAL.pdf

effective design and regulation, there is no reason why the UK ABWR should not achieve a high load factor in the UK.

Waste Disposal and Decommissioning Funding

5.30 The Secretary of State has considered the arrangements made to ensure that the costs of decommissioning and managing the waste from new nuclear power stations are met.

5.31 The Energy Act 2008 (the Energy Act) ensures that operators of new nuclear power stations will have secure financing arrangements in place to meet the full costs of decommissioning and their full share of waste management and disposal costs. Under the Energy Act, Operators of new nuclear power stations are required to have a Funded Decommissioning Programme (FDP) approved by the Secretary of State for Energy and Climate Change in place before construction of a new nuclear power station begins, and to comply with this FDP thereafter.

5.32 The objective of the FDP regime is to ensure that Operators make prudent provision for the full costs of decommissioning their installations; and their full share of the costs of safely and securely managing and disposing of their waste; and that in doing so the risk of recourse to public funds is remote.

5.33 In December 2011 the Government published Guidance[27] on the preparation, content, modification and implementation of a FDP as well as the factors which it may be appropriate for the Secretary of State to consider when deciding whether to approve a FDP.

5.34 The Secretary of State is satisfied that these arrangements will protect the taxpayer from waste and decommissioning costs now and in the future.

Skills and Supply Chain

5.35 New nuclear power stations have the potential to provide significant economic benefits to the UK. Current plans by industry to build five new nuclear power stations of around 16GW of new nuclear capacity will create significant supply chain and job creation opportunities. Based on this build rate, employment of about 110,000-140,000 person years is predicted[28].

5.36 It is estimated that 1,000 new apprentices and 1,000 graduates of science, technology, engineering and mathematics (STEM) subjects are required each year to 2025 to support existing operations and new build capacity, throughout the industry and supply chain. While meeting the skills requirements for new build presents a challenge, Government has put a framework in place to help ensure the sector gets the workers it needs. This includes improving science provision in schools, charging the Sector Skills Council with taking forward a training strategy, and the creation of the National Skills Academy for Nuclear to improve the specialist supply of skills.

5.37 UK contractors, manufacturers and engineers have gained extensive experience from the building, operation, maintenance and upgrading of nuclear power stations and facilities in the UK and abroad. One of the Government's objectives is to help create a globally competitive UK nuclear supply chain, focusing on high value added to support new nuclear power stations. The Government is working with the supply chain and

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[27] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42628/3797-guidance-funded-decommissioning-programme-consult.pdf

[28] Next Generation: Skills for New Build Nuclear, Cogent 2010 www.cogent-ssc.com/research/Publications/Renaissance2.pdf

nuclear power station vendors and operators to assist in this process, and has brought about a package of interventions to help UK suppliers, including establishing the Nuclear Advanced Manufacturing Research Centre to help improve the capacity, capability and quality of UK manufacturers.

5.38 The main forum for taking this work forward is now the Nuclear Industry Council (NIC)[29]. The NIC was established in February 2013 following a recommendation of the Nuclear Industrial Strategy[30] and it provides a partnership between Government and industry with a view to providing high-level strategic direction to the UK's nuclear industry, delivering new nuclear in the UK while strengthening the capability and competitiveness of the UK industry at home and internationally to benefit the economy.

5.39 The NIC is jointly chaired by Ministers from the Department of Energy and Climate Change and the Department of Business, Innovation and Skills and by the Chair of the Nuclear industry Association. Its members are senior representatives from the nuclear industry, including developers, vendors, operators, suppliers, contractors and unions.

Economic impact of accidents

5.40 During the operation of a new nuclear power station, there would be a risk of an accident resulting in the unplanned release of radioactivity into the environment. Evidence suggests that the likelihood of such an accident in the UK is very low. However, if an accident was to occur this could lead to adverse economic effects such as costs relating to damage to property, businesses, health and the environment.

5.41 The White Paper on Nuclear Power considered the economic impact of a potential accident. Given the evidence suggests that the likelihood of accidents is very low, it did not estimate a monetary value that might be associated with such occurrences.

Compensation following an accident

5.42 If an accident did occur, there is in place a well-established international regime for regulating liability and compensation for third party damage. The UK is a party to the Paris Convention on Third Party Liability and the Brussels Supplementary Convention[31], implemented in the UK by the Nuclear Installations Act 1965 (as amended). Compensation would be available, in the first instance from the operator, for personal injury or property damage irrespective of whether the operator is at fault. Further, under this regime operators are required to have in place insurance or other financial security to ensure they can meet their liabilities.

5.43 In accordance with the UK's commitments under the Paris and Brussels Conventions, there will continue to be certain potential liabilities that may fall to the Government.

5.44 The Paris and Brussels Conventions were amended in 2004. The amendments (which are not yet in force) are aimed at ensuring that an increased amount of compensation is available to a larger number of victims in respect of a broader range of nuclear damage. In particular, it will be possible to claim compensation for certain kinds of loss other than personal injury and property damage, including loss relating to impairment of the

[29] https://www.gov.uk/government/groups/nuclear-industry-council

[30] https://www.gov.uk/government/publications/nuclear-industrial-strategy-the-uks-nuclear-future

[31] The Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960 and the Convention of 31 January 1963 Supplementary to the Paris Convention

environment. The Government carried out a consultation on its proposals for implementing the 2004 changes in early 2011 and published its response in March 2012[32]. Overall Government will be implementing its proposals as outlined in the consultation taking into account the responses made.

5.45 The requirement for insurance or other financial security will be extended to cover these new liabilities, some of which cannot currently be fully covered by the private sector insurance market. The Government is currently exploring how this can be addressed. It is considering the options available, including providing cover from public funds in return for a charge to be paid by operators.

5.46 A security incident resulting in unplanned release of radioactivity into the environment could lead to adverse economic effects of the kinds that might be suffered in the event of an accident. However, as in the case of accidents, the risk of a security incident must be seen in the context of the robust regulatory regime in place to protect against such security threats and their consequences (see Chapter 6 (Radiological Health Detriment) and Chapter 9 (Safety, Security and Security)).

Reliability of uranium supplies

5.47 Reliability in the fuel supply chain is a key element in achieving secure energy supplies. The Secretary of State therefore noted the concern among some respondents to the consultation on the Application about the finite nature of uranium and its future availability as a fuel supply and has considered this point further.

5.48 The majority of nuclear fuel is made from enriched uranium. The UK is not a uranium producer but uranium ore may be imported and stockpiled. Deposits of uranium are widely dispersed across a number of countries. Potential sources include countries that the UK does not currently rely on for fossil fuels and there are considerable resources available in OECD countries, meaning that nuclear can therefore help spread the supply risks that could be associated with a particular fuel or region of the world.

5.49 The OECD and IAEA publish a report – “Uranium – Resources, Production and Demand” every two years. The Proposed Decision referred to the report published in 2012. The most recent report, published in 2014[33], comes to similar conclusions. It states that between 2011 and 2013 total identified uranium resources increased by 7%, adding almost 10 years of global reactor requirements to the existing resource base, that at 2012 levels of requirements, identified resources are sufficient for over 120 years of supply for the global nuclear power fleet and that this increased resource base follows a 23% increase in uranium exploration and mine development expenditures between 2010 and 2012. The report concludes that the uranium resource base it describes is more than adequate to meet projected requirements for the foreseeable future.

5.50 The price of uranium is affected by changes in demand and supply but this has only a limited effect on the cost of generation since uranium represents a much smaller part of the cost of electricity in nuclear power stations than for fossil-based forms of electricity generation[34].

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[32] https://www.gov.uk/government/consultations/compensating-victims-of-nuclear-accidents

[33] http://www.oecd-nea.org/ndd/pubs/2014/7209-uranium-2014.pdf

[34] Electricity Generation Costs 2013” Charts and tables on pp 17 – 21 and 27 - 31 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223940/DECC_Electricity_Generation_Costs_for_publication_-_24_07_13.pdf

5.51 In view of this evidence the Secretary of State is satisfied that adequate uranium resources exist to fuel a nuclear power programme in the UK.

Conclusion

5.52 The reliable and affordable supply of electricity is essential to the daily lives of the population of the UK and the functioning of business around the country. Nuclear can provide secure fuel supplies and continuous generation, and is a low-cost form of electricity generation which can yield economic benefits to the UK.

5.53 The Secretary of State has considered the potential benefit through security of supply, arising out of the operation of the UK ABWR. The Secretary of State notes the ability of the UK ABWR to generate 1,350 MWe of low-carbon electricity at a high load factor. He is also conscious that nuclear power is a proven and dependable technology that can be deployed on a large scale and that, because of the low price of uranium relative to overall generation costs, the generation cost of electricity by any UK ABWR which is built in the UK is unlikely to fluctuate greatly, thus helping to contribute to stable electricity prices.

5.54 Government has made clear that the construction, operation and decommissioning of new nuclear power stations is a matter for energy companies. New nuclear power stations will benefit from any general measures introduced as part of the Government's reform of the electricity market to encourage investment in all forms of low-carbon generation, but there will be no support for new nuclear involving the UK ABWR or any other reactors unless similar support is provide to other types of low-carbon generation.

5.55 The Secretary of State is of the opinion that there are unlikely to be any economic disbenefits arising from the normal operation of new nuclear power stations.

5.56 The Secretary of State is conscious that the construction of any UK ABWR in the UK will require substantial financial investment and that much of this investment could benefit UK businesses. He is therefore conscious that there are potential economic benefits to be considered as part of the Regulatory Justification process.

5.57 The Secretary of State is also conscious that there are benefits to consumers from limiting increases in the cost of electricity generation and he is of the opinion that the generation of electricity by the UK ABWR would contribute to this.

5.58 In spite of the economic benefits that the Secretary of State considers should flow from the construction and operation of the UK ABWR he is conscious of the economic detriment that could be suffered in the event of a significant nuclear accident or a terrorist incident. Although the economic detriment associated with either of these events occurring is potentially significant, the Secretary of State considers that the risk of these events taking place is low and minimised by the robust regulatory regime which exists in the UK. The Secretary of State therefore concludes that the risk of economic detriments falling on the taxpayer as the result of an accident or terrorist incident is small and is outweighed by anticipated economic benefits.

5.59 The Secretary of State has also considered the funding arrangements for the management and disposal of radioactive waste, and is satisfied that these arrangements will protect the taxpayer from waste and decommissioning costs now and in the future.

Chapter 6: Radiological Health Detriment

Introduction

6.1 The nuclear reactions that take place in a nuclear power station create a high level of radioactivity in the reactor fuel. Radioactivity occurs naturally in the environment but a nuclear power station creates much higher quantities that require careful management during and beyond its operational life.

6.2 The release of radioactivity into the environment from a nuclear power station could occur through the planned release of gaseous and liquid discharges, through an unplanned release of radioactive waste or as the result of an accident or terrorist incident.

6.3 This Chapter considers the content of the Application relating to the potential radiological health detriment from releases from the UK ABWR, and responses to the consultations on the Application and the Proposed Decision. It then sets out the Secretary of State's view on this potential detriment, on the effectiveness of the regulatory regime in place in mitigating this potential detriment and the potential detriment from the earlier states of conversion, fabrication and enrichment, and on other issues which have been raised.

6.4 The regulatory measures specifically intended to mitigate the potential radiological health detriment from radioactive waste are considered in Chapter 7 (Radioactive Waste).

Summary of the Application

6.5 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

6.6 The Application states that the UK ABWR can meet the UK's regulatory radiological dose limits and constraints for workers and the public, and that it will deliver expectations for preventing and mitigating potential accidents. to result in very low levels of risk .

6.7 The Application states that if, following Justification, the UK ABWR is deployed in the UK, then the principles of "optimisation", by which radiation doses should be reduced to a level as low as is reasonably achievable will be applied to the UK ABWR at all stages of the life cycle of a station from design, construction, commissioning through to operation, decommissioning and final waste disposal. The application of optimisation means that, in practice, radiological doses from the nuclear industry are very significantly below legal limits.

6.8 The Application states that it is not possible to present definitive figures on the radiological impact for members of the public as a result of operation of the UK ABWR against national dose limits for members of the public and single site dose constraints ahead of completing the optimisation stage, which will take place after Justification as part of site specific UK licensing and permitting processes. However the Application identifies a number of reasons to support its position of confidence in the capability of the UK ABWR to keep radiation doses to the public below dose constraints and goes further to state that radiation doses would be so low as to be of no health significance. Dose modelling as part of the GDA process has been undertaken for the UK ABWR and this indicates the capability to meet the 0.3mSv/y dose constraint for new nuclear facilities, a

capability also indicated by the operation of the ABWR in Japan. The UK ABWR, like other modern reactor designs, has been designed to ensure it incorporates features so that its impact can be expected to be similar to, or even smaller than that of existing UK nuclear power stations.

6.9 The Application reviews the level of routine worker doses that might be expected from operation and decommissioning of the UK ABWR and concludes that these can be expected to be comparable with, or lower than, those to which workers in the nuclear industry (and other industries that entail radiation exposure, such as the airline industry) are currently exposed.

6.10 The Application states that in addition to dose constraints, the UK regulatory regime is based on the principle that "all reasonably practicable steps must be taken to prevent and mitigate nuclear or radiation accidents". Appropriate arrangements would have to be provided for any new facilities licensed as a result of the introduction of the UK ABWR, and these would be enforced by the Office for Nuclear Regulation.

6.11 The Application states that the risk of an accident involving the proposed practice in the UK resulting in significant detriments is low. The Application states that the UK ABWR, like other modern reactor designs, has many design features to ensure both workers and the public are protected. The safety systems and application of the defence-in-depth concept are described in detail in Annex 1 of the Application.

6.12 The Application, in a separate Annex 5, sets out in detail the reasons that the events at Fukushima in 2011 have not changed the Applicant's view that the risk of a severe accident in the UK is low. Annex 5 explains that safety features give a great deal of confidence that the essential safety functions of long term cooling and containment can be maintained even in the event of an extreme event or other accident.

6.13 The Application states that in the UK all licensed nuclear sites maintain and rehearse emergency arrangements which are provided to mitigate the consequences of an accident if one were ever to occur.

Summary of responses to the consultation on the Application

6.14 Some responses supported the position taken in the Application.

6.15 Other responses argued against the use of nuclear power because of the potential detriment to health and said that the risk had become more acute since Fukushima. They argued that higher burn-up fuel would increase the danger of radioactive releases. Some also questioned the criteria by which radiation levels are seen as safe by the regulatory regime.

6.16 Some respondents referred to reports which they claimed showed that there was increased incidence of cancer, particularly among children, near nuclear power stations in particular the KiKK report.

6.17 Some responses made detailed points about the design of the UK ABWR and questioned its safety, or said that the operating principles of ABWRs remained the same as those of older BWRs and that improvements to the designs had done little to eliminate risks.

6.18 Some questioned Hitachi's lack of experience of running nuclear power stations and questioned whether the building of a nuclear power station could proceed in advance of knowing who the responsible company would be and whether they had sufficient resources. Others argued that if Hitachi, via Horizon, fulfilled the roles of designer,

constructor and operator then there would not be an independent customer able to challenge the constructor on operational and safety matters, for which he is ultimately responsible. Others argued that it would be impossible for the regulatory regime to separate the roles of constructor and operator effectively in the event of an accident.

Summary of responses to the consultation on the Proposed Decision

6.19 Most responses supported the position taken in the Proposed Decision. One response said that the Application must be rejected because of the known health detriment from nuclear power stations. Another recommended a more extensive treatment of the issue of Fukushima than in the Proposed Decision.

Responses of Statutory Consultees to the consultation on the Proposed Decision

Office for Nuclear Regulation

6.20 ONR confirmed that it had taken part as a member of the JCC in advising on the drafting of the decision document and that it accurately reflected the regulatory regime it enforces and the progress through GDA of the UK ABWR.

Health and Safety Executive

6.21 HSE responded that in view of ONR's involvement it would not itself be responding to the consultation.

Environment Agency

6.22 The Environment Agency confirmed that the UK ABWR had completed Step 2 of GDA. Not all the information needed to complete assessment had yet been provided but the Requesting Party had committed to provide information to a timescale which should enable GDA to be completed within four years [that is, by the end of 2017].

6.23 The Environment Agency confirmed that it had not identified any matters which made the UK ABWR obviously unacceptable or any significant design modifications which were likely to be required. On the information available, the annual radiation dose impact of the UK ABWR on people would be below the UK constraint for a single new source and that radioactive discharges would not exceed those of comparable power stations.

6.24 The Environment Agency confirmed that it would use its regulatory powers to ensure that the discharges and disposal of radioactive waste from any new nuclear power stations using the UK ABWR would be within dose limits and constraints and were optimised so that doses to people are as low as reasonably achievable and that the impact on the environment is small.

6.25 The Environment Agency also confirmed that it would use its regulatory powers to ensure that the impact on people and the environment from other wastes and discharges from any new nuclear power stations using the UK ABWR was minimised and acceptable.

Natural Resources Wales

6.26 NRW confirmed that it was working closely with the Environment Agency and ONR on GDA.

6.27 NRW confirmed that it would use its regulatory powers to ensure that the discharges and disposal of radioactive waste from any new nuclear power stations using the UK ABWR

would be within dose limits and constraints and were optimised so that doses to people are as low as reasonably achievable and that the impact on the environment is small.

6.28 NRW also confirmed that it would use its regulatory powers to ensure that the impact on people and the environment from other wastes and discharges from any new nuclear power stations using the UK ABWR was minimised and acceptable.

Scottish Environmental Protection Agency

6.29 SEPA said that the Environment Agency was better placed to provide comment and scrutiny on the Proposed Decision and that it would not itself be responding to the consultation.

Food Standards Agency

6.30 The FSA said that the potential doses from the UK ABWR are sufficiently low as to be acceptable and as such the detriments from its operation are unlikely to be disproportionate to the benefits.

6.31 The FSA said that if there was a subsequent request for a permit for site specific radioactive waste discharges from the UK ABWR then it would be involved in the assessment stage and would undertake a site specific assessment as part of this process. The FSA did not expect that the dose estimate would increase when using site specific parameters for a site-specific application, and did not expect the detriments, in terms of dose for any actual location proposed to increase compared to the generic version that the justification decision is based on.

6.32 The FSA said that the dose to consumers is considered a detriment for the determination of justification of this reactor type. In the proposal the potential doses for a generic reactor were described. The FSA considered that the evidence on these doses used by the Secretary of State in making his decision on the justification of this reactor type was appropriate and the FSA had no reason to disagree with the Secretary of State's decision in agreeing to the justification of this reactor type.

Public Health England

6.33 PHE said that it did not believe that there were any public health reasons why the UK ABWR should not be justified and thought that the benefits outweigh the relatively small health risks noted. PHE also said that the regulatory system in place would ensure that any health impact from the operation of nuclear power stations operating the UK ABWR would be minimised.

6.34 PHE agreed with the Secretary of State's conclusion that the health risk to workers and members of the public from any UK ABWR would be low.

6.35 PHE believed that the UK regulatory regime was appropriate to ensure that the radiological impact on the health of people from the normal operation of nuclear reactors and other facilities was kept below the limits set in the regulations and that any potential radiological risks from an accident at a nuclear facility were minimised. PHE also believed that the current system of radiological protection which underpins the regulatory system in the UK was the most suitable to provide for effective and efficient regulations to adequately protect human health.

Secretary of State's view

Health detriments arising from radiation

6.36 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

6.37 The Secretary of State has first considered what radiological detriment to health might be expected from the UK ABWR, and its significance.

6.38 The main risk, as with all nuclear power stations, is the potential for release of material which emits ionising radiations[35]. This needs to be set in the context of overall levels of radiation.

6.39 Public Health England (PHE, formerly the Health Protection Agency, HPA), which regularly reviews the radiation exposure of the UK population, has calculated that the overall average annual dose to a member of the public from all sources of radioactivity is 2.7 millisieverts (a measure of dose and abbreviated as mSv) per year.

