



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

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EXECUTIVE SUMMARY

Determination of the Requirement for Off-site Emergency Planning and Prior Information Areas for the Sizewell 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 an 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. Where ONR determines an off-site emergency planning area, the relevant local authority must prepare an emergency plan for the protection of persons in that area, and the operator must provide prior information. 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 requirement for an off-site emergency planning area and the area within which prior information is to be distributed to persons around the Sizewell A nuclear licensed site. It does not re-determine these areas with respect to Sizewell B nuclear licensed site and these remain unchanged.

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 Sizewell A site have concluded that a radiation emergency is reasonably foreseeable and have therefore specified, in consideration of both Sizewell A and B nuclear licensed sites, an off-site local authority emergency planning area and prior information area represented by the area defined by the map in appendix A, generally described as:

A land area informed by 6-figure postcodes located within a circular radius of approximately 2-3 km with an enhanced boundary to include the conjoined town of Leiston and the majority of the village of Aldringham, and an approximately rectangular seaward area that commences at the points where the land area

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'

reaches the coast and extends eastwards (approximately perpendicularly to the coast) 2 km out to sea.

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 Sizewell A site due to the defueled status of the reactors with all spent fuel removed from the site. The Magnox Ltd. RoA for Sizewell A concludes:

'...there are no reasonably foreseeable events associated with on-going operations at Sizewell A that could lead to a dose to the public of 5 mSv or greater in the year following the event.'

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 Sizewell A site.

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

The recommendations of this report are that ONR write to:

- Suffolk County Council and Magnox Ltd. to notify them that a REPPiR off-site emergency planning area is no longer required for the Sizewell A nuclear licenced site.
- Suffolk 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 Sizewell A nuclear licenced site, although the requirement remains in respect of the Sizewell B nuclear licenced 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 Suffolk 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 Sizewell 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 Sizewell A nuclear licenced site, although the requirement remains for the Sizewell B licenced 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 Sizewell A nuclear licenced site although the requirement remains for the Sizewell B nuclear licenced site.

Whilst this assessment removes the requirement for detailed emergency planning under REPPiR in relation to the Sizewell 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 e.g. the Civil Contingencies Act 2004 (CCA);
- Operators have general duties under the Health and Safety at Work etc. Act 1974 to ensure, so far as is reasonably practicable, the safety and welfare of employees and other persons;
- Operators have duties under REPPiR regulation 4(2) to take all reasonable steps to prevent accidents and to limit the consequences of accidents which occur; and
- Operators who hold a nuclear site licence are required to make and implement adequate arrangements for dealing with any accident or emergency (under

licence condition 11 attached to the site licence), and prepare contingency plans under the Ionising Radiations Regulations 1999.

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: REPPIR 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
HEPA	High-Efficiency Particulate Air
HIRE	Hazard Identification and Risk Evaluation
HVAC	Heating, Ventilation, and Air Conditioning
IAEA	The International Atomic Energy Agency
ILW	Intermediate Level Waste
IUWG	Inter-Utilities Working Group
LC	Licence Condition
LLW	Low Level Waste
NEAF	Nuclear Emergency Arrangements Forum
NDA	Nuclear Decommissioning Authority
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RoA	Report of Assessment
SAP	Safety Assessment Principle(s)
TAG	Technical Assessment Guide (ONR)

TABLE OF CONTENTS

1	REGULATORY CONTEXT	1
2	BACKGROUND	1
3	SCOPE	2
4	METHODOLOGY	3
5	ASSESSMENT OF TECHNICAL SUBMISSIONS	6
6	OFF-SITE EMERGENCY ARRANGEMENTS.....	9
7	CONCLUSIONS	10
8	RECOMMENDATIONS.....	11
9	REFERENCES	12

Tables

Table 1 – Candidate faults and potential off-site doses.....	7
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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 (REPPiR) [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 REPPiR as a reasonably foreseeable event where a person off the 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. 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 Sizewell A nuclear licensed site, in accordance with the requirements of REPPiR (reference 2) regulations 9(1) and 16(1) respectively. It does not re-determine these areas with respect to Sizewell B nuclear licensed site and these remain unchanged.

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 Sizewell 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.

³ 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), 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'

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 'REPPiR prior information area'.

In 2014 ONR determined the REPPiR off-site emergency planning area for the Sizewell site [reference 3], comprising the adjacent Sizewell A and Sizewell B sites, as the area shown in appendix A, generally described as:

A land area informed by 6-figure postcodes located within a circular radius of approximately 2-3 km with an enhanced boundary to include the conjoined town of Leiston and the majority of the village of Aldringham, and an approximately rectangular seaward area that commences at the points where the land area reaches the coast and extends eastwards (approximately perpendicularly to the coast) 2 km out to sea.

