



Office for
Nuclear Regulation

Determination of the requirement for Off-site Emergency Planning and Prior Information Areas for the Hinkley Point A Nuclear Licensed Site: Radiation (Emergency Preparedness and Public Information) Regulations 2001.

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Published 06/15

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EXECUTIVE SUMMARY

Determination of the requirement for Off-site Emergency Planning and Prior Information Areas for the Hinkley Point A Nuclear Licensed Site: Radiation (Emergency Preparedness and Public Information) Regulations 2001

The Office for Nuclear Regulation (ONR) is responsible for regulating GB nuclear sites in order to protect the health and safety of employees and the public against risks of harm arising from ionising radiations. ONR's responsibilities include a legal duty, where it is concluded that there is a potential for a reasonably foreseeable radiation emergency (as defined in the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR)), to determine an off-site emergency planning area¹ (i.e. the area within which, in ONR's opinion, any member of the public is likely to be affected by such an emergency). In these cases, there is also a legal duty, under the same Regulations, for ONR to determine an area² within which prior information is to be distributed to the public. A radiation emergency is defined in REPPIR as a reasonably foreseeable event where a person off-site is likely to receive a radiation dose in excess of the thresholds in REPPIR (typically an effective dose in excess of 5 mSv) in the 12 months following the emergency. It therefore constitutes an important component of the UK's overall emergency response framework.

This ONR Project Assessment Report (PAR) describes and explains the basis for its re-determination, in accordance with REPPIR, of the off-site emergency planning area and the area within which prior information is to be distributed to persons around the Hinkley Point A nuclear licensed site.

In relation to this area, the responsible local authority, in this case Somerset County Council, is required to prepare an off-site emergency plan for the defined area with the purpose of minimising, so far as is reasonably practicable, radiation exposures to those likely to be affected by such an emergency. This plan will reflect the potential need to implement appropriate protection measures such as sheltering and evacuation in order to reduce radiation doses to members of the public within all or parts of this area.

REPPIR requires operators who carry out work involving quantities of radioactive materials at or beyond that which it specifies, in this case Magnox Ltd, to undertake a Hazard Identification and Risk Evaluation (HIRE) in relation to their work with ionising radiations. The HIRE must identify all hazards on the site with the potential to cause a radiation accident, and evaluate the nature and magnitude of the risks to employees and other persons (e.g. those who live or work nearby) arising from those hazards. REPPIR also requires operators to assess their HIRE and to submit a Report of Assessment (RoA) to ONR either prior to commencement of the work with ionising radiation, following any relevant material change in this work, or within three years of the last assessment, whichever is the shorter.

Previous determinations by ONR for the Hinkley Point A site have concluded that a radiation emergency is reasonably foreseeable and have therefore specified an off-site local authority emergency planning area and prior information area represented by a single circular area around the site with a radius of 3.5 km.

This re-determination has been undertaken in response to REPPIR submissions to ONR by Magnox Ltd. These report a substantial reduction in both the hazard and risk of a radiation emergency at the Hinkley Point A site due to the defueled status of the reactors with all spent fuel removed from the site. The Magnox Ltd. RoA/HIRE for Hinkley Point A concludes:

¹ ONR has historically used the term detailed emergency planning zone (DEPZ) to refer to the area it defined under REPPIR regulation 9 as requiring an off-site emergency plan. (The term is still used this way in some ONR guidance.) As the term is not used within REPPIR itself (although referred to in the related guidance), and to ensure legal clarity and avoid misunderstanding amongst stakeholders, this report refers to the 'REPPIR off-site emergency planning area' under regulation 9 rather than to 'detailed emergency planning zone' or 'DEPZ'.

² This is sometimes, and has historically been, referred to as the Public Information Zone (PIZ) under regulation 16, but for the same reasons as given above is not used in this report. This report refers to the 'REPPIR prior information area'

'...there are no reasonably foreseeable faults resulting in any member of the public being exposed to a radiological dose in excess of 5 mSv from the facilities at HPA. It concluded that the current REPPiR Regulation 9 Off-site Emergency Plan and Detailed Emergency Planning Zone at 3.5 km are sufficient, but arguably excessive.'

ONR has made an assessment of the operator's technical submissions in accordance with its regulatory processes, guidance associated with REPPiR itself, and the relevant ONR technical assessment guide. The ONR assessment agrees with the Magnox Ltd conclusion that there is no longer a reasonably foreseeable radiation emergency from the Hinkley Point A site.

That being so, some aspects of REPPiR, principally REPPiR regulations 7(1), 9(1) and 16(1), relating to the operator's emergency plan and the identification of off-site planning and prior information areas, no longer apply.