6.40 Of this, about 84% is from natural sources, including cosmic radiation entering the earth's atmosphere from space, and radiation from the radioactive materials that occur naturally in soils and rock, about 16% from medical procedures such as X-ray equipment and about 0.2% from all other sources, including domestic smoke detectors and nuclear power stations[36]. There is no fundamental difference between the radiation that comes from naturally occurring materials and the radiation that comes from materials made radioactive in a nuclear power station, although the particular energy associated with the radiation (and therefore its potential to cause health detriment) may differ[37].

6.41 The release of radioactivity into the environment from a UK ABWR could occur through the planned release of gaseous and liquid discharges, through an unplanned release of radioactive material or as the result of an accident[38].

6.42 In 2009, HPA published a paper providing an introduction to the risks of exposure to low doses of radiation[39]. This explains that:

"At high levels of dose there may be a substantial amount of cell killing, leading to obvious injury e.g. skin reddening, organ damage and even death. At low levels of radiation dose there will be no obvious injury. However, although cells have very effective mechanisms for the repair of DNA damage resulting from radiation exposure and other

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[35] Ionising radiation is any electromagnetic or particulate radiation which produces ion pairs when passing through a medium (Chambers Dictionary of Science and Technology, Revised Edition, 1974).

[36] HPA-RPD-001 – Ionising Radiation Exposure of the UK Population: 2005 Review Authors: S J Watson, A L Jones, W B Oatway and J S Hughes Publication date: May 2005 ISBN: 0-85951-558-3

http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1247816567393 Figures for medical procedures and for all other sources are as amended in a further report by PHE to be published in 2014, which will confirm the general position set out in the 2005 paper.

[37] HPA-RPD-055 – An Introduction to the Estimation of Risks Arising from Exposure to Low Doses of Ionising Radiation, Authors: S Mobbs, S Watson, J Harrison, C Muirhead and S Bouffler, Publication date: June 2009 ISBN: ISBN 978-0-85951-643-3 http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1245052106074

[38] There can also be very small direct radiation doses (principally by gamma radiation) to people, plants or animals very close to the power station. In contrast, virtually all the dose to the power station workforce will be from direct radiation.

[39] HPA-RPD-055 – An Introduction to the Estimation of Risks Arising from Exposure to Low Doses of Ionising Radiation, Authors: S Mobbs, S Watson, J Harrison, C Muirhead and S Bouffler, Publication date: June 2009 ISBN: ISBN 978-0-85951-643-3 http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1245052106074

causes, some DNA damage is more difficult to repair and sometimes mistakes occur, called mutations. Some mutations can result in changes in the characteristics of cells and set them on the path towards uncontrolled proliferation and cancer. Exposure to radiation is not the only way in which a cell can receive DNA damage or be triggered to become cancerous: DNA damage can occur spontaneously, or from exposure to chemicals, and some cancers are associated with specific infections. Hence, the body will carry some cells with these mutations from other causes and subsequent ionising radiation exposure may increase the number of these mutant cells."

6.43 HPA's paper also concludes that a low dose of radiation is one of the many factors that can lead to an increased risk of cancer but that cancer is a common disease and the additional risk resulting from very low doses of ionising radiation is proportionately very low.

6.44 The paper also explains that it is biologically feasible that radiation could cause mutations to genetic material which could be passed on to future generations, although there is no direct evidence of radiation-induced heritable effects in humans and this genetic risk is judged to be considerably lower than that of cancer.

6.45 In the event of an accident, the release of radioactivity into the environment could lead to adverse health impacts through direct exposure to high levels of ionising radiation or following increased contamination of air, land and water, which could lead in turn to ingestion via the water supply or food chain, potentially over a wide area. These consequences could potentially result in death, or in a range of cancers, burns and sensory impairment, depending on the scale of incident that occurred and in which part of the nuclear power station it occurred.

6.46 This potential radiological health detriment already exists for current nuclear power stations, but is mitigated by a strict regulatory regime which covers both emissions associated with normal operation and limits the possibility that nuclear power stations built in the UK may release radioactive material as the result of an accident. Before considering the structure and effectiveness of the existing regulatory regime in mitigating such detriment, the Secretary of State has considered whether the potential radiological health detriment from the UK ABWR raises issues not covered by the existing regulatory regime.

Radiological health detriments of the UK ABWR compared with other designs

6.47 Although Regulatory Justification is not about comparing one design with another, the Secretary of State has considered how the potential radiological health detriment of the UK ABWR compares with other nuclear power station designs, including existing nuclear power stations.

6.48 During consultations which led to the Justification of the EPR and AP1000 designs the Government published a paper by its advisers Integrated Decision Management (IDM)[40] which assessed similarities and differences between different types of nuclear power station, including Boiling Water Reactors such as the UK ABWR as well as Pressurised Water Reactors such as the EPR and AP1000. IDM (with contributions from the National Nuclear Laboratory – IDM-NNL) advised that the benefits and detriments of the different

[40] Advice on the influence of reactor technology on the definition of classes or types of practice for new build justification, Authors: Gregg Butler, Grace McGlynn (IDM) with input from Andrew Worrall and Kevin Hesketh (National Nuclear Laboratory)

http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/assets/decc/idm_report.pdf

designs under consideration were broadly similar at the high level of assessment suitable to Regulatory Justification. The Secretary of State is satisfied that this advice remains valid in the case of the UK ABWR.

UK Regulatory Regime

6.49 Because of the potential for significant health detriment associated with exposure to a high level of radiation, the emission of radiation from nuclear power stations, and from other stages of the process, is heavily restricted and emissions are kept at very low levels. These emissions are at all stages closely regulated and monitored in the UK by a regulatory regime.

6.50 The measures taken to limit exposure to radiation are based on legal, regulatory or advisory limits and constraints on the level of radiation to which people can be exposed. They are therefore matters dealt with by the Optimisation or Dose Limitation processes referred to in paragraphs 2.10 to 2.17 rather than by the Regulatory Justification process itself.

6.51 However, the Secretary of State now considers the regulatory regime in order to inform himself fully on the issues relating to radiological health detriment, and in particular the structure and effectiveness of this regulatory regime in mitigating radiological health detriment to members of the public and employees of the nuclear industry.

UK Regulatory Regime – role of the Regulator

6.52 The safety of nuclear power stations in the UK is secured mainly through the licensing regime established in the Nuclear Installations Act 1965[41] (the 1965 Act). This national regime exists within the international framework for nuclear safety established by the International Atomic Energy Agency (IAEA), and is compliant with International Conventions[42].

6.53 The UK regulatory regime for the protection of members of the public and employees from the health detriment of radiation exposure is jointly the responsibility of the Office for Nuclear Regulation (the ONR), the Environment Agency, the Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW). NRW are actively involved in the GDA process for the UK ABWR with representation on the EA Programme Board.

6.54 ONR was formed in 2011 from the Health and Safety Executive's Nuclear Directorate, as an Agency of the HSE. Through the provisions of the Energy Act 2013 (the 2013 Act)[43], since April 2014 it has operated as an independent statutory corporation. It regulates the safety of nuclear power stations, as well as facilities for fuel fabrication and enrichment and waste management, throughout their lifecycle, by means of an established licensing and permitting regime. ONR's inspectors are appointed under both the 2013 Act and the Health and Safety at Work etc Act 1974[44] (the 1974 Act). They administer the 1965 Act and deal with nuclear and radiological safety issues at licensed nuclear sites. Inspectors'

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[41] Nuclear Installations Act 1965 (c.57)
http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1965/cukpga_19650057_en_1

[42] The International Convention on Nuclear Safety – http://www-ns.iaea.org/conventions/nuclear-safety.htm The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management http://www.iaea.org/Publications/Documents/Conventions/jointconv.html

[43] http://www.legislation.gov.uk/ukpga/2013/32/contents/enacted/data.htm

[44] http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1974/cukpga_19740037_en_1

activities include prior assessment of the safety of proposed nuclear facility designs and operational regimes, inspection of the implementation of the licensee's licence condition compliance arrangements and investigation of incidents and complaints.

6.55 The site licensing system has three parts, related to: the acceptability of the reactor design (which is being partly carried out through GDA); the prospective operator's capability; and site-specific issues. A site licence will define the site boundary and the nuclear-related activities which can be undertaken on site, list the conditions to which these activities are subject. The licence conditions provide for hold points during and after construction, at which ONR may intervene, inspect, stop activity or require the shut-down of operating plant.

6.56 The 1965 Act allows ONR to attach to each nuclear site licence such conditions as it considers necessary or desirable in the interests of safety or with respect to the handling, treatment or disposal of nuclear materials. ONR has the power to add, vary or revoke conditions, so providing scope for the licence to be tailored to specific circumstances and the phase of the installation's life.

6.57 Licence conditions cover all the arrangements for managing safety, including the production of adequate safety cases for all operations, the appointment of competent personnel, safety training and supervision, handling and storage of nuclear material, control of organisational change, response to accidents and emergency planning arrangements.

6.58 With regard to enforcement, the 1965 Act and licence conditions themselves enable ONR to take a range of measures including:

- attaching conditions to a licence, and varying or revoking those conditions;
- varying a licence, to reduce the area of the licensed site;
- consenting to particular actions;
- approving particular arrangements or documents, generally to freeze them so they cannot be changed without ONR agreement;
- notifying the licensee that it requires certain information to be submitted, for example, a safety case;
- issuing specifications to require the submission of particular documents for examination, or specifying that something must be done in a particular way;
- issuing agreements in relation to particular plant or process modifications;
- directing the licensee to shut down particular operations; and
- revoking a nuclear site licence.

6.59 The ONR provides guidance to its inspectors in the form of Safety Assessment Principles (SAPs)[45], which include numerical targets termed the Basic Safety Levels (BSLs) and Basic Safety Objectives (BSOs). The BSLs effectively form a cap on the level of radiological detriment from any facility that would be allowed to proceed. The BSOs form benchmarks that reflect modern nuclear safety standards and expectations.

6.60 The ONR's guidance is also based on the "defence in depth" approach to safety. "Defence in depth" should provide a series of levels of defence (inherent features, equipment and procedures) aimed at preventing accidents and ensuring appropriate

[45] Safety Assessment Principles for Nuclear Facilities http://www.hse.gov.uk/nuclear/saps/saps2006.pdf

protection in the event that prevention fails. The levels of protection should prevent faults, or if prevention fails should ensure detection, limit the potential consequences and prevent escalation.

6.61 Before permitting the operation of a new nuclear power station, the ONR will have to be satisfied that:

- the nuclear power station is designed and operated so that there is adequate protection against exposure to radiation in normal and accident conditions to protect both employees and members of the public, including meeting statutory dose limits;
- sufficient levels of protection and defence are provided against significant faults or failures;
- accident management and emergency preparedness strategies are prepared; and
- all reasonably practicable steps have been taken to minimise the radiological consequences of an accident[46].

6.62 ONR will also require the operator to implement a high standard of flood risk protection to ensure the plant can withstand the effects of sea level rise due to global warming, as well as potential extreme weather events, such as a one in 10,000 year flood risk[47].

6.63 Granting of a site licence can take place well before the start of nuclear construction, but once granted, the licensee must obtain ONR's permission before starting such construction. In considering when to grant a licence, ONR looks at three main aspects of an applicant's proposals:

- the overall nuclear safety case for the activities that are planned to take place following receipt of the licence (this will be likely to require less evidence than will be required to permit the start of nuclear construction);
- evidence that the siting aspects have been adequately considered; and
- evidence that the organisation and resourcing of the proposed licensee corporate body is appropriate to manage that stage of the project, and covering the arrangements needed to meet the licence conditions (normally all covered in a Safety Management Prospectus).

6.64 In view of points made in responses to the consultation on the Application, the Secretary of State notes this last point in particular. He understands that Horizon Nuclear Power rather than Hitachi-GE Nuclear Energy are expected to be the operator at the new nuclear power stations where it is currently proposed that the UK ABWR will be deployed. But whichever company is the operator, there or at any other site, will have to meet the expectations and requirements of the nuclear regulators as set out in this document.

6.65 The Environment Agency, Natural Resources Wales and the Scottish Environmental Protection Agency are responsible for ensuring that new nuclear power station designs meet high environmental standards through using the best available techniques (BAT), or in Scotland Best Practicable Environmental Option (BPEO) and Best Practicable Means

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[46] See also "Licensing Nuclear Installations" published by the ONR
http://www.hse.gov.uk/nuclear/licensing-nuclear-installations.pdf

[47] Safety Assessment Principles for Nuclear Facilities: EHA.4, EHA.11, EHA.12, EHA.14, EHA.15, ECE.23
http://www.hse.gov.uk/nuclear/saps/saps2006.pdf

(BPM), consistent with the OSPAR Convention[48]. The GDA process ensures that the reactor designers address this requirement at an early stage. This ensures that the most appropriate techniques to minimise radioactive waste generation at source and discharges[49] can be incorporated into the designs of the new nuclear power stations.

6.66 The application of BAT, BPEO and BPM would ensure that discharges from new nuclear power stations constructed in the UK would not exceed those of comparable power stations across the world. Any new nuclear power stations will need authorisation or permitting from the relevant environment agency before making any discharges of radioactivity into the environment or disposals of radioactive waste under the provisions of, in England and Wales, the Environmental Permitting (England and Wales) Regulations 2010[50] and, in Scotland and Northern Ireland, the Radioactive Substances Act 1993[51]. The regulators are able to set appropriate conditions in permits that must be complied with[52].

6.67 The Environment Agency, Natural Resources Wales and the Scottish Environment Protection Agency can issue enforcement, prohibition and revocation notices where authorisation conditions are being contravened, or where there is risk of environmental harm.

6.68 The environmental regulators also require operators to assess and report their discharges and disposals of radioactive waste. Operators are required to inform them about any circumstances where they may be failing to comply with the conditions of their permit, for example if they were failing to comply with discharge limits. Additionally, the environmental regulators can set "notification levels" on discharges that require operators to notify them where the levels are exceeded and to carry out a review of their performance with regard to the use of BAT, BPEO and BPM to minimise discharges.

6.69 This regulation will continue throughout the operation of a nuclear power station. Operators would need to manage and incorporate into their business case the potential for any age-related deterioration in nuclear plant components, and the licensing authority would need to be assured of effective mitigating actions where necessary in order to allow the nuclear power station to continue operating.

6.70 In addition to the existing regulatory regime, in July 2009 the EU adopted a Directive on Nuclear Safety[53]. Since then, the EU have undertaken a Stress Test exercise of all the EU's nuclear reactors to ensure that the lessons learned from the accident at Fukushima in Japan in 2011 are taken into account. Additionally the Nuclear Safety Directive was also reviewed and amended to further strengthen the measures in place to ensure the continuous improvement of in the management of the health and safety risks associated

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[48] Convention for the Protection of the Marine Environment of the North-East Atlantic http://www.ospar.org/content/content.asp?menu=01481200000000_000000_000000

[49] The regulatory regime for liquid and gaseous discharges is considered in further detail in Chapter 7 (Radioactive Waste).

[50] The Environmental Permitting (England and Wales) Regulations 2010 (2010 No. 675) http://www.opsi.gov.uk/si/si2010/uksi_20100675_en_1

[51] Radioactive Substances Act 1993 (c. 12) http://www.opsi.gov.uk/acts/acts1993/ukpga_19930012_en_1

[52] See the Environment Agency's published Environmental Principles - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296388/geho0709bqsb-e-e.pdf

[53] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:172:0018:0022:EN:PDF

with the management of civil nuclear facilities. The revised Nuclear Safety Directive was adopted by EU Member States on 8 July 2014.

Regulatory Regime – Members of the public

6.71 As stated, radiation occurs naturally in the environment. PHE, which regularly reviews the radiation exposure of the UK population, has calculated that the overall average annual dose to a member of the public from all sources of radioactivity is 2.7 mSv per year. Of this, about 84% is from natural sources, about 16% from medical procedures and about 0.2% from all other sources, including nuclear power stations[54].

6.72 By law the radiation to which members of the public are exposed from all sources, excluding natural sources and medical procedures, is limited to 1 mSv per year[55]. This limit applies to the cumulative effects of planned exposures and therefore takes into account the cumulative impact of having more than one source of radiation in a particular area. The radiation to which people living near a new nuclear power station are exposed is legally limited to 1 mSv per year, taking into account exposures from other nearby sites and any past controlled releases.

6.73 PHE, in its paper on the risks of exposure to low doses of radiation[56], states that a dose of 1 mSv per year is equivalent to an additional risk of fatal cancer of one in twenty thousand (0.005%) per year, and that a risk at this level is not detectable among normal background levels of cancer risk.

6.74 In addition to the statutory dose limit, operators are required to use BAT, BPEO and BPM to ensure that doses to members of the public are "as low as reasonably achievable" (ALARA). The environment agencies run monitoring programmes to provide an independent check on the impacts of radioactive discharges and publish annual reports[57] which show that radiation doses to people living around nuclear sites remain well below the statutory dose limit of 1 mSv per year.

6.75 As well as the statutory limit of 1 mSv per year, PHE recommends that the radiation to which members of the public are exposed from a proposed controlled source, such as a new nuclear power station, should be no more than 0.3 mSv per year. PHE further recommends that dose constraints lower than this could be set where this is achievable.

6.76 PHE's recommendation is reflected in the Environmental Permitting (England and Wales) Regulations 2010 Schedule 23 Part 3[58], and a Direction issued by Scottish Ministers to

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[54] HPA-RPD-001 – Ionising Radiation Exposure of the UK Population: 2005 Review Authors: S J Watson, A L Jones, W B Oatway and J S Hughes Publication date: May 2005 ISBN: 0-85951-558-3

http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1247816567393 Figures for medical procedures and for all other sources are as amended in a further report by PHE to be published in 2014, which will confirm the general position set out in the 2005 paper.

[55] This is through the Ionising Radiations Regulations 1999, Statutory Instrument 1999 No. 3232 (which includes all activities carried out under a nuclear site licence granted by the Nuclear Installations Inspectorate under the Nuclear Installations Act 1965) http://www.opsi.gov.uk/si/si1999/19993232.htm , the Environmental Permitting (England and Wales) Regulations 2010 http://www.opsi.gov.uk/si/si2010/uksi_20100675_en_1 , and the Radioactive Substances (Basic Safety Standards) (Scotland) Regulations 2000 http://www.opsi.gov.uk/legislation/scotland/ssi2000/20000100.htm

[56] HPA-RPD-055 – An Introduction to the Estimation of Risks Arising from Exposure to Low Doses of Ionising Radiation, Authors: S Mobbs, S Watson, J Harrison, C Muirhead and S Bouffler, Publication date: June 2009 ISBN: ISBN 978-0-85951-643-3 http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1245052106074

[57] For more detail on the RIFE (Radioactivity in Food and the Environment) Reports, see paras 6.69-6.70

[58] http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents

the Scottish Environment Protection Agency[59]. These require the agencies to have regard to a maximum dose of 0.3 mSv per year to members of the public from any new source of radioactive discharges since 13 May 2000 and to have regard to a maximum dose of 0.5 mSv per year from any single site.

6.77 In July 2009, in response to the recommendations in ICRP Publication 103[60]. HPA provided further advice to the Government on its recommended dose constraints[61]. This states:

"Previously, the NRPB recommended a maximum dose constraint for proposed controlled sources of 0.3 mSv y-1 [per year] noting that dose constraints lower than this could be set where such doses are readily achievable. HPA continues to recommend this approach but re- emphasises that the 0.3 mSv y-1 [per year] value is a maximum and that regulators should set lower, more challenging dose constraints where appropriate. At the design stage of new plant it is more straightforward to take measures to reduce exposures of the public than it is when measures have to be introduced to existing plant. Therefore, it is recommended that for new nuclear power stations and new facilities for the disposal of radioactive waste, regulators consider applying a more challenging dose constraint, taking into account the levels of protection that can be achieved internationally. HPA specifically advises the UK Government to select a value for the constraint for members of the public for new nuclear power stations and waste disposal facilities that is less than 0.15 mSv per year. Such a constraint would apply only to new plant as a design criterion and would not apply to existing facilities which should operate within current arrangements."