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 2015, Magnox Ltd submitted an updated RoA [reference 4] summarising the conclusions of its HIRE for the Sizewell A Site 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, in relation to the radiation hazards at the Sizewell A site, is now excessive on the basis that in their opinion

'...there are no reasonably foreseeable events associated with on-going operations at Sizewell A that could lead to a dose to the public off 5 mSv or greater in the year following the event.'

This report sets out the outcome and justification for the determination of the revised requirement for off-site emergency planning and prior information areas for the Sizewell 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 Sizewell 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 Sizewell A RoA [reference 4] provides a detailed description of the remaining plant containing radioactive substances on the site, (which exceed the levels specified in Schedule 2 of REPPiR). Historically, the majority of the radioactivity present on the site was contained in the irradiated fuel. However, following the cessation of power generation (in 2006) and completion of removal of fuel from the site (in late 2014), other radioactive material remains on

the site in the form of both Low Level Waste (LLW) and Intermediate Level Waste (ILW). The remaining potentially important inventories include:

- Solid and wet LLW (approximately 3500 m³)
- Solid and wet ILW (approximately 750 m³)

In addition, radioactivity will also be present by the activation of structural materials, including:

- Graphite moderator (approximately 3600 m³ ILW)
- Reactor vessel and internals (approximately 1000 m³ total LLW & ILW)
- Other structural materials (approximately 31500 m³ LLW)

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 Sizewell A site falls below the stringent levels specified in Schedules 2 and 3 of REPPiR.

4.3 STANDARDS AND CRITERIA

4.3.1 ACTS, REGULATIONS AND GUIDANCE

The relevant standards and criteria considered in this assessment are those contained in the Radiation (Emergency Preparedness and Public Information) Regulations 2001 [reference 2] and its associated guidance [reference 5]. REPPiR is made under the Health and Safety at Work Act etc. 1974 [reference 8] and implements the articles on intervention in cases of radiation emergencies contained in the European Council Directive 96/29/EURATOM – laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation [reference 9].

4.3.2 SAFETY ASSESSMENT PRINCIPLES AND LICENCE CONDITIONS

ONR's Safety Assessment Principles (SAPs) [reference 10] 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.

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 [reference 6]. This incorporates ONR's revised principles for the 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 11]
- IAEA Safety Standards-Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 [reference 12]

5 ASSESSMENT OF TECHNICAL SUBMISSIONS

ONR has subjected Magnox Ltd.'s RoA [reference 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 13] are detailed in sections 5.1 and 5.2 respectively.

5.1 MAGNOX LIMITED ROA

Power generation at Sizewell A ceased in 2006. Subsequent operational activities focused on removing irradiated fuel from the two reactors to the fuel cooling pond and from the pond to off-site reprocessing facilities. These operations have now been completed and the site was declared fuel free in December 2014. The site is now in the care and maintenance preparation phase, where the focus is on radioactive waste management and decommissioning activities, including the retrieval, processing and packaging of dry intermediate level waste and / or packaging of wet wastes such as resins and sludges.

A consequence of all fuel having left 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 building, Fuel Element Debris (FED) and wet and dry waste vaults.

In accordance with REPIR 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. The Magnox Ltd. assessment is based upon a review of the Post De-fuelling Safety Case (PDSC), which considers the site in an inactive state. It contains information about the Sizewell A site, the current and planned operations and their associated radiological hazards.

To identify candidate reasonably foreseeable faults which could lead to a radiation emergency, as defined by REPIR Magnox Ltd. has developed screening criteria based upon the calculated frequency and potential consequences of fault sequences. The criteria include identifying the potential for "cliff-edge" effects, where faults not usually considered reasonably foreseeable could lead to significant radiological consequences.

The dose consequences in the PDSC have been calculated on an unmitigated conservative basis, using the Inter-Utilities Working Group (IUWG) methodology. Magnox Ltd. recalculated the likely doses to a member of the public on a best-estimate basis using the Nuclear Emergency Arrangements Forum (NEAF) methodology to estimate doses that could be averted through the application of early countermeasures.

The dose estimates are based on the exposed person remaining in the path of the plume to receive the maximum dose from all pathways throughout the first 24 hours following the fault. The person is then assumed to remain at the same location for a further 6 days during which only ground shine contributes to the accrued dose. For each fault, the dose value for an adult, child and infant were evaluated and the maximum used.

The pathways include:

- Inhalation of contaminated air;
- Exposure to external radiation emitted by the contaminated air; and
- Exposure to external radiation emitted by radioactive material that has settled on the ground.

Magnox Ltd. grouped variations of faults sharing a common radioactive source term, resulting in eight fault groups. The best-estimate consequences calculated for each group are shown in Table 1.