The recommendations of this report are that ONR write to:

- Somerset County Council and Magnox Ltd to notify them that a REPPiR off-site emergency planning area is no longer required for the Hinkley Point A licensed site.
- Somerset County Council to notify them that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan in respect of the Hinkley Point A licensed site, although the requirement remains in respect of the Hinkley Point B licensed site.
- Magnox Ltd. to notify them that the requirement to ensure the appropriate provision of prior information to the public is no longer required under REPPiR. This should be copied to Somerset County Council.
- Magnox Ltd. to notify them that there is no longer a requirement under REPPiR for an operator's emergency plan.
- EDF Energy, who operate Hinkley Point B, to notify them that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan in respect of the Hinkley Point A licensed site, although the requirement remains for the Hinkley Point B licensed site.
- The Nuclear Decommissioning Authority, Food Standards Agency, the Maritime and Coastguard Agency and the Environment Agency of the outcome of this assessment and the removal of the REPPiR off-site planning and prior information areas for the Hinkley Point A licensed site, although the requirement remains for the Hinkley Point B licensed site.

Whilst this review removes the requirement for detailed emergency planning under REPPiR in relation to the Hinkley Point A site, proportionate emergency arrangements for the protection of the public remain in the form of;

- bodies such as local authorities have duties to make adequate emergency arrangements under other legislation such as the Civil Contingencies Act 2004;
- operators have general duties Under the Health and Safety at Work Act 1974 to ensure, so far as is reasonably practicable, the safety and welfare of employees and other persons; and
- operators who hold a nuclear site licence are required to make and implement adequate arrangements for dealing with any accident or emergency (under site licence condition 11 attached to the nuclear site licence); and to prepare necessary contingency plans as required under the Ionising Radiations Regulations 1999.

These other duties are not directly affected by this determination, and, where ONR is the enforcing authority, ONR will continue to seek assurance that the operator remains compliant with these legal obligations, including any such provision and co-ordination of adequate off-site emergency arrangements as these other duties may require.

LIST OF ABBREVIATIONS

CCA	Civil Contingencies Act (2004)
DEPZ	Detailed Emergency Planning Zone (Ref: REPPPIR regulation 9(1))
EURATOM	European Atomic Energy Community
FED	Fuel Element Debris
FEPA	Food and Environment Protection Act 1985
FSA	Food Standards Agency
GB	Great Britain
HIRE	Hazard Identification and Risk Evaluation
HPA	Hinkley Point A
HSE	The Health and Safety Executive
IAEA	The International Atomic Energy Agency
ILW	Intermediate Level Waste
IUWG	Inter-Utility Working Group
LC	Licence Condition
NEAF	Nuclear Emergency Arrangements Forum
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
REPPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RoA	Report of Assessment
SAPs	(ONR) Safety Assessment Principles
TAG	(ONR) Technical Assessment Guide

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1 REGULATORY CONTEXT

The Energy Act (reference 1) requires the Office for Nuclear Regulation (ONR) to do whatever it considers appropriate for the purposes of protecting persons against risks of harm arising from ionising radiations from GB (Great Britain) nuclear sites, including:

- a) securing the health, safety and welfare of persons at work on GB nuclear sites; and
- b) protecting persons, other than persons at work on GB nuclear sites, against risks to health or safety arising out of or in connection with the activities of persons at work on GB nuclear sites.

ONR does this by providing regulation of the nuclear industry, holding it to account on behalf of the public, and, in particular, ensuring appropriate arrangements are in place to deal with a nuclear emergency.

ONR's responsibilities include a legal duty, where it is concluded that there is a potential for a reasonably foreseeable radiation emergency (as defined in the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPPIR) (reference 2)), to determine an off-site emergency planning area. This is the area within which, in ONR's opinion, any member of the public is likely to be affected by such an emergency³. In these cases, there is also a legal duty under the same regulations for ONR to determine an area within which prior information is to be distributed to the public⁴. A radiation emergency is defined in REPPPIR as a reasonably foreseeable event where a person off the site is likely to receive a radiation dose in excess of the thresholds in REPPPIR (typically an effective dose in excess of 5 mSv) in the 12 months following. It therefore constitutes an important component of the UK's overall emergency response framework.

This report sets out the outcome and justification for the determination of the revised off-site emergency planning and prior information areas for the Hinkley Point A nuclear licensed site, in accordance with the requirements of REPPPIR (reference 2) regulations 9(1) and 16(1) respectively.

2 BACKGROUND

The UK nuclear regulatory system requires that every licensee must demonstrate to the regulator that it fully understands the hazards and risks associated with its operations and controls them appropriately. The regulator assesses the safety and security of the design and operation of nuclear plant to ensure that licensees' provisions are robust and that any risks are reduced so far as is reasonably practicable.

Magnox Ltd. is the company responsible for the decommissioning of the Hinkley Point A Nuclear Licensed site on behalf of the Nuclear Decommissioning Authority (NDA), a non-departmental public body in the UK which is responsible for managing the effective and efficient clean-up of the UK nuclear legacy.