6.78 This retains the status of advice and has not been translated into regulation or guidance.

6.79 The Secretary of State has considered the measures in place to protect employees of the nuclear industry.

6.80 The 2007 Recommendations of the International Commission on Radiological Protection (ICRP) retain the occupational dose limit given in ICRP 60[62] in 1990. These state that for planned exposure situations, that is, during the normal operation of a nuclear power station, the limit should be expressed as 20 mSv per year, averaged over defined five year periods, that is, 100 mSv over five years, without exceeding 50 mSv in any single year[63].

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[59] The Radioactive Substances (Basic Safety Standards) (Scotland) Regulations 2000 http://www.legislation.gov.uk/ssi/2000/100/contents/made

[60] http://ani.sagepub.com/content/suppl/2013/06/25/37.2-4.DC1/P_103_JAICRP_37_2-4_The_2007_Recommendations_of_the_Interenational_Commission_on_Radiological_Protection.pdf

[61] Application of the 2007 Recommendations of the ICRP to the UK. Advice from the Health Protection Agency. Doc HPA, RCE-12, 1–65, July 2009 http://www.hpa.org.uk/web/HPAwebFile/ HPAweb_C/1246519364845

[62] The National Radiological Protection Board stated in 1993 that there appeared to be no practical need for the five year averaging and recommended that the 20 mSv annual limit be observed (NRPB (1993). Occupational, public and medical exposure. Documents of the NRPB: Volume 4, No. 2). HPA restated this view in its response to the 2007 Recommendations of the ICRP (Application of the 2007 Recommendations of the ICRP to the UK. Advice from the Health Protection Agency. Doc HPA, RCE-12, 1–65, July 2009 http://www.hpa.org.uk/web/HPAwebFile/ HPAweb_C/1246519364845

[63] The National Radiological Protection Board stated in 1993 that there appeared to be no practical need for the five year averaging and recommended that the 20 mSv annual limit be observed (NRPB (1993). Occupational, public and medical exposure. Documents of the NRPB: Volume 4, No. 2). HPA restated this view in its response to the 2007 Recommendations of the ICRP (Application of the 2007 Recommendations of the ICRP to the UK. Advice

6.81 Under UK law, all employers are responsible for protecting their employees against exposure to ionising radiations. The Ionising Radiations Regulations 1999[64] require all employers to restrict doses so far as is reasonably practicable and to limit doses to 20 mSv in any calendar year unless the nature of the work makes this impracticable. In this event, the limit may be relaxed to 100 mSv over any consecutive five years with a maximum of 50 mSv in any single year, in accordance with the ICRP Recommendations.

6.82 As is indicated in the Application, the 2005 Health Protection Agency report[65] gives the average annual radiation dose to power station workers across all operators as 0.18 mSv, with 34 workers (out of more than 13,000) with individual doses in the band from 5 to 10 mSv/y, and no worker receiving a dose above this level.

Effectiveness of the Regulatory Regime

6.83 The Secretary of State has considered the evidence for the effectiveness of the regulatory regime.

6.84 The UK regulatory regime is based upon the principle of independent regulators backed up by sanctions. Reviews by the International Atomic Energy Agency in 2006 and 2009 concluded that the regulatory arrangements of the then HSE Nuclear Directorate were mature and transparent, with highly trained, expert and experienced staff. A third review[66] in 2013 commended the systematic way in which ONR had taken into account previous recommendations and the significant progress made in many areas, including on engagement with licensees, assessment of emergency preparedness and response capability, and regulatory guidance.

6.85 Where warranted, regulators take enforcement action against failures to comply with the requirements of a nuclear site licence or with a site's environmental permits, and will prosecute. The UK has a strong safety record with no events having occurred relating to a civil nuclear power station with off-site consequences or where all the safety barriers that are an inherent part of the design were breached.

6.86 The Euratom treaty requires all EU countries to compare radiation doses received with the dose limits. For doses to the UK population, this is the responsibility of the environment agencies, who run monitoring programmes to provide an independent check on the impacts of radioactive discharges. They publish annual RIFE (Radioactivity in Food and the Environment) reports[67] which show that radiation doses to people living around nuclear sites remain well below the statutory dose limit of 1 mSv per year. The most recent report, covering data for 2012, states "These monitoring programmes are independent of, and also used as a check on, the site operators' programmes and continue to show that total doses to the public, from both authorised/permitted discharges and direct radiation around the nuclear sites, remain low".

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from the Health Protection Agency. Doc HPA, RCE-12, 1–65, July 2009 http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1246519364845

[64] The Ionising Radiations Regulations 1999 http://www.opsi.gov.uk/si/si1999/19993232.htm

[65] HPA-RPD-001 – Ionising Radiation Exposure of the UK Population: 2005 Review Authors: S J Watson, A L Jones, W B Oatway and J S Hughes Publication date: May 2005 ISBN: 0-85951-558-3

http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1247816567393

[66] http://www.pressreleasepoint.com/iaea-mission-concludes-peer-review-uks-nuclear-regulatory-framework

[67] RIFE (Radioactivity in Food and the Environment) Reports, produced jointly by the Environment Agency, SEPA, Northern Ireland Environment Agency and the Food Standards Agency. In the most recent report for 2012, published in 2013, see in particular Table 1.1 "Individual doses - direct radiation pathway" and Table 4.1 "Individual doses – nuclear power stations". http://www.sepa.org.uk/radioactive_substances/publications/rife_reports.aspx

6.87 The report is supplemented by the Food Standards Agency publishing provisional analytical results from its radiological monitoring programme on a six-monthly basis, which are later confirmed and interpreted on an annual basis in the RIFE reports[68].

6.88 In addition, the site operators have local stakeholder groups, many of which have meetings that are open to the public, where the operators present the results of their monitoring programmes and the resulting radiation doses. The monitoring that is carried out, together with separate work to determine the habits of those people who are likely to be the most exposed (the critical group) is sufficient to ensure that the public are properly protected from discharges and disposals of radioactive waste from routine operation. The regulators also attend the site stakeholder groups and together provide updates on safety and environmental matters including about operational events, reviews, assessments and findings.

6.89 Operators are required to report to the Environment Agency, Natural Resources Wales and the Scottish Environmental Protection Agency about the levels of discharges and disposals of radioactive waste. The reports are placed on the Environment Agency's Public Registers where they can be inspected by the public[69].

6.90 The regulatory regime has continued to develop. The establishment of the GDA process, run through a Joint Programme Office by ONR and the Environment Agency has facilitated generic consideration of reactor designs ahead of site-specific licence and environmental permit applications, has improved coordination between regulators, allowed identification of issues earlier when they are easier to resolve and has increased transparency through the publication of relevant material on the regulators' and vendors' websites, including on regulatory observations and issues about the designs raised by regulators with the vendors. Natural Resources Wales are also actively involved in the GDA process with representation on EA Programme Board. The establishment of the ONR as an independent statutory corporation in April 2014 puts the regulator in a stronger position to fulfil its mission to provide efficient and effective regulation of the nuclear industry, holding it to account on behalf of the public.

6.91 The regulators completed Step 2 of GDA for the UK ABWR in August 2014[70] and published technical and summary reports.[71] For ONR, Step 2 is the assessment of the fundamental high level safety claims proposed by Hitachi-GE, as documented in its Preliminary Safety Reports (PSRs) and supporting references. In this step, ONR aims to identify features of the UK ABWR design that have the potential to render it unacceptable for construction in the UK. For the Environment Agency, Step 2 is the initial assessment to identify whether potential dose impact assessments are broadly acceptable, what further information is required, if there are any matters that are obviously unacceptable and if any significant design modifications are likely to be required.

6.92 Hitachi-GE have agreed to a number of changes to its Reference Plant to meet UK regulatory expectations. This indicates the key benefit of the GDA process; the identification and resolution of safety, security and environmental issues ahead of any

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[68] http://food.gov.uk/science/research/radiologicalresearch/radiosurv/rife/

[69] http://www.environment-agency.gov.uk/research/library/publicregisters/default.aspx

[70] http://www.onr.org.uk/new-reactors/reports/quarterly-report-q3-2014.pdf

[71] http://www.onr.org.uk/new-reactors/uk-abwr/reports.htm

regulatory permissions for the start of construction, means more predictable and achievable schedules for the construction of the reactors.

6.93 Although the regulators have raised a number of questions about the design with Hitachi-GE, there have been no Regulatory Issues identified so far, Regulatory Issues being the highest category of regulatory concern, which indicate that the technology could be unsuitable for licensing or permitting in the UK. The regulators have now begun Step 3 of GDA. GDA of the UK ABWR is expected to be completed by the end of 2017.

6.94 The Secretary of State notes that a significant amount of the information associated with the GDA process is publicly available through Hitachi-GE's GDA website[72] as well as through the regulators' own website[73].

6.95 The Secretary of State considers that the regulatory regime will ensure effective mitigation of the potential radiological health detriment from any UK ABWR which is built in the UK. The effect of the regulatory regime is to provide confidence that any UK ABWR built will be able to meet regulatory limits and will be robust against the risk of an accident or attack. This is supported by the strong safety and security record of the nuclear industry in the UK. As exemplified by self-examination undertaken by ONR subsequent to the Fukushima accident, the Secretary of State is satisfied that the regulators will ensure that the effectiveness and efficiency of the regulatory regime is kept under continuous review and that improvements are made where necessary, as was the case following the accident at Fukushima.

Fukushima

6.96 As stated in paragraph 6.12, Annex 5 of the Application sets out in detail the reasons why the events at Fukushima in 2011 have not changed the Applicant's view that the risk of a severe accident in the UK is low. The Secretary of State agrees with the Applicant that Fukushima highlighted the potential for nuclear power stations to be affected by natural disasters, and for a severe accident to adversely impact the ability to maintain cooling and backup electrical power supplies. There is clearly potential detriment to be taken into account in a Justification decision.

6.97 The Secretary of State has therefore taken into account the actions taken following the events at Fukushima in 2011. Immediately following the event, the Government commissioned the then Chief Nuclear Inspector at ONR, Mike Weightman, to write a report on the implications of Fukushima for the UK nuclear industry[74].

6.98 Dr Weightman found that the direct causes of the events at Fukushima were a magnitude 9 earthquake, the strongest ever recorded in Japan, and an associated 14m high tsunami, and that these were far beyond the most extreme natural events that the UK would be expected to experience. He concluded "I remain confident that our UK nuclear facilities have no fundamental safety weaknesses. The Office for Nuclear Regulation already requires protection of nuclear sites against the worst-case scenarios that are predictable for the UK."

6.99 Dr Weightman found that there were no fundamental weaknesses in UK nuclear facilities and no reason to curtail the operation of UK operating sites. He found that the UK regulatory regime was effective with no fundamental weaknesses in the UK nuclear licensing regime or the safety assessment principles which underpinned it. He saw no

[72] https://www8.hitachi.co.jp/inquiry/hitachi-hgne/en/general/form.jsp

[73] http://www.onr.org.uk/new-reactors/

[74] http://www.onr.org.uk/fukushima/

reason to revise the strategic advice given by the regulators on which the Nuclear National Policy Statement was based, or any need to change siting strategies for new nuclear power stations in the UK.

6.100 Also, following Fukushima, the UK, with every other nuclear power generating country in Europe, carried out safety 'stress tests'[75]. The tests, completed by licensees, involved a targeted reassessment of each station's safety margins in light of extreme natural events, such as earthquake and tsunami. The European stress tests only focused on nuclear power stations but ONR extended them to all licensed nuclear installations within the UK.

6.101 Dr Weightman's report noted that there were lessons to be learnt around severe accident management and made a number of recommendations to industry, Government and regulators. A, and an implementation report was published in 2012[76]. The report identified actions that new nuclear plants should take to explicitly ensure weaknesses that were present in the Fukushima plant are not present in UK plants. The Application sets out how these have been addressed for the UK ABWR, which compared to the generic ABWR will incorporate new features to deliver a higher level of protection against severe external hazards that are beyond the design basis.

6.102 The Secretary of State is therefore satisfied that the events at Fukushima should not affect his estimate of the benefits and detriments of the UK ABWR.

Studies on the impact of radiation on health

6.103 The Government's view is that new nuclear power stations would pose a very small risk to health. The Secretary of State considers studies on the impact of radiation on human health are potentially valuable information and is aware of differing views about the findings of such studies, notably the reports produced by the Committee on Medical Aspects of Radiation in the Environment (COMARE)[77], and the KiKK study[78].

6.104 The Secretary of State particularly noted respondents' concerns about the findings of the KiKK study. In considering these concerns, the Secretary of State has taken into account the work of COMARE. Annex A explains that COMARE is an independent scientific advisory committee which advises Government departments and devolved authorities on all aspects of health risk to people exposed to natural and man-made radiation[79].

6.105 COMARE has since 1986 investigated the incidence of childhood cancer and other cancers around nuclear sites. COMARE has published a series of reports on topics related to exposure to radiation. Its view is that there is no evidence for unusual aggregations of childhood cancers in populations living near nuclear power stations in the UK.

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[75] http://www.onr.org.uk/fukushima/european-council-stress-tests.htm

[76] http://www.onr.org.uk/fukushima/implementation-report-oct-2012.pdf

[77] http://www.comare.org.uk/

[78] https://doris.bfs.de/jspui/bitstream/urn:nbn:de:0221-20100317939/4/BfS_2007_KiKK-Studie.pdf

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[79] See http://www.comare.org.uk/ and Annex B (Roles of Independent Regulators and Advisory Bodies in the UK) for more information on COMARE'S role and recent reports

6.106 COMARE's tenth report[80], published in 2005, considered the incidence of childhood cancer around nuclear installations. These were divided into nuclear power stations and other nuclear sites. The results for the nuclear power stations supported the conclusion that "there is no evidence from this very large study that living within 25 km of a nuclear generating site in Britain is associated with an increased risk of childhood cancer".

6.107 COMARE's tenth report did, however, conclude that the situation for the other nuclear sites is more complicated. Studies confirmed previous COMARE findings of excess childhood cancers in Seascale near Sellafield, Thurso near Dounreay and around Aldermaston, Burghfield and Harwell. Historically, Sellafield is the UK nuclear site with the largest of all radioactive discharges. COMARE's fourth report[81], published in 1996, which concentrated on Sellafield and childhood leukaemia in Seascale, concluded that "on current knowledge, environmental radiation exposures from authorised or unplanned releases could not account for the excess [of leukaemia and other cancers]."

6.108 In its eleventh report[82], published in 2006, COMARE examined the general pattern of childhood leukaemia in Great Britain and concluded that many types of childhood cancers "have been shown not to occur in a random fashion". It also stated that "The results of analyses […] suggest that there is no general clustering around nuclear installations".

6.109 The Kinderkrebs in der Umgebung von Kernkraftwerken (KiKK) study of childhood cancer in the vicinity of German nuclear power plants between 1980 and 2003 was published in 2008 by the German Childhood Cancer Registry (DKKR), based on data from and designed in consultation with the Federal Office for Radiation Protection (BfS)[83].

6.110 The KiKK study found that there was a correlation between the distance of the home from a nuclear power station and the risk of developing leukaemia before the fifth birthday. However, it also noted that the exposure to ionising radiation in the vicinity of German nuclear power stations was lower by a factor of 1,000 to 100,000 than the exposure to natural background and medical radiation. It concluded "*The present study confirms that in Germany there is a correlation between the distance of the home from the nearest [nuclear power station] at the time of diagnosis and the risk of developing cancer (or leukaemia) before the 5th birthday. This study is not able to state which biological risk factors could explain this relationship. Exposure to ionising radiation was not measured or modelled. Although previous results could be reproduced by the current study, the present status of radiological and epidemiological knowledge does not, as a rule, allow the conclusion that the ionising radiation emitted by German [nuclear power stations] during normal operation is the cause. This study can not conclusively clarify whether confounders, selection or random influences play a role in the distance trend observed.*"

6.111 An analysis by the German Commission on Radiological Protection concluded that the design of the KiKK study was suitable for analysing risks according to distance but not for

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[80] Committee on Medical Aspects of Radiation in the Environment (COMARE) (2005). Tenth Report. The incidence of childhood cancer around nuclear installations in Great Britain.

http://www.comare.org.uk/ documents/COMARE10thReport.pdf

[81] http://www.comare.org.uk/documents/COMARE1-6reports.pdf

[82] http://www.comare.org.uk/press_releases/documents/COMARE11thReport.pdf

[83] https://doris.bfs.de/jspui/bitstream/urn:nbn:de:0221-20100317939/4/BfS_2007_KiKK-Studie.pdf

English translation starts after page xi

establishing a correlation with exposure to radiation from nuclear power stations. It pointed out that the natural radiation exposure within the study area, and its fluctuations, were both greater, by several orders of magnitude, than the additional radiation exposure from the nuclear power stations. The analysis concluded "*If one assumes that the low radiation exposures caused by the nuclear power plants are responsible for the increased leukaemia risk for children, then, in light of current knowledge, one must calculate that leukaemias due to natural radiation exposure would be more common, by several orders of magnitude, than they are actually observed to be in Germany and elsewhere*." [84]

6.112 Following the KiKK study, COMARE requested that a re-analysis of the UK childhood cancer data used in COMARE's tenth report be carried out using the same methodology as the KiKK study as far as was possible. This reanalysis – the Bithell paper[85] – was published in December 2008. It showed that, for the UK, the conclusions of the COMARE tenth report remained valid when applying methodology closer to that of the KiKK study on the same dataset.

6.113 The KiKK study gave the results on childhood cancer in the vicinity of 16 German nuclear power stations from a dataset established by the German Childhood Cancer Registry, which included over 1,500 childhood cancer cases from 1980 to 2003. In comparison, the dataset used for COMARE's tenth report and the subsequent Bithell paper contained over 32,000 cases of childhood cancer from 1969 to 1993. This is a verified national database and is believed to be the largest national database on childhood cancer in the world. The size of the database used by COMARE therefore gives considerable confidence in the results of its tenth report.

6.114 In May 2011 COMARE published as its 14th report[86] a further review of the incidence of childhood cancer around nuclear power stations, with particular reference to the KiKK study and COMARE's 10th and 11th reports. In this 14th report, COMARE found no reason to change its previous advice that there is no evidence to support the view that there is an increased risk of childhood leukaemia and other cancers in the vicinity of nuclear power stations due to radiation effects. COMARE also recommends that the Government keep a watching brief in this area.

6.115 The Secretary of State is satisfied that the best evidence suggests that no appreciable linkage between nuclear power stations and a higher incidence of cancer has been demonstrated.

Regulatory Regime – ICRP

6.116 The Secretary of State noted that respondents to the consultation on the Application questioned the basis of the regulatory regime. The Government believes that using dose limits as prescribed by the International Commission on Radiological Protection (ICRP) system of radiological protection is the correct way to restrict the impact of radiation on individuals, and is in line with the position in other countries. Following the consultation on his Proposed Decision, the Secretary of State asked PHE for further advice on this point.

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[84] http://www.ssk.de/SharedDocs/Beratungsergebnisse_PDF/2008/Kikk_Studie_e.pdf?__blob=publicationFile

[85] Childhood leukaemia near British nuclear installations: methodological issues and recent results, Bithell et al, Radiation Protection Dosimetry 2008 132(2): 191-197 http://rpd.oxfordjournals.org/cgi/content/abstract/132/2/191

[86] http://www.comare.org.uk/press_releases/documents/COMARE14report.pdf

6.117 The system of radiological protection recommended by the ICRP minimises radiation health risks through the application of three principles: the justification of activities leading to radiation exposure of patients, workers and the public; the optimisation of exposures to ensure they are as low as reasonably achievable; and, the limitation of doses received by individuals below internationally agreed levels. This system underpins the Basic Safety Standards Directive which is the basis for Regulatory Justification, and the International Basic Safety Standards for Radiation Protection and Safety of Radiation Sources[87]. PHE therefore confirmed that the ICRP's system of protection has wide international acceptance as a basis for regulatory control and is appropriate as a basis for regulation in the UK.