Table 1 – Candidate faults and potential off-site doses

Fault Group	Description	Initiating Event Frequency (per year)	Public Dose* (mSv) at 75 m (based on NEAF methodology)**
A	Failure of tanks and vessels in the effluent treatment plant & pond following a seismic event leading to a total loss of containment resulting on radioactive materials being spread off-site.	1E-4	5E-4
B	Fire involving a HEPA filter in the effluent treatment or reactor buildings' HVAC systems that leads to radioactive materials in the filter being spread off-site.	2E-3	4.4E-3
C	Catastrophic failure of the hydrogen-cation-exchange unit vessel leading to a total loss of the active resin and pond water to the sand pressure filter room and effluent treatment building resulting on radioactive materials being released off-site.	1E-4	2.1E-7
D	Operator error or equipment failure leading to the injection of sulphuric acid in to the pond water treatment plant pipework causing enhanced corrosion of the Magnox cladding of one irradiated fuel element resulting in radioactive materials being spread off-site.	1E-4	2.7E-4
E	Fire in unlined drum of ILW, resulting on radioactive materials potentially being spread off-site.	1E-2	7.5E-8
F	Fire in ISO container containing ILW, resulting on radioactive materials being spread off-site.	1E-3	7.5E-10
G	Fire in waste storage processing facility, resulting on radioactive materials being spread off-site.	3E-2	7.5E-8
H	Failure of reactor or primary circuit containment leading to a release of contaminated air off-site.	1.3E-2	3.7E-7

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

** Off-site dose consequence for each of the fault groups have been assessed by Magnox Ltd. for comparison with the whole body dose threshold defined in REPPiR Schedule 1 as 5 mSv.

Following removal of all nuclear fuel from Sizewell A, the site's bounding fault is no longer "Exposure of irradiated fuel in the pond through complete loss of water" (as identified in the Magnox Ltd. 2013 RoA), but "Fire in HEPA filter".

The bounding fault is assumed to be a fire that affects either a HEPA filter in the effluent treatment building HVAC system or the reactor building HVAC system. The assessment considers that the radioactive inventory of a used HEPA filter can be as high as 82.7 MBq, noting this value is greater than that considered to be associated with filters recently removed on site. The radioactive composition of the filters has been taken to represent contamination filtered from the air drawn from the active effluent treatment building and is predominately the radionuclide caesium-137.

Filter elements have been assumed to be light weight and combustible such that in the event of a fire the whole radioactive inventory on the filter might be released. The assessment assumes that the activity would be released to the environment via the normal discharge route for filtered air, with the effective release point to atmosphere located at high level.

The RoA 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 HEPA filter fire faults (as described above) or to be beyond those that are considered to be reasonably foreseeable. The RoA concludes that:

“there are no reasonably foreseeable events associated with on-going operations at Sizewell A that could lead to a dose to the public of 5 mSv or greater in the year following the event.”

5.2 ONR TECHNICAL ASSESSMENT OF THE MAGNOX LIMITED ROA

ONR undertook a detailed technical assessment [reference 13] of the Sizewell A RoA, during the course of which ONR sought clarification of the information provided and further information regarding some elements of how doses to the public were estimated. ONR's assessment focused on the adequacy of the Sizewell A submission and the technical basis for any emergency planning area.

In its assessment of the previous HIRE for the Sizewell A site in 2013 [reference 14] ONR accepted that only a total loss of the fuel storage pond water could lead to off-site doses in excess of 5 mSv. Since the fuel has now been removed from the site and there has been no other significant change in the radiological inventory, ONR accepts that this fault is no longer possible.

ONR is satisfied that Magnox Ltd. has performed an appropriate review of the safety case to identify potential faults and that the screening criteria applied to identify potential faults from the safety case are appropriate to meet the requirements of REPPiR.

To demonstrate that they had considered additional faults with off-site consequences Magnox Ltd. provided an estimate [reference 15] of the frequency of an aircraft crash onto safety significant structures and of the potential for FED fire faults. ONR is satisfied that these faults are not considered to be reasonably foreseeable. This conclusion was also supported by ONR in its previous assessment.

Reference 4 provides the initiating frequencies assigned to the fault groups and an overview of the assessment of the consequences of each. ONR asked for clarification to gain confidence of Magnox Ltd.'s modelling of faults and received additional information [references 15 and 16] to support the assessment. The dose estimates are orders of magnitude below the thresholds in REPPiR and so even if key factors in the fault models were changed, the likely doses would remain below these thresholds.

Information provided by Magnox Ltd. indicates that some of the potential release points are closer to the site boundary than 75 m. The distance of 75 m approximates the shortest distance at which the NEAF atmospheric dispersion methodology applies. ONR challenged Magnox Ltd. to provide assurance that this would not affect the conclusions of their assessment. Magnox Ltd. responded to this concern [reference 17] and demonstrated how the dose calculated at 75 m has been scaled to a distance of 30 m to the site boundary. Given the low off-site doses that are predicted (the highest being 0.0044 mSv for Fault Group B in Table 1), ONR is content that none of the identified faults would meet the criteria of a radiation emergency of 5 mSv.