REPPPIR came into force in 2001, and the REPPPIR off-site emergency planning area around the operating reactors at the Magnox Ltd. Hinkley Point A and the EDF Energy Hinkley Point B site was determined at the time to be a circle of radius 3.5 km centred on the mid-point between the two reactors of the Hinkley Point A site. The Hinkley Point A reactors ceased operating in 2000. Since that time, the nuclear fuel has been removed from the site so the level of radiological hazard and risk presented by the site has substantially diminished.

³ ONR has historically used the term detailed emergency planning zone (DEPZ) to refer to the area it defined under REPPPIR regulation 9 as requiring an off-site emergency plan. (The term is still used this way in some ONR guidance.) As the term is not used within REPPPIR itself (although referred to in the related guidance), to ensure legal clarity and avoid misunderstanding amongst stakeholders, this report refers to the 'REPPPIR off-site emergency planning area' under regulation 9 rather than to 'detailed emergency planning zone' or 'DEPZ'

⁴ This is sometimes, and has historically been, referred to as the Public Information Zone (PIZ) under regulation 16, but for the same reason as given above is not used in this report. This report refers to the 'REPPPIR prior information area'.

In relation to emergency planning, REPPIR requires the operator, in this case Magnox Ltd., to undertake a Hazard Identification and Risk Evaluation (HIRE) of all hazards, arising from their work, with the potential to cause a radiation accident. The operator's assessment must be sufficient to demonstrate that all such hazards have been identified and the nature and magnitude of the risks to employees and other persons arising from those hazards have been evaluated. REPPIR also requires that operators submit a report of the assessment (RoA) of this HIRE to ONR prior to commencement of the work with ionising radiation, following any relevant material change in this work, or within three years of the last assessment, whichever is the shorter. REPPIR also makes provision for ONR to request additional information. In practice, it is usual for the HIRE itself to be requested to inform ONR's determination.

Where it is reasonably foreseeable that a radiation emergency (as defined in REPPIR) could arise, REPPIR requires ONR to determine areas within which, in its opinion, persons (including any member of the public) are likely to be affected by such emergencies. This then defines the area for which local authorities are required to prepare an adequate off-site emergency plan (regulation 9(1)) and for which operators are required to provide specified prior information (regulation 16(1)) to members of the public without them having to request it and also make that information publicly available.

The off-site emergency plan, in cases where one is required, should include urgent countermeasures and other protection measures that are relevant, reasonably practicable, and proportionate to the radiological risk in the event of a reasonably foreseeable radiation emergency

In 2013 Magnox Ltd submitted an updated RoA (reference 3) summarising the conclusions of its updated HIRE for the Hinkley Point A Site (reference 4) under regulation 6 of REPPIR, taking account of the relevant material changes due to the cessation of electricity generation and the removal of all fuel elements from site. In this updated RoA Magnox Ltd makes the case that the current emergency planning area of a circle of 3.5 km was excessive on the basis that in their opinion *"...there are no reasonably foreseeable faults resulting in any member of the public being exposed to a radiological dose in excess of 5 mSv from the facilities at HPA...."*

This report sets out the outcome and justification for the determination of the revised off-site emergency planning and prior information areas for the Hinkley Point A nuclear licensed site, in accordance with the requirements of REPPIR regulations 9(1) and 16(1) respectively.

3 SCOPE

This report sets out the basis for, and conclusions of, the ONR assessment of the REPPIR off-site emergency planning and prior information areas relating to the Hinkley Point A nuclear licensed site. It has been undertaken in accordance with the guidance on REPPIR (reference 5) and the supporting relevant ONR Technical Assessment Guide (TAG) (reference 6) which incorporates ONR's principles for determination of REPPIR areas, and related guidance.

ONR's principles recognise the learning that has emerged from global events such as occurred at Fukushima and the subsequent need to review the scope of off-site emergency planning. They also reflect ONR's commitment to high standards of nuclear safety at nuclear installations, and its continual efforts to seek improvements to standards and to the consistency and transparency of its decision making.

Provisions for the implementation of food restrictions are separate to the process of determining the REPPIR off-site emergency planning area on the basis that they are provided separately (Food and Environment Protection Act 1985 (FEPA)) and are under the legal jurisdiction of the Food Standards Agency (FSA). These provisions are therefore addressed by separate legislation other than REPPIR, which may be exercised in a broader range of circumstances (i.e. not restricted to a radiological event), and are subject to existing

planned implementation arrangements made by the FSA. They are therefore outside the scope of this report.