6.118 PHE further explained that knowledge of the health effects of ionising radiation was reviewed by the ICRP in 2007. ICRP Publication 103[88] referred to the conclusions of ICRP Publication 60[89] (published in 1990) and concluded that "[ICRP's] extensive review of the health effects of ionizing radiation has […] not indicated that any fundamental changes are needed to the system of radiological protection". In its response[90] to the recommendations in ICRP Publication 103, HPA was in overall agreement with ICRP's position on the health effects of ionising radiation for the purposes of radiological protection. PHE advised that no information has been published since the recommendations in ICRP Publication 103 that has caused PHE to change its overall views on the control of exposures to ionising radiation.

6.119 PHE said that they continue to endorse the approaches adopted by the ICRP in developing an internationally agreed system for protection against ionising radiation and that concerns raised about the conventional approach to radiation risk were considered in depth in an HPA publication of April 2010 "Risks from ionizing radiation"[91], which specifically examines the criticisms that have been made of the ICRP model.

6.120 PHE continues to assess recent findings and is at the forefront of research on radiation risks from external and internal sources of exposure. PHE endorses the approaches adopted by the ICRP in developing an internationally agreed system for protection in various situations of exposure, based on scientific analyses published by international bodies, principally UNSCEAR.

6.121 The Secretary of State notes respondents' concern about this issue, but has not been presented with any evidence which would cause him to change the conclusion reached in the Proposed Decision that adhering to the principles of justification, optimisation and dose limitation is the correct way to restrict the impact of radiation on individuals.

Overseas practices

6.122 As explained in paragraphs 2.55 to 2.57, the Secretary of State does not consider that he is bound to take practices outside the UK into account in making a Regulatory Justification decision. The recommendations of the ICRP and the EU legislation require

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[87] http://www-pub.iaea.org/MTCD/publications/PDF/p1531interim_web.pdf

[88] http://ani.sagepub.com/content/suppl/2013/06/25/37.2-4.DC1/P_103_JAICRP_37_2-4_The_2007_Recommendations_of_the_Interenational_Commission_on_Radiological_Protection.pdf

[89] http://ani.sagepub.com/content/suppl/2013/06/25/21.1-3.DC1/P_060_JAICRP_21_1-3_1990_Recommendations_of_the_ICRP.pdf

[90] Application of the 2007 Recommendations of the ICRP to the UK. Advice from the Health Protection Agency. Doc HPA, RCE-12, 1–65, July 2009 http://www.hpa.org.uk/web/HPAwebFile/ HPAweb_C/1246519364845

[91] HPA-RPD-066 :Risks from ionising radiation, Mobbs S F, Muirhead C R and Harrison J D, http://www.hpa.org.uk/Publications/Radiation/HPARPDSeriesReports/HPARPD066/

each country to assess the benefits and detriments of a class or type of practice carried on within its own borders, and to enforce the conclusions from such assessments. This is consistent with the Secretary of State's powers under the Regulations, which give no authority to acquire information outside the UK for the purposes of making a Justification decision and no powers to enforce any decision. In addition the UK Justifying Authority has no jurisdiction to assess the social benefits associated with a practice being conducted outside the UK.

6.123 However, the Secretary of State is aware of concerns about overseas practices in the context of uranium mining and therefore, to the extent that it is readily possible, sets out his views on the subject.

6.124 The United Nations established the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), staffed by scientists from member states, to assess and report levels and effects of exposure to ionizing radiation, and, given the different position and procedures in different countries, to make comparisons between them.

6.125 UNSCEAR has been publishing reports on exposure to radiation from the whole nuclear fuel cycle since the 1970s[92]. Its 2000 report, "Sources and Effects of Ionising Radiation"[93], and in particular Annex C, "Exposures from man-made sources of radiation", covering exposure to members of the public and Annex E, "Occupational radiation exposures", covering exposure to employees of the nuclear industry is relevant to this issue.

6.126 UNSCEAR's finding is that the dose rate to members of the public from uranium mining is low, and "would be imperceptible from variations of the normal background dose rate from natural sources"[94].

6.127 UNSCEAR's finding[95] is that "The average annual effective doses to workers in the nuclear fuel cycle are, in most cases, larger than the doses to those in other occupations; for the fuel cycle overall, the average annual effective dose is about 1.75 mSv. For the mining of uranium, the average annual effective dose to monitored workers in countries reporting data was about 4.5 mSv [for the most recent period considered (1990 – 1994)], and for uranium milling operations, it was about 3.3 mSv. There are, however, very wide variations about these average values, with doses of about 50 mSv being reported in some countries."

6.128 UNSCEAR's finding summarises detailed evidence presented in the report[96]. From this evidence it is clear that these high doses are exceptional. In only one country and period (uranium mining in Gabon in the period 1985 – 1989) is the average annual effective dose to workers recorded as being over 20 mSv, at 21.0 mSv. In all other countries the average annual effective dose to workers is consistently below 20 mSv, in most cases well below, and in most countries, including Gabon, the trend over the periods covered (from 1975 – 1979 to 1990 – 1994) is downwards.

6.129 Across the world, therefore, UNSCEAR reported the exposure of employees to radiation for uranium mining and milling as, with some exceptions, well below the recommended ICRP annual limit applied in the UK of 20 mSv.

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[92] http://www.unscear.org/unscear/en/publications.html

[93] http://www.unscear.org/unscear/en/publications/2000_1.html

[94] Annex C, paragraph 124 of UNSCEAR 2000 Report

[95] Annex E, paragraph 308 of UNSCEAR 2000 Report

[96] Annex E, Tables 3 and 4, from page 559, of UNSCEAR 2000 Report

6.130 In August 2010, UNSCEAR published the first volume of its 2008 report[97], "Sources of Ionising Radiation", which includes as Annex B further consideration of "Exposures of the public and workers from various sources of radiation".

6.131 On public exposure[98], UNSCEAR's finding was that an average annual effective dose of 25 microsieverts was still valid for the major producing countries.

6.132 On occupational exposure, UNSCEAR's finding[99] was that average annual effective doses have declined further since their previous report, from 4.5 mSv in 1990 – 1994 to 3.9 mSv in 1995 – 1999 and 1.9 mSv in 2000 – 2002 for uranium mining, and from 3.3 mSv in 1990 – 1994 to 1.6 mSv in 1995 – 1999 and 1.1 mSv in 2000 – 2002 for uranium milling.

6.133 The Organisation for Economic Co-operation and Development (OECD) conducted a study in 2000[100]. Although its purpose was to compare options for the management of spent fuel, this involved looking at the radiation exposure caused by uranium mining. The study found that the dose levels to employees, although higher than for other stages in the nuclear fuel cycle, remained at levels similar to the averages reported by UNSCEAR, and therefore well below the recommended ICRP annual limit applied in the UK of 20 mSv[101].

6.134 The study also found that doses to members of the public were "low compared to the pertinent regulatory limits, and also insignificantly low compared with exposures from natural background radiation"[102].

6.135 The findings of these studies are therefore that the radiation exposure caused by uranium mining is high compared with other stages of the fuel cycle but in the vast majority of cases low in terms of impact on employee and members of the public and well below regulatory dose limits. This is consistent with the advice received by the Secretary of State from Integrated Decision Management and the National Nuclear Laboratory (IDM–NNL) at the time of the consultation on the Proposed Decisions to Justify the EPR and AP1000 designs[103].

6.136 A further source of information is a report by a Committee of the Australian Parliament, published in 2006 followed an inquiry by the Committee which heard evidence from supporters and opponents of uranium mining[104].

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[97] http://www.unscear.org/unscear/en/publications/2008_1.html

[98] Annex B, paragraph 161 of UNSCEAR 2008 Report

[99] Annex B, paragraphs 524 and 530 of UNSCEAR 2008 Report

[100] Radiological Impacts of Spent Nuclear Fuel Management Options http://www.oecd-nea.org/rp/reports/2000/nea2328-PARCOM-ENG.pdf

[101] OECD Report, Table 16, page 45

[102] OECD Report, pages 61 - 62

[103] http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/assets/decc/consultations/proposedregulatoryjustificationdecisionsnewnuclearpowerstations/1_20091109121208_e_@@_technicaladviceregulatoryadvice.pdf

[104] http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCsQFjAA&url=http%3A%2F%2Fwww.aph.gov.au%2Fparliamentary_business%2Fcommittees%2Fhouse_of_representatives_committees%3Furl%3Disr%2Furanium%2Freport%2Ffullreport.pdf&ei=iQowU53NHYLm7AbVpYG4Bg&usg=AFQjCNFJifYfr1JQPWjdEd0oqghFZD3OLA

6.137 On the basis of the evidence heard, the Committee concluded that the radiation exposure for employees of uranium mines was less than half the regulatory dose limit of 20 mSv a year and that the radiation exposure for members of the public was a small fraction of the public limit of 1 mSv a year[105].

6.138 It appears from the UNSCEAR report that in some countries where regulatory regimes are less developed workers in the industry can in some cases be exposed to levels of radiation higher than would be acceptable in the UK. However, the Secretary of State is satisfied that overall the evidence presented by UNSCEAR, the OECD and the Australian Parliament is overwhelmingly to the effect that radiation exposure from uranium mining is at levels well below internationally agreed dose limits and that he has not been presented with any evidence which would cause him to question that view. So if the Secretary of State is wrong and overseas practices are a matter he should take into account in taking his decision he confirms that even having regard to them, he would be satisfied that limited health detriments arise from the mining of uranium.

Conclusion

6.139 Exposure to high levels of radiation has potentially significant health detriments. Low levels of radioactivity occur naturally in the environment but the nuclear reactions that take place in the UK ABWR create a high level of radioactivity in the reactor. The by-products that result from these reactions are capable of giving off high levels of radiation and therefore require careful management during and beyond the operational life of a nuclear power station.

6.140 Extensive safety precautions are taken in order to protect those that work in nuclear power stations and members of the public from the health detriments arising from these by-products. The UK ABWR has been designed to prevent the unplanned release of radioactivity during normal operations and in the event of accident, both through a system of protective barriers and through a system of defences to protect these barriers from failure. In addition to these inherent safety features any UK ABWR that is built in the UK will be subject to the regulatory regime, which is internationally recognised as mature and transparent, with highly trained and experienced regulatory staff.

6.141 Regulations require limitation of doses to employees of the nuclear industry and members of the public. By law, the radiation to which members of the public are exposed from all sources, excluding medical exposures of patients and natural radiation, is limited to 1 mSv per year. Further dose constraints provide that planned discharges from a single source cannot lead to doses to the public greater than 0.3 mSv per year, though a lower dose constraint of less than 0.15 mSv per year to members of the public has been recommended by PHE.

6.142 Having considered advice from the regulators on the health detriments of exposure to low levels of radiation, the Secretary of State is satisfied that compliance with the regulatory regime would ensure that any UK ABWR would give rise to a very limited health impact on both workers and members of the public.

6.143 The Secretary of State has considered the information submitted by the Applicant about the UK ABWR, advice from the regulators based on many years of experience in regulating existing nuclear power stations and their assessments through the GDA process, advice from technical advisers, and the responses to the consultations on the

[105] Paragraph 1.39 and page 343 of Australian Parliament Report

Application and the Proposed Decision. He is confident, subject to the completion of GDA, that the specified dose limits and constraints should be achievable.

6.144 The Secretary of State is also confident that the design and safety precautions of the UK ABWR are such that the chance of exposure to members of the public or employees at nuclear power stations of high levels of radiation arising from an accident at a UK ABWR are very small.

6.145 The Secretary of State has confidence that, with many years of regulatory experience, the regulatory regime is sufficiently robust to ensure that the UK ABWR is operated so that dose levels remain within the limits set. In coming to this conclusion he is conscious of the extensive powers that the regulators have to enforce compliance, including issuing directions requiring compliance and ultimately removing the licence to operate a nuclear power station.

Chapter 7: Radioactive Waste

Introduction

7.1 ICRP Publication 77[106] states that "Waste management and disposal operations are an integral part of the practice generating the waste. It is wrong to regard them as a free-standing practice needing its own justification." The Secretary of State therefore considers waste management and disposal as part of the Justification of the UK ABWR.

7.2 The Secretary of State, in setting out in paragraphs 6.36 to 6.46 the radiological detriment to health that might be expected from the UK ABWR, noted that the release of radiation into the environment from nuclear power stations can occur through the planned and unplanned release of radioactive materials and that this requires careful management during and beyond the operational life of the nuclear power station.

7.3 The Secretary of State noted that this potential radiological health detriment already exists for current nuclear power stations and that this is reflected in the regulatory regime, which applies to the management and disposal of radioactive waste from nuclear power stations. The Secretary of State's main concern when considering the management and disposal of radioactive waste in the context of Regulatory Justification is its potential detriment to health.

7.4 Annex B of the Nuclear National Policy Statement published in 2011[107], "Radioactive Waste Management" states that the Government is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations in the UK. The UK Government's framework for implementing geological disposal is set out in the July 2014 White Paper '*Implementing Geological Disposal*'[108]

7.5 The Secretary of State considered all this material in coming to his decision.

7.6 This Chapter considers the content of the Application relating to the potential radiological health detriment from waste management and disposal from the UK ABWR, and responses to the consultation on the Application and the Proposed Decision. It then sets out the Secretary of State's view on this potential detriment, on the effectiveness of the regulatory regime in place in mitigating this potential detriment, and on other issues which have been raised.

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106 http://ani.sagepub.com/content/suppl/2013/06/25/27.1_suppl.DC1/P_077_JAICRP_27_S_Radiological_Protection_Policy_for_the_Disposal_of_Radioactive_Waste.pdf

107 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47860/1943-nps-nuclear-power-annex-volII.pdf

108 https://www.gov.uk/government/publications/implementing-geological-disposal

Summary of the Application

7.7 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

7.8 The Application states that the UK ABWR will generate very similar types of radioactive wastes during operation and decommissioning to those generated by the AP1000 and EPR reactors which were the subject of previous Justification decisions. It states that the ABWR has been developed elsewhere in the world to reduce waste generation through improved technologies and efficient operation, outlines the systems by which this has been done and expresses confidence that these systems will help enable the UK ABWR to gain UK regulatory acceptance through GDA.

7.9 The Application states that a programme of new nuclear power stations such as the UK ABWR would add a relatively small volume of radioactive waste to that which already requires management and disposal in the UK. The types of waste created by the UK ABWR would be similar to those which already exist, and for which management and interim storage arrangements over a prolonged period of decades, if required, are currently in place before long-term disposal under the Government's geological disposal facility (GDF) programme.

7.10 The Application outlines the radioactive materials that need to be managed during the operating lifetime of nuclear power stations and outlines the nuclear safety, environmental protection and transport regulations relevant to the management of radioactive waste and spent fuel.

7.11 The Application states that Low-Level Radioactive Waste (LLW) arising from an UK ABWR would be similar in scale to that arising from existing reactors and could be managed in accordance with the same regulatory regime. This would involve applying the waste hierarchy, which gives priority to preparing it for re-use, then recycling, then other recovery such as energy recovery, and last of all disposal (for example in landfill). As a result, there should be no significant detriment from LLW material produced by the UK ABWR.

7.12 The Application states that Intermediate Level Waste (ILW) from the UK's existing nuclear power stations is stored safely and securely on site pending disposal, that the scale of additional ILW created by new nuclear power stations is likely to be relatively modest in comparison with the quantity that is already created. Any station deploying UK ABWR technology would incorporate facilities capable of managing ILW produced during its operation and storing it safely at the nuclear power station site.

7.13 The Application states that there is uncertainty around the quantity of spent fuel that might be produced by any station using new reactor technology, including the UK ABWR, because this depends on a number of operational factors including power output and lifetime. The percentage increase in the spent fuel and ILW area of the geological disposal facility of a nuclear programme using the UK ABWR design will be estimated in the RWM[109] Disposability Assessment of UK ABWR waste and spent fuel. The Application states that there is no technical reason why spent fuel could not be disposed of within the same deep geological repository provided for existing similar waste or in an

[109] Radioactive Waste Management Limited (RWM) is a wholly owned subsidiary of the Nuclear Decommissioning Authority (NDA) established in April 2014 and is responsible for implementing Government policy on geological disposal.

extension to it. The spent fuel from a new programme of UK ABWR reactors would not need to be disposed of immediately, but could be stored safely on site (or elsewhere) until the site was decommissioned and a suitable repository was available. On the above basis the detriment associated with managing and ultimately disposing of additional spent fuel from the Proposed Practice should not lead to a significant detriment.

7.14 The Application states that the decommissioning of any UK ABWR built in the UK would be subject to the UK regulatory regime throughout the decommissioning process. It would also be subject to the provisions in the Energy Act 2008, which ensure that operators of new nuclear power stations will have secure financing in place to meet the full cost of decommissioning and their full share of waste management and disposal costs, by requiring the approval of a Funded Decommissioning Programme as a pre-condition to the development of a UK ABWR.

Summary of responses to the consultation on the Application

7.15 Some responses supported the position taken in the Application.

7.16 Others said that radioactive waste was an important argument against the use of nuclear power. The potential detriment from the waste which the UK ABWR would produce, the length of time it would have to be held in interim storage and the absence to date of a facility for long-term disposal, meant that nuclear power involved too great a risk to be pursued. They argued that these considerations applied to the UK ABWR as well as to other reactor designs, that the introduction of the UK ABWR would add to the problem and that therefore it should not be Justified.

Summary of responses to the consultation on the Proposed Decision

7.17 Most responses received supported the position taken in the Proposed Decision. One response said that the Application must be rejected because of the known health detriment from nuclear power stations.

Responses of Statutory Consultees to the consultation on the Proposed Decision

Environment Agency

7.18 The Environment Agency confirmed that it would use its regulatory powers to ensure that the discharges and disposal of radioactive waste from any new nuclear power stations using the UK ABWR would be within dose limits and constraints and were optimised so that doses to people are as low as reasonably achievable and that the impact on the environment is small.

Public Health England

7.19 PHE agreed with the Secretary of State's conclusion that the health detriment caused by the radioactive waste generated by any UK ABWR and from its decommissioning would be very small and would remain very small up to and beyond final disposal of such waste.

7.20 PHE also agreed that satisfactory arrangements have been made in the UK for the safe management and disposal of radioactive waste arising from proposed new nuclear power stations and that the waste originating from any new nuclear power stations will not substantially differ from the waste generated by existing nuclear power stations.

7.21 PHE is also satisfied that the regulatory regime currently in force in the UK to limit exposure of people to radiation from the operation of nuclear facilities during their entire life-cycle can be applied effectively to the management and disposal of radioactive waste generated by any UK ABWR to ensure that doses from these practices are below the limits set by law and optimised to be as low as reasonably achievable.

Secretary of State's view

7.22 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

7.23 The Secretary of State is of the opinion that while there is a potential health detriment from the management and disposal of radioactive waste arising from the generation of electricity from any UK ABWR which is built in the UK, he considers that the health detriment from such radioactive waste would be very small and would remain very small up to and beyond disposal.

7.24 As is set out in Chapter 6 (Radiological Health Detriment), PHE, which regularly reviews the radiation exposure of the UK population, has calculated that the overall average annual dose to a member of the public from all sources of radioactivity is 2.7 mSv per year. Of this, about 84% is from natural sources, about 16% from medical procedures and about 0.2% from all other sources, including nuclear power stations[110]. By law, the radiation to which members of the public are exposed from all sources, excluding medical exposures of patients and natural background radiation, is limited to 1 mSv per year[111]. This limit, and PHE's recommendation that the radiation to which members of the public are exposed from a proposed controlled source should be no more than 0.3 mSv per year, also applies to the management and disposal of spent fuel and radioactive waste[112].

7.25 The generation of electricity in a UK ABWR will result in spent fuel and radioactive waste in the form of intermediate level waste (ILW), low level waste (LLW) and liquid and gaseous discharges. Consideration is given to each of these waste streams below. In addition, in order to consider all the information about the UK ABWR, the Secretary of State has also considered the transport of radioactive waste and the handling and disposal of non-radioactive hazardous waste.