The initiating event frequencies of all of the identified groups of faults identified by Magnox Ltd. in Table 1 may be considered to be reasonably foreseeable. The calculated doses are, at worst, approximately three orders of magnitude lower than the REPPiR 5 mSv threshold. ONR acknowledges the significant reduction of the hazard and risk arising from the site resulting from de-fuelling activities and the site being declared fuel free. As a consequence, the fault groupings and estimated consequences identified by Magnox Ltd. are consistent with ONR's expectations.

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. It concluded that there are no apparent cliff-edge effects in the relevant fault sequences that could undermine the validity of Magnox Ltd.'s assessment.

ONR's technical assessment of the Sizewell A RoA concurs with Magnox Ltd.'s view that the most significant reasonably foreseeable faults with off-site public dose consequence are those associated with a fire in a HEPA filter leading to a radiological release. REPPiR and ONR guidance [references 5 and 6] specify that the best-estimate analysis should be used by operators to calculate off-site 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 groups identified in Table 1 is appropriate to support the conclusions of the RoA 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 a fire in a HEPA filter leading to a radiological release. This results in an estimated effective dose significantly less than 5 mSv for a member of the public at the site fence.

ONR is therefore satisfied that a radiation emergency as defined in REPPiR is no longer reasonably foreseeable at the Sizewell A site as the doses associated with such emergencies are accepted as falling significantly 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 Sizewell 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 a reasonably foreseeable radiation emergency, the application of Step B of ONR's determination process (relating to the consideration of other practical and strategic factors to identify an off-site planning area) is not required.

6 OFF-SITE EMERGENCY ARRANGEMENTS

Although a radiation emergency is no longer reasonably foreseeable (and consequently a local authority off-site emergency planning area and a prior information area are no longer required by REPPiR specifically for Sizewell A), the radioactive inventory of Sizewell 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 its HIRE and submit a RoA 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. Sizewell 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 Sizewell B nuclear licensed site adjacent to the Sizewell A site, the local authority will still have a requirement under REPPiR for a local authority off-site emergency plan in respect of the Sizewell 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 for the Sizewell A nuclear licenced site and the consequential requirements (or otherwise) for REPPiR off-site emergency planning and prior information areas, which were prescribed previously as the area shown in appendix A.

The conclusion of this report is that:

- ONR is satisfied that the overall risk from the Sizewell 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 Sizewell A nuclear licenced site;
- The ONR assessment does not affect the status of the REPPiR off-site emergency planning area for the Sizewell B nuclear licenced site (which reflects the residual potential for a reasonably foreseeable radiation emergency from the Sizewell B site), which will remain as the area shown in appendix A, until such time as ONR determines otherwise, and the requirement for a local authority off-site emergency plan for the Sizewell B nuclear licenced site;
- The ONR assessment does not affect the status of the REPPiR prior information area for the Sizewell B nuclear licensed site (which reflects the residual potential for a reasonably foreseeable radiation emergency from the Sizewell B site), which will remain as the area shown in appendix A, 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 Suffolk County Council and Magnox Ltd. to notify them that a REPPiR off-site emergency planning area is no longer required for the Sizewell A nuclear licenced site.
- Recommendation 2 Suffolk 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 Sizewell A nuclear licensed site, although the requirement remains in respect of the Sizewell B nuclear licenced 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 Suffolk 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 Sizewell 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 Sizewell A nuclear licenced site, although the requirement remains for the Sizewell B licenced 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 Sizewell A nuclear licenced site although the requirement remains for the Sizewell B nuclear licenced 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 Sizewell A nuclear licenced site. These include the residual emergency and contingency related legal requirements of the Health and Safety at Work Act etc., the Nuclear Installations Act and the Ionising Radiations Regulations 1999.

9 REFERENCES

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17. Email: Sizewell A HIRE – Magnox judgement on faults less than 75 m from site fence, November 2015. TRIM 2015/447274.

APPENDIX A

ONR determination of the REPIR off-site emergency planning area and the REPIR prior information area around the combined Sizewell A and B nuclear licensed sites.*

The area defined by this map may be generally described as:

A land area informed by 6-figure postcodes located within a circular radius of approximately 2-3 km with an enhanced boundary to include the conjoined town of Leiston and the majority of the village of Aldringham, and an approximately rectangular seaward area that commences at the points where the land area reaches the coast and extends eastwards (approximately perpendicularly to the coast) 2 km out to sea.

Definitive Sizewell REPIR Off-site Emergency Planning Area:



Scale: 1:50,000

* This area was defined for the Sizewell A and B nuclear licenced sites in April 2014 and remains unchanged as a result of the conclusion of this report that Sizewell A no longer requires such an area.