4 METHODOLOGY

4.1 ONR's PROCESS FOR DETERMINING A REPPIR OFF-SITE EMERGENCY PLANNING AREA

This process requires that ONR:

- A. Conduct an initial independent technical assessment of the information provided by the licensee in their HIRE and RoA and seeking and using additional information as appropriate; and
- B. Where the potential for a REPPIR defined reasonably foreseeable radiation emergency exists, establish and consider any other relevant practical and strategic factors relating to the planning and practical implementation of protection measures to restrict public exposure so far as reasonably practicable (e.g. urgent countermeasures) for those persons who are likely to be affected by a radiation emergency.

Step A requires ONR to assess the operator's identification and characterisation of the likelihood, nature and magnitude of the radiation related risks that may result for a radiation accident. ONR also assess the operator's assessment of whether there is the potential for a radiation emergency to occur that is reasonably foreseeable. If this potential exists ONR will then consider the likely extent of any area within which the dose criteria contained within Schedule 1 of REPPIR may be met or exceeded. This indicates the minimum distance for further consideration in Step B, and is usually presented in the operator's RoAs as a circle with a specified radius centred at the source of the potential accident.

Step B applies additional pragmatic, population (including vulnerable groups), geographic and practical factors to the ONR determination and requires dialogue with the relevant local authority. The nature of these factors is set out in detail in the relevant ONR TAG (reference 6). Whilst the determined REPPIR off-site emergency planning area, as a result of considering these additional factors, need not be circular, it cannot be smaller than that arising from the technical assessment under Step A.

ONR's principles relating to practical and strategic considerations (reference 6) emphasise that, in the undertaking of the determination, it is important to ensure that a sensible balance is achieved between the assessment of the technical report provided by the licensee and such additional practical and strategic considerations that, in ONR's opinion, are judged necessary in the interests of confidence in public safety. As a consequence, the extent of the REPPIR off-site emergency planning area represents a regulatory judgement of the significance of all of these factors, and is made on a case-by-case basis.

The factors that ONR's principles and associated guidance indicate should be considered are summarised as follows:

- local geographic, population and practical implementation factors;
- avoidance of bisection of local communities where sensible to do so;
- inclusion of immediately adjacent groups of vulnerable people;
- the need for the REPPIR off-site emergency planning area to provide for a credible emergency plan, for the purposes of public protection, in which the public will be confident;
- consideration of the implications of the extent of the REPPIR off-site emergency planning area in the context of an effective emergency response (e.g. dilution of resources (i.e. police, fire and ambulance) and potential dis-benefits associated with immediate/ urgent countermeasures);

- relevant international good practices; and
- other relevant site specific factors of which ONR are aware.

The starting point for the emergency planning areas is based on the most significant reasonably foreseeable event. Such an event could be caused, for example, by possible plant and equipment failures, breakdown of administrative arrangements, and potential unauthorised behaviour of employees or the public.

For events that are judged not to be reasonably foreseeable (e.g. extremely low frequency but potentially higher consequence events), the guidance associated with REPPIR recommends, as a good practice, that local authorities should be capable of extending their emergency response beyond the REPPIR off-site emergency planning area should it be necessary to do so. However, as such extended zones are not statutorily required under REPPIR, such arrangements are not considered further in this determination.

Although the local authority off-site emergency plans include many protection measures to reduce radiation doses to members of the public, the most commonly referenced off-site urgent countermeasures available in the early stages of a nuclear emergency are sheltering, evacuation and, in the case of operating nuclear power reactors, the administration of stable iodine tablets.

In determining a REPPIR off-site emergency planning area ONR acknowledges that the implementation of urgent countermeasures, for example rapid evacuation, can, in some circumstances, convey a risk of harm to individuals to whom they are applied. For example, see the report in the Lancet by Koichi Tanigawa et al. in relation to the urgent countermeasures taken following the Fukushima accident in Japan in March 2011 (reference 7). Within a REPPIR off-site emergency planning area, the local authority may expect some countermeasures to be applied immediately or urgently across at least a part of the area (normally that closest to the potential source of radiation). It is important that the area within which they are applied, in the event of an emergency, is targeted and proportionate in order to ensure that overall risks to those affected are reduced so far as is reasonably practicable.

4.2 BASIS OF ASSESSMENT

The REPPIR off-site emergency planning area must, as a minimum, include all of the area around the site within which a person (including members of the public) could receive an effective dose in excess of 5 mSv in the year following a reasonably foreseeable radiation emergency (or other dose criteria defined in REPPIR Schedule 1). When assessing the extent of exposure, REPPIR requires that operators assess the potential doses to members of the public from all exposure routes and, for this purpose, must disregard any health protection measures that may have been taken by the local authority, emergency services or the exposed persons themselves, during the first 24 hours immediately following the event.