7.26 In coming to his decision, the Secretary of State has taken into account progress to date on detailed regulatory assessment of the UK ABWR through GDA, as set out in paragraphs 6.91 to 6.95[113].

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[110] HPA-RPD-001 – Ionising Radiation Exposure of the UK Population: 2005 Review Authors: S J Watson, A L Jones, W B Oatway and J S Hughes Publication date: May 2005 ISBN: 0-85951-558-3

http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1247816567393 Figures for medical procedures and for all other sources are as amended in a further report by PHE to be published in 2014, which will confirm the general position set out in the 2005 paper.

[111] This is through the Ionising Radiations Regulations 1999, Statutory Instrument 1999 No. 3232 (which includes all activities carried out under a nuclear site licence granted by the Nuclear Installations Inspectorate under the Nuclear Installations Act 1965) http://www.opsi.gov.uk/si/si1999/19993232.htm, the Environmental Permitting (England and Wales) Regulations 2010 http://www.opsi.gov.uk/si/si2010/uksi_20100675_en_1,and the Radioactive Substances (Basic Safety Standards) (Scotland) Regulations 2000 http://www.opsi.gov.uk/legislation/scotland/ssi2000/20000100.htm

[112] http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents http://www.legislation.gov.uk/ssi/2000/100/contents/made

[113] http://www.onr.org.uk/new-reactors/reports/gda-quarterly-report-january-march-2014.pdf

7.27 As stated there, the regulators completed Step 2 of GDA for the UK ABWR in August 2014[114] and published technical and summary reports[115]. On the subject of radioactive waste management[116], the regulators report that they have examined proposals for the safe minimisation, handling, storage and disposal of radioactive waste arising from all parts of the UK ABWR and the proposals for decommissioning. They find that Hitachi-GE is developing strategies for radioactive waste management, spent fuel management and decommissioning for the UK ABWR which appear to be reasonable and adequate in principle, have been developed for use across the world and are therefore advanced. They find that all major waste streams have been identified and disposability assessments, where applicable, are being discussed. Some areas require further development, but overall, ONR see no reason, on radioactive waste management, spent fuel management and decommissioning grounds, why the UK ABWR should not proceed to Step 3 of GDA.

7.28 As part of the GDA process RWM is undertaking a disposability assessment of waste and spent fuel from the UK ABWR. The Secretary of State understands that RWM expects to complete this process in June 2015 and that so far nothing has emerged that suggests that waste from the UK ABWR presents technical issues different from those presented by other nuclear reactors which have successfully completed assessment through GDA.

Spent Fuel

Spent fuel – Characteristics

7.29 Spent fuel is defined as “nuclear fuel that has been irradiated in and permanently removed from a reactor core”[117]. Spent fuel from currently operating nuclear power stations is not categorised as waste, because it still contains uranium and plutonium which could potentially be separated out through reprocessing and used to make new fuel.

7.30 The Government’s position is that any new nuclear power stations that might be built in the UK should proceed on the basis that spent fuel will not be reprocessed, that plans for, and financing of, waste management should also proceed on this basis and that the spent fuel from new nuclear power stations would be treated as waste and disposed of in a GDF. The Secretary of State has therefore not considered high level waste (HLW), which arises from fuel reprocessing, in this decision document.

7.31 The Secretary of State has noted the view expressed by some respondents that the UK ABWR would generate greater quantities of waste, and waste of a higher radioactive content, than existing designs.

7.32 The latest generation of nuclear power plants are designed to extract more energy from the fuel by leaving it in the reactor longer for increased irradiation, otherwise known as “burn-up”. The higher burn-up of the fuel will mean that comparatively fewer spent fuel assemblies will be required to be managed, but higher burn-up means that an individual

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[114] http://www.onr.org.uk/new-reactors/uk-abwr/reports.htm

[115] http://www.onr.org.uk/new-reactors/uk-abwr/reports.htm

[116] http://www.onr.org.uk/new-reactors/uk-abwr/reports/step2/uk-abwr-step-2-summary-report.pdf - section 9.3.5

[117] IAEA Glossary http://www.iaea.org/ns/tutorials/regcontrol/intro/glossarys.htm

spent fuel assembly will have a higher heat output and external radiation compared with a fuel assembly currently discharged from nuclear reactors currently in use.

7.33 One of the characteristics of increased burn-up fuel is that the inventory of long-lived radionuclides[118] in the fuel assembly increases. These long-lived radionuclides will decay causing the fuel to emit greater levels of gamma and neutron ionising radiation than is the case with legacy (lower burn-up) spent fuel and as a consequence to be thermally hotter. Therefore higher burn-up fuel will in general require longer periods of cooling in interim storage.

7.34 With regard to external radiation, immediately on discharge from the reactor, the heat output and radioactivity of spent fuel is dominated by the presence of short-lived radionuclides. The amounts of short-lived radionuclides produced are independent of fuel burn-up. Therefore in the short-term (up to about one month) there will be no significant difference in heat output and overall radioactivity between fuels discharged from a currently operating nuclear reactor (for example, Sizewell B) and any future new UK ABWR.

7.35 However, in the longer term (beyond about one month) as the short-lived radioactivity decays, heat output and radioactivity becomes dominated by decay of longer-lived radionuclides. The concentration of longer-lived radionuclides in general increases with burn-up, the result of which will be an increase in heat output, gamma and neutron dose rates. It is calculated that at equivalent cooling times, the neutron dose rate from a fuel assembly irradiated to the higher burn-ups expected of a UK ABWR will be greater (how much greater is dependent on the level of burn-up) than for a fuel assembly irradiated to burn-ups typical for a currently operating nuclear reactor.

7.36 However, this is not significant for the management of the spent fuel since the total external dose rate from the spent fuel is dominated by the gamma radiation dose and not the neutron dose, which would contribute, at most (for example, for a burn-up of 60 gigawatt days per tonne of uranium (GWd/tU)), only 6% to the total external dose rate with the remainder being gamma. A study[119] on the safety of transport of 50 year cooled Sizewell B PWR fuel with an upper bound burnup of 60 GWd/teU has shown that the relevant International Atomic Energy Agency (IAEA) dose rate limits can be met by a combination of a 14cm thick stainless steel gamma shield surrounded by a 5cm thick neutron shield. Such shield configurations are quite typical of what is likely to be required for existing legacy vitrified HLW.

7.37 As explained in para 6.48, during previous Justification consultations the Government published a paper by its advisers Integrated Decision Management (IDM)[120] which assessed similarities and differences between different types of nuclear power station, including Boiling Water Reactors such as the UK ABWR as well as Pressurised Water Reactors such as the EPR and AP1000. The paper stated that the benefits and detriments of the different designs under consideration, including those related to waste

[118] A radionuclide is an atom that exhibits radioactivity. As radionuclides decay they release radiation. This rate of decay is known as the substance's half-life.

[119] AREVA Risk Management Consulting Ltd, Study of the Transport of UK High Level Waste and Spent Fuel, a report commissioned by Nuclear Decommissioning Authority, https://www.nda.gov.uk/documents/biblio/upload/Study-of-the-Transport-of-UK-High-Level-Waste-and-Spent-Fuel-R08-099_C_IssueC.pdf

[120] Advice on the influence of reactor technology on the definition of classes or types of practice for new build justification, Authors: Gregg Butler, Grace McGlynn (IDM) with input from Andrew Worrall and Kevin Hesketh (National Nuclear Laboratory)

management, were broadly similar at the high level of assessment suitable to Regulatory Justification.

7.38 The Secretary of State is satisfied that this advice remains valid in the case of the UK ABWR and that despite some differences in characteristics, waste and spent fuel from new nuclear power stations would not raise such different technical issues compared with nuclear waste from legacy programmes as to require a different technical solution. Given a disposal site with suitable characteristics, the spent fuel from the UK ABWR is expected to be disposable. He also understands that so far nothing has emerged through the GDA process that suggests that waste from the UK ABWR presents technical issues different from those presented by other nuclear reactors which have successfully completed GDA.

7.39 Geological disposal is the means by which higher activity waste (mainly HLW, ILW and spent fuel) will be managed in the long term. This will be preceded by safe and secure interim storage until a GDF can receive waste. The UK Government's framework for implementing geological disposal is set out in the July 2014 White Paper '*Implementing Geological Disposal*'[121]. This will be taken forward alongside on-going interim storage and research to support its implementation. The Secretary of State considers this in further detail below.

Spent fuel – quantity

7.40 There is uncertainty around the quantity of spent fuel that might be produced by a new UK ABWR. The volume of spent fuel produced by a UK ABWR depends on a number of factors, including the reactor power output, its operational lifetime and various other operational considerations, including the reactor refuelling regime which affects fuel burn-up.

7.41 RWM, as part of its disposability assessment for the UK ABWR, will consider the potential impact on the size of a GDF of the disposal of spent fuel from a UK ABWR.

7.42 The Government recognises that it is possible that there might need to be more than one GDF. For example, this could be necessary if the geology at potential sites was not suitable for a "co-located" GDF (i.e. a GDF containing all higher activity wastes) though the Government's strong preference is for a co-located facility should an available site prove suitable for this. With regard to the disposal of new build wastes, it is recognised that the size of any programme of new nuclear power stations will have an impact on whether all of the new waste could be emplaced in the same GDF as legacy waste. Hence, although the Government favours a single GDF for all higher activity wastes if that proves technically possible, it has not ruled out the alternative of there being more than one facility, and the site selection process is designed to be sufficiently flexible to accommodate this.

Spent fuel – interim storage

7.43 The Secretary of State is satisfied that interim storage would provide an extendable, safe, secure and environmentally sound means of containing waste for as long as it took to site and construct a GDF, and that this is based on experience in the UK and overseas of the interim storage of higher activity wastes in line with requirements for safety, security and environmental protection. The Secretary of State has further considered the

[121] https://www.gov.uk/government/publications/implementing-geological-disposal

arrangements for ensuring that spent fuel from new nuclear power stations is kept in safe and secure interim storage until a GDF is available.

7.44 The time that will be required for the safe and secure on-site interim storage of spent fuel prior to disposal is contingent on a number of factors.

7.45 The Government expects the operators of new nuclear power stations to optimise the interim storage requirements for radioactive waste, taking account of safety, security and environmental protection and the availability of a GDF, and also to ensure that the duration of interim storage is minimised and the waste should be disposed of at the earliest opportunity.

7.46 The Secretary of State has also considered the fact that the interim storage of spent fuel will be subject to the same regulatory regime (set out in Chapter 6 (Radiological Health Detriment)) as that covering existing nuclear power stations in the UK. The site licensing and permitting processes are intended to ensure that operators provide safe, secure and environmentally acceptable interim storage for spent fuel. Therefore, regulatory consent for the construction of a new nuclear power station will not be given unless the regulators are satisfied that the operator will be able to adequately provide for interim storage of the spent fuel produced by the new nuclear power station.

7.47 The Secretary of State is therefore satisfied that the interim storage of spent fuel can and will be carried out in a manner which causes a very low level of health detriment, and considers below the arrangements for ensuring the safe and secure disposal of spent fuel from new nuclear power stations.

Spent fuel – Geological Disposal

7.48 In October 2006, following recommendations made by CoRWM, the Government and the Devolved Administrations published a response accepting CoRWM's recommendation that geological disposal, preceded by safe and secure interim storage, was the best available approach for the long-term management of existing and committed higher activity radioactive wastes. The response made a commitment to consult on a framework for implementing geological disposal as the next stage of the programme. A consultation was carried out in 2007. The Managing Radioactive Waste Safely White Paper[122] published in June 2008, then set out a framework for the implementation of this policy. A new GDF White Paper, setting out a revised framework for implementation, was published in July 2014, following a further round of public consultation.

7.49 The Secretary of State recognises that CoRWM's 2006 recommendation was made in relation to the existing and committed inventory of higher activity wastes. A separate process was undertaken in relation to new build through the 2007 Consultation on the Future of Nuclear Power and the subsequent Nuclear White Paper in January 2008.

7.50 With regard to waste from new nuclear power stations, the White Paper on Nuclear Power[123] set out the Government's view that "it is technically possible to dispose of new higher-activity radioactive waste in a geological disposal facility and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations. The Government considers that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the MRWS [geological disposal] Programme".

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[122] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228903/7386.pdf

[123] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228944/7296.pdf page 27

Geological Disposal – Regulatory Regime

7.51 The Secretary of State takes account of the fact that the Government has considered how to introduce a GDF into the regulatory regime.

7.52 As explained, RWM is responsible for implementing Government policy on geological disposal. The Government is committed to strong and effective control and regulation of the GDF development process. Government will look to early and continued involvement of the regulators, who will make clear their regulatory requirements to RWM at an early stage. Regulatory processes for granting any necessary licences or permits will provide opportunity for input and assessment of public and stakeholder views. The Environmental Permitting (England and Wales) Regulations 2010, which replaced the Radioactive Substances Act 1993 in England and Wales, included new provisions which improve regulation of a potential GDF by enabling the Environment Agency and Natural Resources Wales to take a staged approach to permitting.

7.53 It is intended that the GDF will require a licence under the Nuclear Installations Act 1965, since the Government intends to prescribe geological disposal facilities for the purposes of section 1 of the Nuclear Installations Act 1965 to bring geological disposal within the licensing framework, the licensing regime applied by ONR.

7.54 Operators of nuclear licensed sites will be required by the regulators to confirm that the specific wastes identified to be produced could be placed in a GDF in line with requirements for safety, security and environmental protection. This will be underpinned by advice from RWM based on their assessment of the disposability of the wastes that are proposed to be produced. This will apply to any site at which a UK ABWR reactor is constructed.

7.55 As referred to above, RWM will carry out, as part of the GDA process, a disposability assessment for the ILW and spent fuel expected to be produced by the UK ABWR. In the future, when reactor site-specific consideration is given to waste, a Radioactive Waste Management Case will be required and detailed consideration of waste disposability will be addressed by RWM through the established Letter of Compliance assessment process. In cases where RWM has concluded that the proposed waste package is compliant with geological disposal and underpinning assessments, RWM will confirm this by the issue of a Letter of Compliance. The independent regulators will scrutinise the operators' and RWM's assessments, taking due account of all relevant work that has been carried out in GDA.

7.56 The Secretary of State is therefore confident that the regulatory regime will assist in ensuring that suitable steps are taken to progress the design, construction and use of a suitable GDF.

Geological Disposal – Technological Feasibility

7.57 The Secretary of State has considered the technological feasibility of the proposal for geological disposal.

7.58 The OECD NEA published a statement in 2008 which said that: "The overwhelming scientific consensus worldwide is that geological disposal is technically feasible". The NEA further noted that "Releases from engineered barriers would occur over thousands of years after disposal and would be very small. Additionally these releases are diluted and slowed by the geological formation surrounding the repository and are further reduced by radioactive decay. The resulting potential radiological exposure in the

biosphere would not represent, at any time, a significant increment above the natural background"[124].

7.59 A number of geological disposal concepts, based on the use of multiple containment barriers, have been shown to be capable of meeting high standards of safety and security. Although no spent fuel GDF is in operation currently, programmes in Finland[125] and Sweden[126] are well advanced and plans are for each of these countries to have such a facility operational by about 2020, following underground research that is already being undertaken. In March 2011 SKB (the Swedish Nuclear Fuel and Waste Management Company)[127] submitted a licence application to build a final repository for spent nuclear fuel at Forsmark. The application is currently being reviewed by the Swedish regulators who plan to issue a final review statement with a recommendation to the Government in early 2016. Subject to approval it is hoped that construction will start by 2019.

7.60 The specific technological challenges presented by spent fuel from new nuclear power stations have been examined by Posiva in Finland in the context of an Environmental Impact Assessment for the extension of its spent fuel GDF to accept fuel discharged from the EPR-type reactor under construction at Olkiluoto. The assessments carried out show that the technology is available to provide suitable shielding to enable safe handling of high burn-up spent fuel. They also show that existing engineered barrier technologies, as envisaged for the spent fuel from currently operating nuclear power stations, can be applied to the safe disposal of high burn-up fuel.

7.61 The assessments also show that, under the conditions relevant to the Finnish GDF, the long-term safety of the facility is robust in pessimistic scenarios, for example, where a number of failures of disposal canisters occur due to seismically induced rock movement. The disposability assessments previously carried out for previous requesting parties (EDF/Areva and Westinghouse) under GDA similarly show that existing engineered barrier technologies can be applied to achieve the safe disposal of high burn-up fuel even using what are expected to be conservative calculations of disposal canister integrity.

7.62 The UK does not present special geological difficulties that would make successful implementation unlikely on a technological basis. CoRWM found that "there is high confidence in the scientific community that there are areas of the UK where the geology and hydrogeology at 200 metres or more below ground will be stable for a million years and more into the future".

7.63 The technology identified in disposal concepts that would be suitable for spent fuel from new nuclear power stations is already available in terms of engineered barrier designs and materials. Therefore, the technology is expected to be available in an appropriate timeframe to be applied at a suitable site that becomes available through the site selection process for a GDF.

7.64 In line with CoRWM's 2006 recommendations, RWM will undertake further research during the GDF's development process in order to further refine concepts, improve

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[124] Organisation for Economic Co-operation and Development (OECD), Nuclear Energy Agency (NEA), Moving Forward with Geological Disposal of Radioactive Waste, A Collective Statement by the NEA Radioactive Waste Management Committee (RWMC), NEA No. 6433, 2008 http://www.nea.fr/html/rwm/reports/2008/nea6433-statement.pdf

[125] http://www.oecd-nea.org/rwm/profiles/Finland.pdf

[126] http://www.oecd-nea.org/rwm/profiles/Sweden_profile_web.pdf

[127] http://www.skb.se/default____24417.aspx

understanding of chemical and physical interactions in a disposal facility, address specific issues raised by regulators, support development of site-specific safety cases and optimise facility design and delivery.

7.65 In respect of external dose rate, the encapsulation, transport and emplacement of high burn-up spent fuel can be shown to be feasible using existing technology applied in the management of vitrified HLW. In particular, the relevant IAEA dose rate limits for transport can be met after interim storage by providing a combination of a 14 cm thick stainless steel gamma shield surrounded by a 5 cm thick neutron shield. Shield configurations based on these principles will be deployed in returning vitrified HLW from the UK to overseas fuel reprocessing customers. This HLW already has a much higher neutron dose rate than that calculated for any proposed new build spent fuel. Well-established methods exist for developing potential disposal facility designs to take account of heat generated by such wastes and the external radiation dose rate is less than that from materials such as vitrified HLW which are already managed safely under existing arrangements through storage awaiting final disposal at a GDF.

7.66 The Secretary of State considers that the scientific progress made with respect to geological disposal is such that it is technically achievable and is the safest form of long-term waste management.

Geological Disposal – Site Selection

7.67 The Secretary of State has considered the approach to the selection of a site for the implementation of geological disposal.

7.68 To identify potential sites where a GDF could be located, the UK Government favours a voluntarist approach based on working with communities that are willing to participate in the siting process.

7.69 The 2014 White Paper, *Implementing Geological Disposal*[128], sets out the policy framework for the future implementation of geological disposal in the UK. This includes: establishing an upfront process of national screening; bringing GDFs, and the borehole investigations that support their development, within the statutory definition of 'Nationally Significant Infrastructure Projects' within the Planning Act 2008; and developing the process of working with communities.

7.70 The site selection process for a GDF will take a number of years to complete, due to the need for extensive technical investigations at any prospective site and the need to move at a pace consistent with maintaining public confidence. However, orderly progress is being made.

7.71 The Government recognises it has a responsibility to deal with long-term higher activity waste management and is committed to geological disposal as the technical solution. As has been the case since 2008, the UK Government continues to reserve the right to explore other approaches in the event that, at some point in the future, an approach to siting that is based on voluntarism does not look likely to work.

7.72 The Government's preference is for a co-located spent fuel, HLW and ILW GDF, should an available site prove suitable for this. The facility would be designed to allow appropriate disposal areas to be provided underground for spent fuel, HLW and ILW (and

[128] https://www.gov.uk/government/publications/implementing-geological-disposal

other materials that may eventually be declared as higher activity waste) and for essential infrastructure and services to be shared. For this approach to be confirmed, the site selection process must deliver a site with suitable characteristics and volumetric capacity sufficient to accommodate the wastes, and a satisfactory safety case must be developed.