The Hinkley Point A RoA (reference 3) provides a detailed description of the remaining plant containing radioactive substances on the site, (which exceed the levels specified in Schedule 2 of REPPIR). These include the following stored materials in the wet and dry waste vaults:

- Approximately 100 m³ of radioactive sludges
- Approximately 160 m³ of radioactive resins
- Approximately 750 m³ of fuel element debris (FED)

Additionally, the RoA indicates that radioactivity will also be present in certain structural materials associated with the R1 and R2 reactor buildings, including:

- Approximately 3600 m³ of graphite moderator (ILW)
- Approximately 9800 m³ of reactor internal materials (e.g. control rods, thermocouples, activated mild and stainless steel items; and

- Approximately 27000 m³ of concrete (bioshield)

Magnox Ltd. notes that the activity associated with the structural material is substantially fixed within the structures and would be unlikely to contribute significantly to any release to the environment, even in the case of a severe accident.

As a consequence of the residual inventory, some (although not necessarily all) provisions of REPPIR will continue to apply until such a time as the total inventory of radioactive material held on the Hinkley Point A site falls below the stringent levels specified in Schedule 2 and 3 of REPPIR.

4.3 STANDARDS AND CRITERIA

4.3.1 ACTS, REGULATIONS AND GUIDANCE

The relevant standards and criteria considered within this assessment are those contained within the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) (reference 2) and its associated guidance (reference 5). REPPIR is made under the Health and Safety at Work Act 1974 and implements the articles on intervention in cases of radiation emergencies contained in the European Council Directive 96/29/EURATOM - Basic Safety Standards for the Protection of the Health of Workers and Members of the Public against the Dangers from Ionising Radiation (reference 8).

4.3.2 SAFETY ASSESSMENT PRINCIPLES & LICENSE CONDITIONS

ONR's Safety Assessment Principles (SAPs) provide inspectors with a guiding framework for making consistent regulatory judgements on nuclear safety cases. Although the SAPs are not directly relevant to the assessment of REPPIR submissions, cognisance has been taken of SAP: AM.1 - Accident management and emergency preparedness (reference 9).

4.3.3 TECHNICAL ASSESSMENT GUIDES

The SAP principles are supported by a suite of internal Technical Assessment Guides (TAG), with the following TAG being relevant to this assessment:

- The technical assessment of REPPIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 2, 2013 (reference 6). This TAG incorporates ONR's revised principles for determination of REPPIR off-site emergency planning areas.

4.3.4 NATIONAL AND INTERNATIONAL STANDARDS AND GUIDANCE

The following national guidance has also been considered and, where appropriate, has informed this assessment:

- A guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (reference 5).

ONR also notes the relevance of the following International Standards and Guidance:

- IAEA Safety Standard Series – Preparedness and Response for a Nuclear or Radiological Emergency GS-R-2 (reference 10).
- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 (reference 11).

5 ASSESSMENT OF TECHNICAL SUBMISSIONS

ONR has subjected Magnox Ltd's RoA and HIRE (references 3 and 4) and supporting documentation to expert and detailed technical assessment. A summary of Magnox Ltd's

submissions and ONR's technical assessment of them (reference 12) are detailed in sections 5.1 and 5.2 respectively.

5.1 MAGNOX RoA/HIRE

After 35 years of electricity generation, the two nuclear power reactors (R1 and R2) at Hinkley Point A ceased production in 2000. The reactors and fuel ponds have since been completely defueled and all nuclear fuel elements removed from the site. The site was declared fuel free in 2010 and preparations for long term care and maintenance are currently being undertaken.

A consequence of the defueling of the site is that the radiological hazards and risk presented by the site have been very substantially reduced. The vast majority of the remaining radioactivity on site is contained in structures within the reactor buildings and in the fuel element debris (FED) wet and dry waste vaults associated with each reactor.

In accordance with REPPiR regulation 5, Magnox Ltd. have undertaken a review of their HIRE and identified and assessed all hazards on site with the potential to cause a radiation accident.

As part of the HIRE, Magnox Ltd. reviewed the extant site safety cases to identify faults which exceeded the likelihood of occurrence of 10^{-5} per year or greater, and a public dose consequence of 5 mSv or greater for further assessment. In order to allow for cliff-edge effects, faults meeting one or more of the criteria were considered, rather than those that only met both. Magnox Ltd. also considered faults that were within an order of magnitude of the frequency screening criteria.

The HIRE concludes that the fault sequences which could lead to an off-site radiological exposure arise from an aircraft crash involving the radioactive inventory in the reactor buildings or waste facilities (wet and dry vaults). For the consequence to be realised, it is assumed that a major impact into the facilities is required, followed by a significant fire. Only military combat aircraft and large commercial / military transports were considered a credible source of such a hazard. These sequences are described below.