7.73 There is no reason why co-location should not be technically possible, however, it would also be possible to build more than one GDF. This could be necessary if the geology at potential sites was not suitable for a 'co-located' GDF.

7.74 To improve visibility of progress on the geological disposal programme, the Government provides annual reports to Parliament on the progress of the programme.

Geological Disposal – Conclusion

7.75 On the basis of the above evidence and information, the Secretary of State is therefore satisfied that geological disposal of spent fuel is technologically feasible, that there is a robust process in place to identify a suitable site, and that a GDF will be incorporated into the existing robust regulatory regime which limits radiological emissions and consequent harm to human health. He is also satisfied that suitable arrangements already exist for the safe and secure interim storage of spent fuel and that these will ensure that spent fuel is stored in such a way as to cause very low radiological health detriment until such time as it is emplaced in a GDF. The Secretary of State concludes therefore that spent fuel will be managed and disposed of in a manner which causes a very low level of radiological health detriment.

Intermediate Level Waste (ILW)

7.76 The Secretary of State has considered ILW, which is defined in the UK as waste "with radioactivity levels exceeding the upper boundaries for low-level wastes, but which do not require heating to be taken into account in the design of storage or disposal facilities."

7.77 ILW arises mainly from the reprocessing of spent fuel, from general operations and maintenance at nuclear sites and from decommissioning. ILW can include metal items such as reactor components, and sludges, filters and resins from the treatment of radioactive liquid effluents.

7.78 Legacy ILW is typically being managed through a process of conditioning and packaging into a passively safe and disposable form as soon as reasonably practicable and placed into interim storage. Conditioning is frequently achieved by encapsulation in cement or other suitable binder and packages are highly-engineered 500 litre stainless steel drums or higher capacity steel or concrete boxes. Unlike spent fuel, heat-generation is not an issue and there is not the same requirement for decay cooling before being placed in a disposal facility.

7.79 As with spent fuel, there is uncertainty over the quantity of ILW that is expected to be produced by a new nuclear programme. The total quantity of ILW produced by a new nuclear programme will depend on the size of the programme, but is expected to be small in comparison with the volumes of legacy ILW.

ILW – Interim storage

7.80 Much of what has been said above about the interim storage and disposal of spent fuel applies equally to ILW from new nuclear power stations and is not repeated in this section.

7.81 Geological disposal is the preferred option for management of ILW in the long term. This will be preceded by safe and secure interim storage until a GDF can receive waste.

7.82 The Secretary of State has considered the arrangements for ensuring that ILW from any new nuclear power stations is stored in safe and secure interim storage facilities until a GDF is available.

7.83 The regulatory framework described for the interim storage of spent fuel above applies equally to ILW from any new nuclear power stations. In the specific case of ILW arising from any new nuclear power stations, the regulators' GDA process is in progress to give confidence that new nuclear power station designs will be compatible with UK licensing and other requirements.

7.84 The GDA and site licensing processes are intended to ensure that operators can provide safe, secure interim storage for ILW and therefore regulatory consent for the construction of a new nuclear power station will not be given unless the regulators are satisfied with the operator's proposal for interim storage of the ILW produced by the new nuclear power station.

7.85 The NDA is committed to hazard and environmental risk reduction by ensuring that radioactive waste (whether HLW, ILW or LLW) is managed and converted into a passively safe form as soon as reasonably practicable and placed into interim storage. This will continue to be the preferred strategy for handling ILW that arises in future from any nuclear power stations, in line with regulatory requirements.

7.86 The NDA has conducted a detailed review of the status of existing storage capacity in the UK for higher activity radioactive waste, which included an assessment of storage regimes for solid ILW (raw and immobilised) across the UK on both NDA and non-NDA sites. It produced a number of findings and potential topics for NDA's future work programme.

7.87 The technology for storing ILW already exists and ILW conditioning and packaging is already being implemented in the UK with waste packages manufactured and in safe and secure interim storage awaiting provision of a GDF. These packages have been assessed through the Letter of Compliance process described in paragraph 7.55, to give confidence that they not only meet requirements for interim storage but also will be compliant with the needs of transport and disposal.

7.88 Decommissioning ILW, which is generally activated steel (for example reactor pressure vessel components), will be size-reduced and loaded into disposal containers. The technology for achieving this is not new and capacity to provide the necessary facilities will be provided with the new nuclear power station. The complete decommissioning of nuclear power stations has already taken place in the USA, Spain and other countries. In the case of decommissioning wastes there may exist the option to transport the waste off-site to a GDF immediately without the need for on-site interim storage.

7.89 The Secretary of State is therefore satisfied that the interim storage of ILW can and will be carried out in a manner which causes a very low level of health detriment, and considers below the arrangements for ensuring the safe and secure disposal of ILW from new nuclear power stations.

ILW – Geological Disposal

7.90 The operational and decommissioning ILW that would be produced from new nuclear power stations would be very similar to that which is currently produced, or will be produced in the future, from Sizewell B and from LWR-type reactor systems operated in

other countries, the safe and secure disposal of which has been extensively researched and, in the case of operational wastes, implemented in a number of countries (for example, Sweden, Finland and France).

7.91 The technology identified in disposal concepts that would be suitable for ILW from new nuclear power stations is already available in terms of engineered barrier designs and materials. Given the similarity between the wastes from new nuclear power stations and legacy wastes, the same disposal technologies would be expected to apply. In terms of immobilisation and packaging, it is expected that the ILW waste packages currently in use would be acceptable for disposal in all potentially suitable UK geological settings.

7.92 The Government has said that it has a strong preference for a single GDF for all higher activity wastes; however, as discussed above, the Government recognises that it might be necessary to build more than one GDF and the site selection process for a GDF is designed to be sufficiently flexible to accommodate this.

7.93 The Secretary of State is of the opinion that a disposal route will exist to deal with ILW arising from the UK ABWR which would cause a very low level of health detriment.

Low Level Waste

7.94 LLW is the lowest activity category of radioactive waste, and was defined in the "Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom" as: "Radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity".

7.95 LLW is generally made up of materials such as plastics, glass, metal, paper and soil that have become contaminated by contact with radioactive liquids or powders. Such materials derive from hospitals, research establishments and the nuclear industry. The majority of solid radioactive waste in the UK by volume is LLW.

7.96 Very low level waste (VLLW) is a subset of the LLW category of radioactive waste, covering miscellaneous waste arising with very low concentrations of radioactivity. VLLW is divided into two types: low volume VLLW and high volume VLLW. Low volume VLLW is defined as "radioactive waste that may be disposed of to an unspecified destination, with each 0.1m3 having less than 400 KBq total activity or single items with less than 40 KBq of total activity". High volume VLLW is defined as "having a maximum concentration of 4 MBq/tonne of total activity which may be disposed of to specified landfill sites". The UK radioactive waste inventory estimates that LLW makes up some 90% of the total volume of the UK's existing or committed radioactive waste but contains less than 0.0003% of the total radioactivity.

7.97 As with spent fuel and ILW, there is uncertainty over the quantity of LLW that is expected to be produced by a new nuclear programme but it is expected to be small in comparison with the volumes of legacy LLW.

LLW- Storage and Disposal

7.98 The "Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom"[129] (the 2007 LLW Policy Statement), published in March 2007, outlines the priorities for managing LLW responsibly and safely, by :

- allowing greater flexibility in managing the wide range of LLW that already exists and will arise in the future;

[129] http://www.scotland.gov.uk/Resource/Doc/30701/0048172.pdf

- maintaining a focus on safety, with arrangements supported by the independent regulators, including the Health and Safety Executive and the Environment Agencies;
- applying the waste hierarchy to seek to first minimise the amount of low level waste created before looking at disposal options, through avoiding generation, minimising the amount of radioactive substances used, recycling and reuse;
- creating a UK-wide strategy for managing low level waste from the nuclear industry;
- initiating a UK-wide strategy for the management of non-nuclear industry LLW; and emphasising the need to involve communities and the wider public in developing and delivering LLW management plans.

7.99 Among other things the policy set out that plans for the management of all radioactive waste, including LLW, must be developed by waste managers. These plans must be prepared in a form, and to a level of detail, suitable for consideration by the relevant regulatory bodies.

7.100 The NDA published the Low Level Waste Strategy[130] (the Strategy) in response to the March 2007 Government policy statement on Solid LLW. The Strategy recognises the need for new fit-for-purpose waste management routes and seeks to encourage these, including making additional waste segregation services available to industry in order to minimise waste volumes going to the national repository. The necessary disposal routes must be available if the NDA is to progress the decommissioning and clean-up programme and it must be able to make full use of appropriate, safe and environmentally sound waste management options, including the waste hierarchy.

7.101 The storage and disposal of LLW will be subject to the same regulatory regime (set out in Chapter 6 (Radiological Health Detriment)) as that which covers existing nuclear power stations. Very low activity LLW (Very Low Level Waste – VLLW) is disposed of to conventional landfills where co-disposal arrangements are managed and authorised. Incineration is also used for some combustible waste, particularly clinical waste from hospitals. LLW/VLLW producers must hold permits under the Environmental Permitting (England and Wales) Regulations 2010 in England and Wales, or authorisations under the Radioactive Substances Act 1993 in Scotland and Northern Ireland. High volume VLLW can only go to landfills that hold such permits or authorisations.

7.102 Before issuing a permit, the EA, Natural Resources Wales and the Scottish Environment Protection Agency (SEPA) must be satisfied that disposal can be carried out safely. The EA has published guidance on how it regulates disposal.

7.103 All nuclear licensed sites have a plan for the management of their LLW holdings and predicted future arisings that is part of a wider integrated waste management strategy. LLW management plans must take into account all current and anticipated future arisings of LLW, and their radiological and non-radiological properties. Such plans must be developed with appropriate regulatory and stakeholder involvement and should take into account current best practice. As a general principle, such plans should be developed and agreed with the regulatory bodies in advance of the production of any new LLW streams.

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[130] http://www.nda.gov.uk/2010/08/nda-launches-uk-strategy-for-managing-low-level-radioactive-waste/

7.104 LLW storage and disposal technology is well-established. It is expected that LLW from new nuclear power stations will be handled in a manner similar to current practice and in line with Government policy on LLW. The LLW originating from new nuclear power stations will not vary greatly from that of existing nuclear power stations.

7.105 LLW storage is not a major feature of power station operations. Regulators discourage accumulation of waste at sites of origin if a disposal route is available. Therefore nuclear power station sites during operation place LLW in containers such as half-height isofreight containers (HHISOs) and send these for disposal when full. However, storage does take place in particular circumstances, for example at Dounreay where LLW is being stored in anticipation of a planned local disposal facility becoming available. Here LLW is packaged in HHISOs and stored in a specially constructed temporary storage facility above ground.

7.106 Most operational LLW is currently super-compacted to reduce its volume and sent for disposal at the LLW repository in West Cumbria, where it is packaged and encapsulated in cement and large steel containers. These are then placed in an engineered vault a few metres below the surface. Some LLW not suitable for existing disposal routes has not yet been disposed of and will need to be disposed of in a GDF.

7.107 LLW produced from eventual nuclear power station decommissioning is a different issue from the management of operational waste. Larger volumes of waste will be produced, some of which will be VLLW in the form of lightly contaminated steel or concrete. In line with the 2007 LLW Policy Statement and the 2010 UK Strategy, the NDA strategy is to minimise VLLW being consigned to highly engineered LLW disposal, where this is not necessary for such low activity material. Some landfill sites are permitted to take certain LLW and VLLW and during decommissioning, the VLLW that arises could be consigned to landfills, or other fit for purpose disposal arrangements, at existing or new locations, in line with the 2007 LLW Policy Statement. The management of LLW will be carried out in accordance with the waste hierarchy principles set out in the 2010 LLW Strategy. The objective of the Strategy is to ensure continued capability and capacity for the safe, secure and environmentally responsible management and disposal of LLW in the UK.

7.108 The Secretary of State is satisfied that the LLW originating from new nuclear power stations will not vary greatly from that of existing nuclear power stations, and expects that LLW from new nuclear power stations will be handled in a manner similar to current practice and in line with Government policy on LLW.

Liquid and gaseous radioactive discharges

7.109 The Secretary of State has considered liquid and gaseous radioactive discharges. These are planned releases of radioactive materials into the environment, either in liquid form into the sea or in gaseous form into the air. These planned discharges account for almost all of the radioactivity released by nuclear power stations.

7.110 The total radiation released through discharges must be within the dose limits set out in paragraphs 6.71 to 6.82 and the discharges are regulated by the Environment Agency under the Radioactive Substances Act 1993 or Environmental Permitting (England and Wales) Regulations 2010 to ensure compliance. Operators of licensed nuclear sites in England and Wales must have an authorisation or permit from the Environment Agency to cover discharges. These authorisations set out limits and conditions on discharges and disposals, including a requirement for operators to use best available techniques (BAT) to ensure that doses to members of the public are as low as reasonably achievable (ALARA). The Devolved Administrations have similar arrangements in place

which are administered by their equivalent competent authorities (the Environment Agencies).

7.111 The Environment Agency is working with ONR through the GDA process to ensure that the need to meet high environmental standards is considered at an early stage of the regulatory process and that BAT are used to minimise radioactive waste and discharges. There are many technical developments in nuclear power station design, including those designs likely to be built in the UK, and operational practices that have reduced the amount of radioactive wastes produced; for example through the selection of materials, the segregation and recycling of effluent streams to enable more effective treatment and abatement, fuel design and improvements of the management of coolant chemistry. The technologies used in the UK for existing nuclear power stations and those proposed for new nuclear power stations are consistent with international best practice and have been, or will need to be, demonstrated to the relevant regulators as representing BAT. The application of the BAT principle will ensure that new nuclear power stations constructed in the UK will be designed to ensure that doses to members of the public are as low as is reasonably achievable.

7.112 The UK has committed to the objectives of the OSPAR Convention 1992[131] and the OSPAR Radioactive Substances Strategy[132] both of which aim to reduce discharges into the marine environment of the North-East Atlantic Region to levels where the additional concentrations above historic levels, resulting from such discharges, are close to zero.

7.113 It is important to note that while the objectives of the OSPAR Convention ultimately aim to reduce the concentrations in the marine environment they do not prohibit the future development of the nuclear sector and the building of new reactors. OSPAR's Radioactive Substances Strategy acknowledges the need to take account of what is achievable and focuses on the delivery of the Convention's objectives through the application and use of BAT and Best Environmental Practice (BEP).

7.114 It is also important to bear in mind that, as any UK ABWR built in the UK will be operated at a time when existing, earlier reactors which give rise to greater discharges are being or have been phased out, it is likely that the overall detriment to health arising from liquid and gaseous discharges from nuclear power stations as a whole will be reduced. Additionally, this Regulatory Justification decision does not allow for the reprocessing of spent fuel from UK ABWRs which again will significantly reduce the levels of discharges as compared to the current levels.

7.115 These factors are reflected in the UK's Strategy for Radioactive Discharges[133], first published in July 2002 and updated in June 2009. The revised Strategy reaffirms the Government's commitment to the progressive reduction of radioactive discharges and discharge limits, human exposure to ionising radiation arising from radioactive discharges and concentrations of radionuclides in the marine environment resulting from radioactive discharges. Additionally, the Strategy provides an assessment of the position

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[131] Convention for the Protection of the Marine Environment of the North-East Atlantic http://www.ospar.org/content/content.asp?menu=01481200000000_000000_000000

[132] The Radioactive Substances Strategy starts on page 16 of the 2003 Strategies of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic: http://www.ospar.org/html_documents/ospar/html/Revised_OSPAR_Strategies_2003.pdf#nameddest=radioactive_substances

[133] http://www.scotland.gov.uk/Resource/Doc/280203/0084414.pdf

reached since 2002 and the projected discharges during the period covered by the OSPAR Radioactive Substances Strategy – 2006-2030.

7.116 The Secretary of State acknowledges that new nuclear power stations will continue to make liquid and gaseous discharges which will require continued regulation and is satisfied that there is an effective regulatory regime in place to ensure that such discharges will remain within discharge limits set by the regulators.

Transport of Radioactive Waste

7.117 The Secretary of State has considered the transport of radioactive waste and the measures in place to prevent detriment to health arising from it.

7.118 Regulation of the safety of radioactive material transport by road, rail and sea in Great Britain (GB) is currently carried out by ONR and the Maritime and Coastguard Agency. The ONR exercises its statutory powers of enforcement under the Energy Act 2013 and the Carriage of Dangerous Goods Regulations 2009. Transporters of nuclear material outside of civil licensed nuclear sites also have to be approved by ONR under its nuclear security remit, and transport security plans are required to be in place before the transport of certain nuclear materials can take place.

7.119 In particular the Secretary of State notes that experience in the UK and overseas shows that spent fuel can be, and is currently, transported safely and securely. The UK has decades of experience of transporting radioactive wastes in a safe and secure fashion. Any radiological consequences resulting from accidents or incidents during the transport of irradiated nuclear fuel have been categorised by PHE as none or extremely low[134].

7.120 Radioactive wastes are transported in accordance with GB legislation based upon International Atomic Energy Agency (IAEA) regulations and in accordance with European Agreements and Directives. The packaging requirements for material containing radionuclides are dependent upon the radionuclide specific activity of the material, its form (solid, liquid or gas) and the total quantity of activity in the consignment.

7.121 Spent fuel from new nuclear power stations will be transported in a shielded transport flask designed to reduce external dose rates to the low levels required by the transport regulations and to provide containment of the radioactive material both during normal transport conditions and conditions representing transport accidents involving fire and impact. The transport of spent fuel from existing nuclear power stations also meets these transport regulatory requirements.

7.122 Experience in the UK and overseas shows that spent fuel can be, and is currently, transported safely and securely. In respect of external dose rate, the Secretary of State notes that the packaging and transport of high burn-up spent fuel can be achieved in accordance with the transport regulations using existing technology after a period of interim storage.

7.123 ILW packaging arrangements are already being implemented in the UK for legacy wastes. RWM is developing transport containers that will meet transport regulatory requirements in order to give confidence that these wastes can ultimately be transported to a GDF. Similar arrangements would also be applicable to ILW generated from the operation and decommissioning of new nuclear power stations.

[134] http://www.hpa.org.uk/Publications/Radiation/CRCEScientificAndTechnicalReportSeries/HPACRCE037/

7.124 LLW transport methods are well-established by both road and rail. LLW is routinely transported in packages that are designed, certified and transported by industry as permitted in the transport legislation. ONR has regulatory oversight and verifies the system operated by industry, backed by enforcement powers, to ensure that LLW transport packages meet the prescribed requirements of the transport regulations.

7.125 The Secretary of State agrees that radiological health detriment from transport of waste arising from nuclear power stations will be subject to the robust regulatory regime and consequently will be very low. He also acknowledges that the potential consequences of an escape of this waste material such as might result from an accident or terrorist attack are very significant. However, he considers that the risks of transporting nuclear materials are very small and there is an effective regulatory framework in place that ensures that these risks are minimised and sensibly managed by industry.

Handling and disposal of non-hazardous radioactive waste

7.126 Although Regulatory Justification is an assessment of radiological health detriment, in order to consider all the information about the UK ABWR the Secretary of State has also considered the handling and disposal of non-radioactive hazardous waste.

7.127 Non-radioactive wastes are produced from operating and maintaining both the "conventional" side of the new nuclear power station and the "nuclear island", and this includes some non-radioactive hazardous wastes, such as laboratory chemicals, and lubricating and fuel oils, which need safe management and disposal.

7.128 Hazardous waste is waste with one or more properties that are hazardous to health or to the environment. Categories or generic types of hazardous wastes as well as the properties of hazardous waste are listed in the European Commission's Hazardous Waste Directive. Controls are implemented by the Hazardous Waste Regulations.