5.1.1 AIRCRAFT CRASH AND FIRE AFFECTING A SINGLE REACTOR BUILDING.

The radioactivity is enclosed within the reactor buildings with the following items included in the dose assessment: graphite moderator, reactor internals (including control rods, thermocouples, activated mild and stainless steel items) and the concrete bioshield.

The assessment considers aircraft impacts into either of the R1 or R2 reactor buildings. Due to the physical separation (approximately 50 m) between the R1 and R2 buildings, Magnox Ltd. consider it not reasonably foreseeable that an aircraft crash would result significant concurrent damage to both reactor buildings.

Although the site was declared fuel-free in 2010, in the assessment of an aircraft crash into either of the reactor buildings, Magnox Ltd. has considered that a single fuel element (9.76 kg) remains within each reactor vessel and that the radioactivity within each has decayed for 5 years. This dose assessment was undertaken as part of the post defueling safety case in 2004. This dose assessment therefore includes a degree of conservatism in both the presence of the fuel element and its decay period.

Release fractions have been applied for burning waste and for the carbon and stainless steel components.

5.1.2 AIRCRAFT CRASH INTO THE RADIOACTIVE WASTE FACILITIES.

The dry Magnox debris storage vaults (one for R1 and one for R2), which are located next to each reactor building, are designed for the dry storage of FED resulting from the processing

of the fuel element casings⁵. The vaults reached capacity and were sealed in the early 1980s. The vaults are largely located above ground level and are of a concrete construction.

The wet Magnox debris storage vaults (one for R1 and one for R2) are designed for underwater storage of FED resulting from the processing of the fuel element casings. The vaults are open topped concrete tanks, with a mesh grill floor, which provides access above the vaults. Several metres of water provide radiation shielding to personnel on the mesh grill. Approximately 50% of each vault is below ground level. In addition to the primary concrete containment structure the vaults have a secondary concrete containment, where instrumentation is sited to detect leaks from the primary containment.

The aircraft impacts either the R1 or R2 wet and dry vaults. The duration and severity of the impact being such that damage to the wet vaults results in drain down of the water contents and the aircraft fuel fire is of sufficient duration to result in ignition of both wet and dry vault contents.

Magnox Ltd's assumption is that the whole facility is destroyed such that no building containment factor being applied in the subsequent dose assessment. Due to the severity of the impact and fire, all of the radionuclide inventory in the vaults has been considered to be affected by the resulting fire.

Due to the physical separation (approximately 100 m) between the R1 and R2 wet and dry vaults, Magnox Ltd. consider it not reasonably foreseeable that an aircraft crash would result in concurrent ignition of the waste contained within both of the R1 and R2 wet and dry vaults.

5.1.3 ASSESSED DOSES TO PERSONS OFF-SITE

The two faults considered by Magnox Ltd. to fall within their screening criteria were further assessed using the Nuclear Emergency Arrangements Forum (NEAF) methodology (reference 13). Estimates of the likely radiation doses to a member of the public in the event that any of the relevant fault sequences identified in their HIRE occur are summarised in Table 1 below.

Table 1 – Magnox Ltd. assessment of Hinkley Point A fault scenarios (reference 4)

Description of event	Public dose* at the site boundary (based on NEAF Methodology)**	Estimated fault scenario frequency
Aircraft crash and fire associated with a single reactor building (R1 or R2)	0.51 mSv (~75 m from the reactor)	1x10 ⁻⁶ per year
Aircraft crash into the radioactive waste facilities resulting in loss of containment and ignition of the vault contents	0.58 mSv (~75 m from the vault)	2x10 ⁻⁷ per year

* Public dose – whole body effective dose received in the 12 months following the event

** Off-site dose consequences for each of the fault scenarios have been assessed by Magnox Ltd. for comparison with the threshold defined in REPPiR schedule 1

5.1.4 CONCLUSIONS OF THE MAGNOX LTD HIRE AND RoA

Magnox Ltd. conclude that none of the faults described above could lead to a radiation emergency as defined by REPPiR. I.e. each fault scenario has likely public doses of less

⁵ Fuel Element Debris (FED) consists of the splitters or lugs removed from Magnox fuel elements before the spent fuel was sent to Sellafield for reprocessing.

than 5 mSv in the following 12 months. There are therefore no reasonably foreseeable events that could lead to significant potential off-site effective or equivalent doses from any fault sequence that exceed the thresholds in REPPiR Schedule 1 (reference 3 and 4).

The HIRE also discusses high consequence, low frequency events including, extreme weather, seismic events, flooding, and security breaches. These events are either assessed as being bounded by the aircraft crash faults sequences (as described above) or to be beyond those that are considered to be reasonably foreseeable.

5.2 ONR TECHNICAL ASSESSMENT OF THE MAGNOX RoA/HIRE

ONR's technical assessment of the Hinkley Point A RoA (reference 12) concurs with Magnox Ltd's view that the most significant reasonably foreseeable faults with an off-site public dose consequence are those associated with aircraft crashes into either of the reactor buildings or either of the waste facilities.

REPPiR and ONR guidance (references 5 and 6) specify that best-estimate analysis should be used by operators to calculate off-site dose consequences and that "evidence should be presented that unwarranted conservatism is not being used". Some conservatism may be used in the calculation of off-site dose figures, for example to simplify analysis, but unwarranted conservatism can give rise to a disproportionately extensive emergency plan. Therefore, careful consideration has been given as to whether analysis undertaken by Magnox Ltd. for the fault scenarios identified in Table 1 is appropriate to support the conclusions of the RoA/HIRE and that these faults are not likely to lead to a reasonably foreseeable radiation emergency as defined in REPPiR.

ONR considers that the fault that could generate the largest off-site public dose consequence, and should hence be used as the most significant reasonably foreseeable event, is the aircraft crash into the radioactive waste facilities causing a total loss of containment and subsequent fire in either the R1 or R2 wet and dry vault (reference 14). This event results in an estimated effective dose of 0.58 mSv (Table 1) for an adult at the site fence.

ONR considers this fault sequence to be at the lower frequency range of what could be considered reasonably foreseeable.

Magnox Ltd. used two dose methodologies to support its REPPiR submissions: A very conservative and pessimistic methodology (Inter-Utility Working Group (IUWG) method) (reference 14) to screen the significance of fault sequences, and a second and less conservative methodology to estimate doses that could be averted through the application of early countermeasures (NEAF method).

Noting the importance of the dose estimation in this determination, ONR observed that Magnox Ltd. had made some simplifying assumptions regarding the habits of the exposed individuals during and post the radiological release, and the impact of food restrictions on the dose calculations. ONR therefore sought further information to ensure that these did not undermine compliance with the requirements of REPPiR. Specifically, it is ONR's opinion that Magnox Ltd's application of the NEAF methodology did not take sufficient account of doses resulting from ingestion, direct radiation exposure from ground deposition of radionuclides, and public occupancy in reaching the calculated off-site dose. In response to this, Magnox Ltd. provided a sensitivity study (reference 15) on different occupancy models, added appropriate dose contributions from ingestion doses, and ensured the estimated dose from direct radiation exposure due to ground deposition of radionuclides is assessed over the 12 months period required by REPPiR.

ONR's assessment of these additional dose estimates undertaken by Magnox Ltd. has confirmed that they are suitable for comparison to REPPiR Schedule 1. Taking these additional exposure pathways into account (and having also undertaken a sensitivity analysis of the dose calculations), the maximum doses are still significantly less than the thresholds set out in REPPiR Schedule 1. For Hinkley Point A, the revised dose assessment for the

most significant reasonably foreseeable event, an aircraft crash into the radioactive waste facilities, taking in to account the additional ingestion and habitation factors, results in an estimated effective dose of 1.75 mSv in the year following.

The dose estimate is based on an adult member of the public spending the first 24 hours at the site fence, and then at a nominal critical habitation for the rest of the year, which ONR considers to be conservative.

In addition, ONR's technical assessment considered the potential for cliff-edge effects (i.e. circumstances where a small perturbation in the initial fault condition potentially leads to a very significant change in the fault dose consequences) and concluded that there are no apparent cliff-edge effects in the relevant fault sequences that could undermine the validity of the assessment due to the conservatism applied in the dose consequence assessment by Magnox Ltd.

ONR is therefore satisfied that a radiation emergency as defined in REPPiR is no longer reasonably foreseeable at the Hinkley Point A site as the doses associated with such emergencies are accepted as falling below the threshold for applicability of regulations 7, 9 and 16 of REPPiR (which relate to the, requirement for an operator's emergency plan, the determination of an off-site planning area by ONR, the preparation by the local authority of a corresponding off-site emergency plan, and the provision of prior information by the operator).

Consequently, there are no longer legal requirements under REPPiR relating to the Hinkley Point A site for:

- ONR to determine a local authority off-site emergency planning area;
- the local authority to prepare an off-site emergency plan;
- the operator to provide prior information under REPPiR; and
- for the operator to prepare a REPPiR operator's emergency plan.

As a result of the absence of the need for a local authority off-site emergency plan under REPPiR, Step B of ONR's determination process (relating to the application of other practical and strategic factors to a planning area) is not required.

6 OFF-SITE EMERGENCY ARRANGEMENTS

Although a radiation emergency is no longer reasonably foreseeable (and consequently that a local authority off-site emergency planning area and a prior information area are no longer required by REPPiR specifically for Hinkley Point A), the radioactive inventory of Hinkley Point A continues to exceed the specified quantities set out in REPPiR Schedule 2. Consequently, under REPPiR regulations 5(1) and 5(2), the licensee continues to be required to review and submit a HIRE periodically or following a material change in the work with ionising radiation. Whilst not anticipated, should such a re-submission suggest any material increase in the risk profile of the site, ONR will make a further re-determination to consider whether further measures under REPPiR to protect the public in the event of a reasonably foreseeable radiation emergency would be justified.