7.129 The volumes of non-radioactive hazardous wastes produced by new nuclear power stations is expected to be small in relation to the total volumes of such wastes produced in the UK[135].

7.130 The treatment and disposal of waste is regulated by the UK environment agencies in order to ensure the protection of the environment and human health. Non-radioactive hazardous wastes will be managed according to regulatory requirements and current practices and will be disposed of promptly using established disposal routes.

7.131 Amounts of non-radioactive hazardous waste arising from reactor construction and decommissioning are expected to be broadly equivalent to those arising from any major infrastructure or power construction or demolition project and amenable to the normal waste minimisation techniques. The construction of a new nuclear power station is likely to require a specific Site Waste Management Plan as with any other large construction site.

7.132 No substantial on-site treatment is expected to be required for the management of non-radioactive hazardous wastes other than segregation of wastes dependent upon disposal route and safe storage pending commercial disposal. Based on existing nuclear power station sites, wastes would be disposed to commercial recycling and disposal routes at the nearest practicable facility in the same way as wastes from any other site.

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[135] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296752/geho1208bpdd-e-e.pdf

7.133 The Secretary of State is satisfied that new nuclear power stations would not be expected to contribute significantly to the amount of hazardous non-radioactive wastes or requirements for future disposal capacity.

Conclusion

7.134 The generation of electricity by any UK ABWR built in the UK would give rise to spent fuel, ILW, LLW and liquid and gaseous discharges, all of which contain differing levels of radioactivity. The Secretary of State recognises that the unnecessary introduction of ionising radiation into the environment is undesirable, and has considered the steps taken to limit the exposure of individuals to radiation from these sources.

7.135 Geological disposal is the means by which higher activity waste (in this case mainly spent fuel and intermediate level waste) will be managed in the long term. This will be preceded by safe and secure interim storage until a GDF can receive waste.

7.136 The Secretary of State is aware that RWM's disposability assessment of waste and spent fuel from the UK ABWR carried out during GDA has not yet been completed. However, based on RWM's and others expert technical advice (see paragraphs 7.27 – 7.28 and 7.37 – 7.38), despite some differences in characteristics, he does not expect that waste and spent fuel from UK ABWRs would raise such different technical issues compared with nuclear waste from existing operating reactors as to require a different technical solution.

7.137 The Secretary of State has noted that the length of time for the safe and secure on-site interim storage of spent fuel is contingent on a number of factors, but remains satisfied that interim storage of spent fuel and also ILW can and will be carried out in a way which causes a very low level of health detriment.

7.138 The Secretary of State is satisfied that a GDF would be able to, and would be required to, meet the strict dose limits and risk guidance level required by the UK regulatory regime. He has taken into account the fact that the Government is considering steps to ensure that any GDF built in the UK would be introduced into the regulatory regime in a staged manner with the involvement of the regulators at an early stage. The Secretary of State is satisfied that it is technologically feasible to build a GDF which could contain both higher activity wastes arising from existing nuclear power stations and from any UK ABWR which might be built in the future, with only very low levels of health detriment.

7.139 The Secretary of State, having considered the Government's approach to the selection of a site for the implementation of geological disposal, is satisfied that there is a robust process in place to identify a suitable site.

7.140 The Secretary of State is satisfied that the LLW originating from any new nuclear power stations would not vary greatly from that of existing nuclear power stations, and expects that LLW from new nuclear power stations would be handled in a manner similar to current practice and in line with Government policy on LLW.

7.141 Liquid and gaseous discharges from nuclear power stations give rise to emissions of radioactivity into the environment. The levels of these discharges and the consequences for human health are considered in Chapter 6 (Radiological Health Detriment). In relation to these discharges the Secretary of State is satisfied that the regulatory regime is sufficiently robust to ensure that doses arising from such discharges will remain within limits and will be as low as reasonably achievable (ALARA).

7.142 The existing regulatory regime, which limits by law the radiation to which people can be exposed from nuclear installations, would apply to the management and disposal of radioactive waste from any UK ABWR and from its decommissioning, as well as to

activities during its operation. The Secretary of State is confident that this will ensure that the management and disposal of radioactive waste will give rise to only very low levels of health detriment.

7.143 The Secretary of State is satisfied that the regulatory regime will act to ensure that the release of radiation from the radioactive waste from any UK ABWR remains within regulatory dose limits. In coming to this conclusion, the Secretary of State has given particular weight to the arrangements already in place to deal with waste from existing nuclear power stations, the effectiveness and transparency of the existing regulatory regime, and to the extensive powers that the regulators have to enforce compliance.

7.144 Considering all of the above and having taken into account the points made by respondents to the consultation, the Secretary of State is of the opinion that whilst there is a potential health detriment from the management and disposal of radioactive waste arising from the generation of electricity from any UK ABWR which is built in the UK he considers that the health detriment from such radioactive waste would be very small and would remain very small up to and beyond disposal.

Chapter 8: Environmental Detriment

Introduction

8.1 The Regulations, the Basic Safety Standards Directive and the ICRP do not specify that a Regulatory Justification decision needs to consider the impact of a class or type of practice on health or the environment beyond that caused by the release of radiation.

8.2 However, the Secretary of State has taken the view that he should consider this wider impact so as to satisfy himself that he has considered all the ways in which the UK ABWR might involve potential detriment, and responded to people's concerns in this area.

8.3 Such potential detriment might include environmental impacts related to: flood risk; the quality or availability of water resources; coastal change; air quality; noise levels; traffic levels; biodiversity and geological conservation; landscape; amenities and cultural heritage; and pressure on local services.

8.4 This Chapter considers the content of the Application relating to the environmental impacts arising from the UK ABWR, and responses to the consultation on the Application and the Proposed Decision. It then sets out the Secretary of State's present view on the measures being taken by the Government and regulators to avoid or effectively mitigate any environmental detriment arising from the construction, operation and decommissioning of the UK ABWR.

Summary of the Application

8.5 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

8.6 The Application states that new nuclear power stations, like all major infrastructure projects, have impacts on the environment. These are addressed generically through the Strategic Environmental Assessment process, and in detail on a project-specific basis through the Environmental Impact Assessment and environmental permitting processes, which must take place before a project can receive development consent.

8.7 The Application notes that these impacts are not a consequence of the use of radiation, and similar impacts would result from the construction of other large scale energy projects.

8.8 The Application states that the design and operation of any cooling towers required for a UK ABWR, if cooling towers were used, would be based on the lessons learned from past operating experience, and would follow similar guidelines. If cooling towers were used, the majority of environmental impacts would be mitigated or unlikely to occur. This could be achieved through the appropriate use of technology, such as hybrid cooling towers with plume abatement. It is likely that there would be significant visual impacts, but not to the extent that they would be unacceptable against the character of the surrounding landscape. Such impacts would be assessed and regulated as part of the development consent process. In particular, the Nuclear National Policy Statement confirms that proponents of new nuclear projects would be required to justify the use of large natural draught cooling towers before they were permitted.

8.9 The Application states that, like many other large infrastructure projects, the development of a UK ABWR could impact on sensitive species and habitats. The impact will depend primarily on the sites where the UK ABWR is deployed. The Application notes that the Nuclear National Policy Statement provided that further consideration would need to be given to the potential effects when applications are made for specific developments. Under the Habitats Directive and Habitats Regulations the decision-making authority will have to assess the likely significant effects on protected sites before deciding whether to authorise the development of a new nuclear power station. The developer is required to provide sufficient information (including in relation to avoidance and mitigation measures) in order for the assessment to be made.

8.10 The Application states that the siting of new nuclear power stations takes into account the implications of climate change, including the possibility of more severe weather patterns and rising sea levels in coastal locations. In accordance with the Nuclear National Policy Statement, any proposed development incorporating the UK ABWR will need to incorporate adaptation measures to take account of the effects of climate change, including coastal erosion, storm surge and rising sea levels, higher temperatures and risk of drought.

8.11 The Application states that the UK ABWR design is highly robust, with substantial capability to withstand extreme events such as high temperature, and so scope for any detriment to arise from more intense weather patterns is very small. This will be tested through the GDA process and then on a site-specific basis as part of permitting under the nuclear site licence. The Application notes that predictions of more severe weather in the UK are within the range sustained by nuclear power stations elsewhere in the world.

8.12 The Application notes that developers of new nuclear power station projects have to demonstrate that projects are consistent with both the general flood risk policies applicable to energy projects set out in the Overarching National Policy Statement for Energy, as well as the specific requirements for nuclear projects set out in the Nuclear National Policy Statement in order to be granted development consent. These require, in particular, that adaptation to potential increases in flooding in the future is possible. Any UK ABWR will need to include robust flood defence provisions which would ensure that any new power stations would be protected from any increase in flooding risks due to climate change.

8.13 The Application states that nuclear operators are responsible for funding their own flood risk management and coastal protection defences and for ensuring they are compatible with other defences in the area. This obligation remains in force until operation has ceased, and waste in interim storage has been removed from the site. As part of this, nuclear operators have to cooperate with the relevant environmental regulators who have responsibility for flood risk management.

Summary of the responses to the consultation on the Application

8.14 Some responses supported the position taken in the Application. Other responses raised concerns about potential detriment to sites where it is proposed that the UK ABWR should be built. These included the scope for evacuation in the event of an accident, the visual impact of cooling towers and the impact of the construction and operation of a new nuclear power station on local agriculture, tourism and (with Wylfa) on the Welsh language. Other respondents were concerned about the effect of climate change through coastal erosion and rising sea levels, of flooding and earthquakes and said that these concerns argued against building new nuclear power stations on the coast.

Summary of responses to the consultation on the Proposed Decision

8.15 Most responses supported the position taken in the Proposed Decision. One response said that the Application must be rejected because of the known health detriment from nuclear power stations.

Secretary of State's view

8.16 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

8.17 The Secretary of State acknowledges respondents' concerns about the potential environmental impact of constructing new nuclear power stations.

8.18 As stated in paragraphs 2.1 - 2.6, Regulatory Justification is an initial, high-level assessment and a class or type of practice must be Justified before it is first adopted. The Secretary of State does not therefore consider it appropriate to take into account site-specific environmental issues, where information would mostly not be available until the project stage, and which are addressed by site specific assessment processes, such as the development consent, site licensing and environmental permitting systems. The Secretary of State also believes that the environmental impacts of new nuclear power stations would not be significantly different to those of other forms of electricity generation and that they are manageable, given the legal and regulatory requirements in place in the UK and Europe to assess and mitigate the impacts.

8.19 However, the Secretary of State, in the interests of addressing these concerns, has considered how the environmental impact of new nuclear power stations would be assessed and regulated before, during and beyond operation, at national and site-specific level.

Legislative and Regulatory background – the Nuclear NPS

8.20 The Nuclear National Policy Statement (NPS)[136], published in July 2011, provides the primary basis for decisions taken by the Secretary of State following recommendations by the Planning Inspectorate on applications to build new nuclear power stations in England and Wales. It includes a list of the eight sites which the Government had determined were potentially suitable for the deployment of new nuclear power stations before the end of 2025.

8.21 The list of sites was arrived at following a strategic siting assessment, which included Appraisals of Sustainability and Habitats Regulations Assessments for the NPS as a whole and for individual sites. The Appraisals of Sustainability[137] informed the public consultation on the NPS by analysing the environmental, social and economic impacts of implementing the NPS by granting development consent. The Habitats Regulations Assessments[138] considered the likely effects of implementing the NPS on internationally important sites designated for their ecological status.

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[136] https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure

[137] https://www.gov.uk/government/publications/appraisal-of-sustainability-of-the-revised-draft-nuclear-national-policy-statement

[138] https://www.gov.uk/government/publications/habitats-regulations-assessment-of-the-revised-draft-nuclear-national-policy-statement

8.22 The NPS sets out policy and considerations relating to the potential environmental and other impacts of proposed nuclear power stations to be taken into account by the Secretary of State in considering applications, both in general terms and in relation to the eight sites.

Environmental Statements

8.23 All applications to build nuclear power stations are subject to the EU Directive on the assessment of the effects of certain plans and programmes on the environment (known as the Strategic Environmental Assessment Directive)[139], given effect in UK law by the Environmental Assessment of Plans and Programmes Regulations 2004[140].

8.24 The Directive specifically refers to effects on people, fauna and flora, soil, water, air, climate, the landscape, material assets and cultural heritage, and the interaction between them. All applications must include an Environmental Statement from the applicant describing the likely significant effects of the proposed project on the environment and the measures envisaged for avoiding or mitigating significant adverse effects[141].

8.25 When considering cumulative effects, the Environmental Statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development, including projects for which consent has been sought or granted, as well as those already in existence.

8.26 Under regulation 3 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended), the Secretary of State must not make an order granting development consent for "EIA development" (as defined in those regulations) unless "he has first taken the environmental information into consideration" and must state in his decision that he has done so[142].

Other considerations

8.27 New nuclear power stations will have long lifetimes with operation expected to last for around 60 years and decommissioning for around 30 years. Applicants must provide information to show that they have considered the impacts of climate change and appropriate adaptation measures when planning the location, design, and operation (including safe and secure interim waste storage) and where appropriate the decommissioning of the site.

8.28 The Secretary of State also needs to be satisfied that, having regard to regulatory and other constraints, nuclear power stations are as durable and adaptable as they can be (including taking account of natural hazards such as flooding), subject to the need to ensure the safety and security of the power station. The Secretary of State should also

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[139] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0042&from=EN

[140] http://www.legislation.gov.uk/uksi/2004/1633/pdfs/uksi_20041633_en.pdf

[141] Government guidance on Environmental Statements is at http://planningguidance.planningportal.gov.uk/blog/guidance/environmental-impact-assessment/ As an example of the amount of detail thought suitable for a major project, the Environmental Statement which formed part of the application for HInkley Point C is at http://infrastructure.planningportal.gov.uk/projects/south-west/hinkley-point-c-new-nuclear-power-station/?ipcsection=docs&stage=app&filter=Environmental+Statement

[142] http://www.legislation.gov.uk/uksi/2009/2263/contents/made

satisfy itself that the applicant has taken into account consideration of good design, and the design of the project should seek to mitigate environmental impacts such as those from noise, vibration and transport.

8.29 Under the Planning Act 2008, the Secretary of State must also have regard to any local impact report submitted by a relevant local authority, any relevant matters prescribed in regulations, and any other matters which he thinks are important and relevant to a decision.

8.30 The Secretary of State will be able to attach conditions to a decision to mitigate damage to the environment from developments or aspects of developments which might otherwise not be environmentally acceptable.

8.31 The Secretary of State can also decide not to grant consent where it judges that the adverse impact of a development, which could include the adverse environmental impact, outweighs its benefits. In cases where a development might cause environmental harm which could not be fully mitigated or avoided, this allows the Secretary of State to take a decision, in light of the particular circumstances of the application, about whether the benefits of that development justify the environmental detriment it would cause.

Environmental Regulatory Regime

8.32 In considering an application for development consent, the Secretary of State should focus on whether the development is an acceptable use of the land, and the impacts of that use, rather than the control of processes, emissions or discharges themselves. The Secretary of State should work on the assumption that the relevant pollution control regime will be properly applied and enforced. The planning consent process should act to complement, but not seek to duplicate it.

8.33 The Secretary of State will base his decision on advice from the nuclear regulators (the Environment Agency, Natural Resources Wales and the Office for Nuclear Regulation) as he will need to be satisfied that the necessary licences, authorisations and permits to manage and control the impacts of the development have been or are likely to be issued in due course.

8.34 Issues relating to non-radioactive discharges or emissions, air quality, water quality, noise and nuisance such as dust and litter are controlled by relevant regulatory authorities such as the Environment Agency and local authorities. The disposal of radioactive waste is regulated by the Environment Agency under the Environmental Permitting regime. When an operator applies to the Environment Agency for an Environmental Permit, the Environment Agency requires that the applicant demonstrates that processes are or will be in place to meet all relevant Environmental Permit requirements. In considering the impacts of the project, the Planning Inspectorate may consult the Environment Agency on any management plans that would be included in an Environmental Permit application. Where possible, applicants are encouraged to submit applications for Environmental Permits and other necessary consents at the same time as applying development consent so that the imposition of conditions can be consistent across the planning and permitting regimes.

8.35 Through the GDA process regulators are also working to ensure that the need to meet high environmental standards is considered at an early stage and that the most modern techniques to minimise radioactive waste – including discharges to the environment – can be incorporated into the designs of new nuclear power stations. The application of the principle of BAT (Best Available Techniques) in England and Wales will ensure that

discharges from new nuclear power stations constructed in the UK will not exceed those from comparable nuclear power stations across the world.

8.36 The Secretary of State is satisfied that the existing legislative and regulatory regime will continue to function effectively under the new planning regime and that the planning process will take regulators' views into account.

Regulatory Regime – Environmental Impact of an Accident or Security Incident

8.37 The Secretary of State acknowledges respondents' concerns about the impact on the environment of an accident at a nuclear power station. The Secretary of State, however, has not seen any information which would cause him to depart from the Government's view that the risk of an accident can be managed through arrangements for design and regulatory and corporate governance for the nuclear industry. The UK's nuclear safety regime and the security requirements in place to minimise the risk of an accident or security incident is considered by the Secretary of State in detail in Chapter 6 (Radiological Health Detriment) and Chapter 9 (Safety and Security).

Regulatory Regime – Climate Change and Flood Risk

8.38 The Secretary of State has taken the advice of the Environment Agency and the Office for Nuclear Regulation about concerns about climate change and potential flood risk generally and has also taken specific advice in respect of the nominated sites. These issues will be looked at in detail as part of the planning process and the Secretary of State has confidence that this will ensure that any risk is limited.

8.39 The regulators are satisfied that protections are in place to ensure that only suitable sites achieve development and operational consent. This will be reviewed in detail as part of the planning and licensing stage and as part of the Flood Risk Assessment that applicants for development consent must undertake. Should sites achieve development consent, their capacity to withstand potential climate change will remain under consideration throughout the life of the nuclear power station.

Non-Radiological Health Detriment

8.40 The Regulations, the Basic Safety Standards Directive and the ICRP do not specify that a Regulatory Justification decision needs to consider the impact of a class or type of practice on health beyond that caused by the release of radiation.

8.41 However, in the interests of considering all the information relevant to the UK ABWR, the Secretary of State has considered its potential non-radiological health detriment.

8.42 The Nuclear AoS assesses the impact on human health and well-being of the Nuclear NPS as a whole and at each of the potentially suitable sites for the deployment of new nuclear power stations by the end of 2025. This assessment includes consideration of non-radiological health detriment from new nuclear power stations.

8.43 The AoS has identified potential positive and negative effects for health and wellbeing from new nuclear power stations. It states that the operation of new nuclear power stations is unlikely to be associated with significant noise and air quality effects (although there may be localised effects from transport activities during construction and from construction itself) and that the subsequent effects on human health are unlikely to be significant.

8.44 In common with other major industrial processes the construction, operation and decommissioning of new nuclear power stations could impact on health care provision, for example by placing demand on health monitoring services.

Conclusion

8.45 The Secretary of State recognises that construction, operation and decommissioning of a UK ABWR, as a major infrastructure project, will involve potential detriment to the environment, and that this potential detriment needs to be addressed.

8.46 The Secretary of State has considered in detail in other Chapters of this document some of the issues covered in the AoS and HRA of the Nuclear NPS, including radiological health detriment, radioactive waste, and security of supply and climate change.

8.47 In the case of the other areas considered, including biodiversity, landscape, air quality, soils, water quality and flood risk, these can by their nature only be effectively addressed at a site-specific level in connection with individual applications to build nuclear power stations.

8.48 Such site specific matters are not suitable considerations in making a Regulatory Justification decision. In any event there are other site specific assessment processes that exist, such as the planning, permitting and licensing systems, which will ensure that any environmental detriment caused by the construction of a UK ABWR will be minimised. The Secretary of State is conscious of the UK's obligations under EU law with regard to the environment and is confident that these processes will ensure that any environmental damage is kept within limited and acceptable levels.

8.49 The Secretary of State has considered the arrangements for processing applications for development consents for new nuclear power stations. In advising the Secretary of State on an application for development consent, the Planning Inspectorate must generally act in accordance with the NPS and its supporting documents. These contain policy aimed at minimising and mitigating harm to the environment that could arise from the construction and operation of a UK ABWR. When considering an application, the Secretary of State will also have the benefit of an Environmental Statement which details all the potential impacts of the development on the environment. The Secretary of State will be able to attach conditions to a decision to mitigate damage to the environment from developments or aspects of developments which might otherwise not be environmentally acceptable.

8.50 The Secretary of State can also decide not to grant consent where he judges that the adverse impact of a development, which could include the adverse environmental impact, outweighs its benefits. In cases where a development might cause environmental harm which could not be fully mitigated or avoided, this allows the Secretary of State to take a decision, in light of the particular circumstances of the application, about whether the benefits of that development justify the environmental detriment it would cause.

8.51 The Secretary of State will make his decisions on the basis of advice from the Environment Agency and other regulatory bodies. The Secretary of State is satisfied that the existing regulatory regime will continue to function effectively under the new planning regime, both before and after decisions are taken.

8.52 The Secretary of State is satisfied that the planning regime set up under the Planning Act 2008 for major infrastructure allows environmental considerations to be identified and addressed at an early stage of the planning process, including through consultation with the regulators and the public, so that (together with the environmental permitting and site licensing regime) unsuitable development can be prevented and potential adverse

impacts mitigated. The Secretary of State is therefore satisfied that any environmental detriment arising from the construction, operation and decommissioning of the UK ABWR, outside those factors considered elsewhere in this document, will be effectively mitigated.

Chapter 9: Safety, Security and Safeguards

Introduction

9.1 The International Commission on Radiological Protection (ICRP) is clear that accident prevention should be the first safety priority of both designers and operators[143], and provides guidance[144] on the regulatory framework for dealing with "potential exposure" (radiation exposure that is not certain to occur, but to which a probability of occurrence can be assigned). The guidance says that:

"*The first step in regulation in the context of potential exposures is that of establishing a duty on the operating management to conduct assessments of the expected frequency and possible consequences of events, such as accidents and major errors of design and operation, that might give rise to doses substantially higher than those in normal conditions. […] "The second stage is that of regulatory review. Depending on the likely scale of the problems posed by the events giving rise to potential exposures, the regulatory agency should establish a procedure for reviewing the operators' assessments. […] "Compliance with risk limits and constraints has to be judged from the results of assessments of the quality of the design, operation and maintenance of the plant and equipment and the quality of the management arrangements*."

9.2 The release of radioactivity into the environment from an accident or security incident at a new nuclear power station could lead to significant adverse health and long-term environmental impacts through direct exposure to high levels of ionising radiation, or from increased contamination of air, land and water, which could lead in turn to ingestion via the water supply or food chain, potentially over a wide area depending upon the scale and nature of the incident.

9.3 As explained in Chapter 6 (Radiological Health Detriment), the potential health consequences of an accident could include a range of cancers, burns, sensory impairment and even death and would depend upon the scale of what occurred and which part of the nuclear power station it occurred in.

9.4 The Secretary of State has therefore considered the potential detriment from an accident or security incident at a UK ABWR.

9.5 This Chapter considers the content of the Application relating to issues of safety and security raised by the UK ABWR, and responses to the consultations on the Application and the Proposed Decision. It then sets out the Secretary of State's view on the effectiveness of the regulatory regime in place to minimise the detriment to health which could arise from an accident or a security incident at a nuclear power station.

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[143] http://ani.sagepub.com/content/suppl/2013/06/25/21.1-3.DC1/P_060_JAICRP_21_1-3_1990_Recommendations_of_the_ICRP.pdf

[144] http://ani.sagepub.com/content/suppl/2013/06/25/23.1.DC1/P_064_JAICRP_23_1_Protection_from_Potential_Exposure_-_A_Conceptual_Framework.pdf

Summary of the Application

9.6 This is a brief summary of points made in the Application. Anyone wanting to follow the Application's arguments, evidence and supporting references should read the Application in full.

9.7 The Application states that a new programme of nuclear power stations including the UK ABWR would not materially change the existing very low risk of proliferation of nuclear weapons on the basis that an effective regulatory framework is already in place to prevent any such diversion from the UK's existing nuclear fleet.

9.8 The Application notes that new nuclear power stations, like existing power stations and other major infrastructure, could be potential targets for terrorist or other malicious attacks. The Application outlines the security measures in place to minimise this risk. Each site licensee is required to develop and implement a Nuclear Site Security Plan to ensure the security of its site, to make provision for the protection of nuclear and other radiological material, both on sites and in transit, against the risks of theft and sabotage, and for the protection of sensitive nuclear information, such as site security arrangements and sensitive areas of plant. This Plan is subject to the scrutiny and approval of the independent security regulator.

9.9 The Application states that nuclear site licensees are under a legal requirement to undertake emergency exercises that demonstrate their ability to implement satisfactory contingency plans.

9.10 The Application states that the potential vulnerability of nuclear power stations to terrorists or other malicious threats is further reduced by the same design features that provide high levels of protection against the effects of accidents.

9.11 The Application states that these measures, combined with other security measures which are not design features, demonstrate that potential security-related detriment from the UK ABWR is very small.

9.12 The Application states that the nuclear industry applies high standards to all aspects of worker health and safety, both in relation to radiation exposures and general industrial safety. The industry's industrial safety performance compares well to other industries. The Application states that the potential industrial safety detriments relating to the UK ABWR would be very low, similar to or lower than those from other major industrial projects.

9.13 The Application notes that the 2011 Fukushima accident in Japan highlighted the potential for multi-unit nuclear power stations to be affected by natural disasters. and for a severe accident to adversely impact cooling and long term electrical power supplies. The Application contains, in Annex 5, more detailed information underlying the Applicant's conclusion, following Fukushima, that the risk of significant detriments from extreme events and severe accidents remains low. The Application summarises the grounds for this conclusion as :

- the capability and resilience of UK plants that is being further enhanced in the light of lessons from Fukushima;
- the commitment of UK operators to nuclear safety;
- stress tests conducted on EU nuclear installations in response to Fukushima to ensure that any further improvements to the resilience of plants were identified for implementation; and

- the robustness of the regulatory regime and the independence and effectiveness of the UK nuclear regulator in promoting and overseeing high levels of governance in the nuclear industry.

Summary of responses to the Application

9.14 Some responses supported the position taken in the Application. Others were concerned about the safety and security of the UK ABWR once in operation, and in particular the risk of terrorism and the risk of uranium being used for military purposes.

Summary of responses to the consultation on the Proposed Decision

9.15 Responses which commented on this issue supported the position taken in the Proposed Decision.

Secretary of State's view

9.16 The Secretary of State has considered the Application and the responses received to the consultations on the Application and on the Proposed Decision.

9.17 The Secretary of State acknowledges that some respondents' concerns about the impact of an accident or incident lead them to question the view that the risk of an accident or security incident can be managed through arrangements for design and regulatory and corporate governance for the nuclear industry. The Secretary of State has therefore considered the measures in place to prevent accidents and protect against security threats such as terrorism.

Safety Regulatory Regime

9.18 The regulatory regime governing the safety of nuclear power stations and nuclear transport is considered in more detail in paragraphs 6.49 to 6.95.

9.19 The regulators will continue to assess the UK ABWR as part of the GDA process and have made clear that new nuclear power stations will not be built if they are not satisfied through GDA and the site-specific process.

9.20 Before giving permission for the start of construction, the ONR would have to be satisfied that, among other things, several levels of protection and defence are provided against significant faults or failures, that accident management and emergency preparedness strategies are prepared and that all reasonably practicable steps have been taken to minimise the radiological consequences of an accident.

9.21 As explained in paragraphs 2.1 to 2.6, legislation requires a Regulatory Justification decision to be taken before a class or type of practice is adopted. It is an initial, high-level process, and not intended as a substitute for the detailed examination of reactor designs which is made through the regulatory process, including GDA.

Security Regulatory Regime

9.22 The Office for Nuclear Regulation is responsible for regulating security within the civil nuclear industry. ONR regulates in accordance with the Nuclear Industries Security Regulations 2003 (as amended) (NISR)[145] which are intended to ensure that nuclear

[145] http://www.legislation.gov.uk/uksi/2003/403/made

materials, nuclear facilities and sensitive nuclear information are protected from malicious acts including theft, sabotage and terrorism. Under NISR dutyholders are required to produce and comply with security plans designed to deal with the assessed threat to the UK nuclear industry. ONR approves security arrangements, monitors compliance and takes enforcement action where deemed necessary.

9.23 The UK's regulatory regime reflects international best practice and meets the UK's international obligations and commitments, especially the Convention on the Physical Protection of Nuclear Material[146] and key guidance "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC/225/Revision5) issued by the International Atomic Energy Agency[147].

9.24 To ensure the rapid and effective identification and notification of changes to this threat, ONR has a permanent presence within UK's Joint Terrorism Analysis Centre. Intelligence on the threat is disseminated to the nuclear industry in updates to the Nuclear Industries Malicious Capabilities (Planning) Assumptions document (NIMCA).

9.25 Security plans identify potential security issues and arrangements for their mitigation. ONR assess and approve these plans initially and thereafter review and re-assess them routinely. They become the basis against which the dutyholders' security regimes are judged for compliance. This judgement is based on regulatory activities including routine inspections, investigations and assessment of counter-terrorist exercises allowing a comparison of how closely security practice conforms to the plan.

9.26 Security regulation at civil nuclear facilities including nuclear power stations starts early in the construction phase, when activities under a planning permission or development consent are carried out on the construction site. Security regulation continues through the life of the facility.

9.27 Security measures in place reflect the quantity and of the nuclear and radioactive material present on site, and the potential hazards associated with these. Armed officers from the Civil Nuclear Constabulary provide an onsite response at operating nuclear power stations.

9.28 For understandable security reasons, the UK does not comment publicly on the detail of operational security measures.

9.29 Since October 2012 ONR has adopted a goal-setting regulatory approach to security planning more analogous to the nuclear safety regime. The National Objectives, Requirements and Model Standards (NORMS)[148] enable and empower industry to propose alternative solutions for the delivery of the required security objectives. NORMS describes, rather than prescribes, model security standards as methods by which these objectives might be achieved. Dutyholders have worked to produce NSSPs, conforming to the NORMS security objectives, for assessment and approval by ONR. Where alternative security arrangements are proposed there must be evidence in the plan that these arrangements will achieve the required security objectives.

9.30 These plans also need to demonstrate effective and appropriate integration of the following elements of security:

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[146] http://www.iaea.org/Publications/Documents/Conventions/cppnm.html

[147] http://www-pub.iaea.org/books/IAEABooks/8629/Nuclear-Security-Recommendations-on-Physical-Protection-of-Nuclear-Material-and-Nuclear-Facilities-INFCIRC-225-Revision-5

[148] http://news.onr.org.uk/2012/10/onr-rolls-out-new-security-guidance-to-industry/

- physical site protection;
- information and cyber security;
- vetting and personnel security; and
- nuclear material transport security.

9.31 In addition, ONR continue to ensure that security and its integration with safety is an integral part of the studies considered by the GDA process for nuclear new build activities.

9.32 The UK's security regime for the civil nuclear industry is kept under constant review to ensure that it remains robust and effective.

9.33 ONR is satisfied with the security arrangements in the civil nuclear industry and believes that allowing new nuclear power stations to be built would be unlikely to increase the risk of security incidents.

9.34 Further, the Secretary of State notes that the Government and industry have an emergency preparedness framework in place to mitigate health effects in the unlikely event of an accidental release of radioactivity into the environment. This framework includes detailed site-specific plans for each nuclear facility. Detailed plans must provide for:

- the control of any release of radioactivity on the site, whether resulting from an accident or a malicious incident;
- assessment of actual and potential accident consequences, and alerting the relevant authorities and the public; and
- introduction of countermeasures to mitigate the consequences of the incident; and return to normal conditions.

9.35 The plans are tested regularly through exercises, some of which involve the Government and simulated media involvement.

9.36 The effectiveness and efficiency of the regulatory regime is under continuous review and improvements are made where necessary.

Non-Proliferation and Safeguards

9.37 The Secretary of State acknowledges concerns about the possibility of diversion of nuclear material and the proliferation of nuclear weapons.

9.38 ONR Safeguards ensures that the UK complies with its international safeguards obligations, including those under the Euratom Treaty[149], the UK/Euratom/International Atomic Energy Agency (IAEA) safeguards agreement and it's Additional Protocol[150]. It does this by working with the industry and inspectors from the European Commission (Euratom) and the IAEA to make sure that the safeguards measures applied are both effective and efficient.

9.39 The operators of new nuclear power stations will be subject to the same stringent safeguards provisions as existing operators, including inspection and verification by the international safeguards inspectorates of the European Commission and, should they choose, the IAEA.

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[149] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:084:0001:0112:EN:PDF

[150] http://www.onr.org.uk/safeguards/additional-protocol.htm

9.40 The Secretary of State has noted concerns that building new nuclear power stations would make it harder for the UK to press for the abandonment of nuclear power world-wide in the interests of non-proliferation. But the Government does not accept that pressing other countries to forego nuclear power is an effective or legitimate approach to non-proliferation. Rather, multilateral action is needed to support and strengthen the nuclear non-proliferation regime, e.g. through the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[151], under which non-nuclear weapon states (NNWS) signatories have a right to the peaceful development of nuclear power. All potential new nuclear states who are NNWS signatories of the NPT would also be bound by their treaty obligations not to manufacture or otherwise acquire nuclear weapons and to submit all nuclear material to IAEA safeguards.

9.41 The Secretary of State believes therefore that there is no reason to think that the building of new nuclear power stations in the UK would result in any significant rise in proliferation risk from the current low levels.

Conclusion

9.42 The Secretary of State is conscious of the significant detriments to health and the environment that could result from an accident or terrorist attack at a new nuclear power station. However, the scale of potential damage must be seen in the light of the robust regulatory regime which exists in the UK to prevent accidents and protect against security threats including terrorist attacks. The Secretary of State is also conscious of the good record of the nuclear industry in the UK and the regulatory regime which governs it.

9.43 The Secretary of State has also considered the proliferation risks associated with the nuclear material related to a UK ABWR. He is satisfied that any UK ABWR that is built in the UK will be subject to the international safeguards verification under the Euratom Treaty and the terms of the UK/Euratom/International Atomic Energy Agency (IAEA) safeguards agreement.

[151] http://www.un.org/en/conf/npt/2005/npttreaty.html

Annex A: List of Independent Regulators and Advisory Bodies in the UK

Independent Regulators

1. **The Environment Agency (EA**) is the leading public body for protecting and improving the environment in England and Wales. It has pollution control powers, being responsible for the regulation of radioactive waste disposals, including discharges; abstraction from, and discharges to, controlled waters, including rivers, estuaries, the sea and groundwaters; assessment and where necessary, clean-up of contaminated land; disposal of conventional waste; and certain flood risk management matters[152].
2. **The Scottish Environment Protection Agency[153]**, **Natural Resources Wales**[154] and the **Northern Ireland Environment Agency[155]** within the **Department of the Environment, Northern Ireland[156]** perform similar functions in Scotland, Wales and Northern Ireland.
3. **The Office for Nuclear Regulation[157]** has responsibility for the safety regulation of nuclear facilities in Great Britain. The ONR regulates nuclear power stations by means of a licensing and permitting regime. A site cannot have a nuclear installation on it unless the user has been granted a site licence by the ONR. The ONR has the power to attach to the nuclear site licence conditions in the interests of safety and also with respect to the handling, treatment and disposal of nuclear matter providing for the general requirements for safety on the site. This regime enables the ONR to provide regulatory oversight of the operator's safety-related activities throughout the lifecycle of the plant including design, siting, construction, commissioning, operation and modification through to completion of decommissioning
4. The **Office for Nuclear Regulation** is also the regulator for security in the civil nuclear industry. It is responsible for regulating:
    - nuclear and other radioactive materials on civil licensed nuclear sites;
    - Category I-III nuclear materials stored off licensed sites;
    - domestic transport of nuclear materials by road, rail and sea; and
    - international transport of nuclear and other radioactive materials by UK flagged vessels
    - sensitive nuclear information wherever it is held;

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[152] https://www.gov.uk/government/organisations/environment-agency

[153] http://www.sepa.org.uk/

[154] http://naturalresourceswales.gov.uk/splash?orig=/

[155] http://www.doeni.gov.uk/niea

[156] http://www.doeni.gov.uk

[157] http://www.hse.gov.uk/nuclear/about.htm

5. **ONR Safeguards** is part of ONR and oversees the application of nuclear safeguards in the UK. Nuclear safeguards are measures to verify that States comply with their international obligations not to use nuclear materials (plutonium, uranium and thorium) for nuclear explosives purposes. ONR Safeguards works with the UK nuclear industry and others with safeguards reporting requirements, and safeguards inspectors from the European Commission and the International Atomic Energy Agency (IAEA), to make sure that the safeguards measures applied are both effective and efficient.

6. The **Food Standards Agency** (FSA)[158] is an independent Government department set up by an Act of Parliament in 2000. It is responsible for protecting the public's health and consumer interests in relation to food, by assessing the potential detriments in the form of what radiological doses members of the public could be exposed to as a result of routine operational discharges of radioactive material.

Advisory bodies

7. **Radioactive Waste Management Limited (RWM)** is a wholly owned subsidiary of the Nuclear Decommissioning Authority (NDA), established in April 2014, and is responsible for implementing Government policy on geological disposal[159]. As the developer of a GDF, RWM is responsible for safety, security and environmental protection throughout the lifetime of the programme. RWM is responsible for complying with all the regulatory requirements on geological disposal. RWM also provides companies proposing nuclear reactor designs with disposability assessments for wastes predicted to arise from the operation and decommissioning of new nuclear power stations for submission to the regulators as part of the GDA process.

8. **Public Health England**[160] is an independent organisation which was set up by the Government to protect the public from threats to their health from infectious diseases, environmental hazards and radiation. It does this by providing advice and information to the general public, to health professionals such as doctors and nurses, and to national and local government.

9. The **Committee on Medical Aspects of Radiation in the Environment** (COMARE)[161] is a scientific advisory committee providing independent advice on all aspects of health risk to humans (both adults and children) exposed to natural and man-made radiation. The Committee has produced 15 major reports since its establishment in November 1985 covering a range of subjects from the incidence of childhood cancers through to the health effects and risks associated with UV sunbeds. The Committee was established in response to the final recommendation of the report of the Independent Advisory Group chaired by Sir Douglas Black in 1984, which had been commissioned to investigate reports of a high incidence of leukaemia occurring in young people living in Seascale, close to Sellafield. A number of the COMARE reports have followed on from this work, with requests to investigate the incidence of childhood cancers at specific locations. These requests have often been prompted by concerns from the general public.

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158 http://www.food.gov.uk/

159 http://www.nda.gov.uk/2014/04/nda-creates-new-subsidiary/

160 https://www.gov.uk/government/organisations/public-health-england

161 http://www.comare.org.uk/

Annex B: Consultation and Decision Timetable

Regulatory justification process	**Indicative Timetable**
Government received Application from Nuclear Industry Association (NIA).	December 2013
Justification Co-ordination Committee considered Application.	December 2013 – January 2014
Public consultation on the NIA Application	18 February 2014
Closing date for responses.	13 May 2014
Considered comments received, sought further information as necessary, and prepared draft decision document, in consultation with the JCC. Draft decision document set out the Justifying Authority's assessment of the benefits and detriments of the class or type of practice.	May – July 2014
Public consultation on draft decision document	24 July 2014
Closing date for responses	23 October 2014
Decision by Secretary of State: if the class or type of practice is found to be Justified, the Justifying Authority will make a regulatory justification decision in the form of secondary legislation (a Statutory Instrument).	December 2014
Bring to the attention of any person likely to be affected by the decision by writing to the applicant, issuing a press notice and publishing notices in the London, Edinburgh and Belfast Gazettes.	December 2014

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