Notwithstanding that there is no longer a direct requirement under REPPiR for an operators plan, or for the provision of prior information by the operator in respect of the Magnox Ltd. Hinkley Point A site, the operator will continue to have relevant legal duties under other legislation that are not directly affected by this determination.

Specifically, due to the location of the EDF Hinkley Point B nuclear licensed site adjacent to the Hinkley Point A site, the local authority will still have a requirement under REPPiR for a local authority off-site emergency plan in respect of the Hinkley Point B licensed site.

Similarly, nuclear licensees have general duties to ensure, so far as is reasonably practicable, the safety and welfare of employees and other persons; to make and implement adequate arrangements for dealing with any accident or emergency (under standard licence

condition 11 attached to the nuclear site licence); and to prepare contingency plans under the Ionising Radiation Regulations 1999 as appropriate.

ONR, where relevant, will continue to deliver regulatory oversight of the other legal duties as they apply to Magnox Ltd.

7 CONCLUSIONS

This report describes ONR's assessment of the operator's RoA/HIRE for the Hinkley Point A nuclear licensed site and the consequential requirements (or otherwise) for REPPIR off-site emergency planning and prior information areas, which were previously prescribed as an area of radius 3.5 km centred on the reactor buildings of the Hinkley Point A nuclear licensed site.

The conclusions of this report are that:

- ONR is satisfied that the overall risk from the Hinkley Point A site has significantly reduced since it ceased generation and removed all fuel elements from the site, and that the technical submission made by Magnox Ltd. demonstrates that members of the public are not likely to be exposed to doses at or in excess of 5 mSv in the year following a reasonably foreseeable radiation emergency (or other relevant dose criteria in Schedule 1 of REPPIR);
- As a result of ONR's conclusion that a radiation emergency is no longer reasonably foreseeable, there is no longer a requirement under REPPIR regulations 7(1), 9(1) and 16(1) for an operator's emergency plan, the identification of off-site planning and prior information areas by ONR, the preparation of a local authority off-site emergency plan, or for the provision by the operator of prior information to the public in respect of the Hinkley Point A nuclear licensed site;
- The ONR assessment does not affect the status of the REPPIR off-site emergency planning area for the Hinkley Point B nuclear licensed site (which reflects the residual potential for a reasonably foreseeable radiation emergency from the Hinkley Point B site), which will remain at a radial distance of 3.5 km, until such time as ONR determines otherwise, and the requirement for a local authority off-site emergency plan for the Hinkley Point B nuclear licensed site; and
- The ONR assessment does not affect the status of the REPPIR prior information area for the Hinkley Point B nuclear licensed site (which reflects the residual potential for a reasonably foreseeable radiation emergency from the Hinkley Point B site), which will remain at a radial distance of 3.5 km, until such time as ONR determines otherwise.

8 RECOMMENDATIONS

As a result of the conclusions of this report, it is recommended that ONR write to:

- Recommendation 1: Somerset County Council and Magnox Ltd. to notify them that a REPPiR off-site emergency planning area is no longer required for the Hinkley Point A licensed site.
- Recommendation 2: Somerset County Council to notify them that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan in respect of the Hinkley Point A licensed site, although the requirement remains in respect of the Hinkley Point B licensed site.
- Recommendation 3: Magnox Ltd. to notify them that the requirement to ensure the appropriate provision of prior information to the public is no longer required under REPPiR. This should be copied to Somerset County Council.
- Recommendation 4: Magnox Ltd. to notify them that there is no longer a requirement under REPPiR for an operator's emergency plan.
- Recommendation 5: EDF Energy, who operate Hinkley Point B, to notify them that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan in respect of the Hinkley Point A licensed site, although the requirement remains for the Hinkley Point B licensed site.
- Recommendation 6: The Nuclear Decommissioning Authority, Food Standards Agency, the Maritime and Coastguard Agency and the Environment Agency of the outcome of this assessment and the removal of the REPPiR off-site planning and prior information areas for the Hinkley Point A licensed site although the requirement remains for the Hinkley Point B licensed site.

ONR will continue to seek assurance that, following the removal of the requirement for an operator's emergency plan and a local authority off-site emergency plan under REPPiR, the operator continues to make adequate provisions and maintains emergency arrangements for the Hinkley Point A nuclear licensed site. These include the residual emergency and contingency related legal requirements of the Health and Safety at Work Act, the Nuclear Installations Act and the Ionising Radiations Regulations 1999.

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