



Determination of the requirement for Off-site Emergency Planning and Public Information Areas for the Trawsfynydd 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 Public Information Areas for the Trawsfynydd 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 Trawsfynydd nuclear licensed site.

In relation to this area, the responsible local authority, in this case Gwynedd Council (GC), 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 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 Trawsfynydd 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 1.3 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 Trawsfynydd site due to the defueled status of the reactors with all spent fuel removed from the site. The Magnox Ltd RoA/HIRE for Trawsfynydd 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 in the current safety case nor any envisaged in the safety cases associated with preparations for Care and Maintenance or Care and Maintenance itself, (where any remaining ILW [Intermediate Level Waste] will be passively stored) which could lead to a radiation emergency as defined by REPPiR (off-site dose exceeding 5 mSv).'

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 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:

- Gwynedd Council and Magnox Ltd to notify them that a REPPiR off-site emergency planning area is no longer required for the Trawsfynydd licensed site;
- Gwynedd Council to notify them that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan;
- Magnox Ltd to notify it that the requirement to ensure the appropriate provision of prior information to the public is no longer required under REPPiR. This notification should be copied to Gwynedd Council;
- Magnox Ltd to notify it that there is no longer a requirement under REPPiR for an operator's emergency plan; and
- The Nuclear Decommissioning Authority, the National Assembly for Wales, Natural Resources Wales and the Food Standards Agency notifying them of the outcome of this assessment and the removal of the REPPiR off-site planning and prior information areas for the Trawsfynydd licensed site.

Whilst this review removes the requirement for detailed emergency planning under REPPiR, proportionate emergency arrangements for the protection of the public remain in the form of;

- i. bodies such as local authorities have duties to make adequate emergency arrangements under other legislation such as the Civil Contingencies Act 2004;
- ii. 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
- iii. 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 USED

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
FSA	Food Standards Agency
HIRE	Hazard Identification and Risk Evaluation
HSE	The Health and Safety Executive
GB	Great Britain
GC	Gwynedd Council
IAEA	The International Atomic Energy Agency
NEAF	Nuclear Emergency Arrangements Forum
ILW	Intermediate Level Waste
NDA	Nuclear Decommissioning Authority
NRW	Natural Resources Wales
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RoA	Report of Assessment
SAPs	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 (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 doses 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 Trawsfynydd nuclear licensed site, in accordance with the requirements of REPPIR (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 Trawsfynydd Nuclear Licensed site on behalf of the Nuclear Decommissioning Authority (NDA), a non-departmental public body in the UK which is responsible for the managing the effective and efficient clean-up of the UK nuclear legacy.

Trawsfynydd was the first inland civil Magnox nuclear station and drew its cooling water from Llyn Trawsfynydd. It was in service between 1965 and 1991, by which time it had generated

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), 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'.

⁴This 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'.

69 TWh of electricity. The site was declared non-operational in July 1993 and the reactors have been defueled since 1995 with all spent fuel now removed from site. Decommissioning has been on-going since 1995 with the aim of moving into long term care and maintenance in 2016. Magnox Ltd refer to care and maintenance as sites, and any structures that remain, being kept in a passively safe and secure state for a great number of years in order to allow for radiation levels to naturally decay over time.

In relation to emergency planning, REPPIR requires operators, in this case Magnox Ltd, to undertake a Hazard Identification and Risk Evaluation (HIRE) of hazards arising from their work with the potential to cause a radiation accident on their site. These HIREs 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 their HIRE to the ONR prior to commencement of the work, following any material change, and at least every three years, whichever is the shorter.

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, may include urgent countermeasures in order to reduce radiation doses to members of the public, such as sheltering, evacuation, administering stable iodine tablets (in the case of operating nuclear reactors), and other protection measures that are relevant, reasonably practicable, and proportionate to the radiological risk.

The current off-site emergency planning area was determined in 1995, at the outset of decommissioning at Trawsfynydd to be a circle of radius 1.3 km centred on the mid-point between the two reactors. This was retained when REPPIR came into force in 2001.

This report sets out the main considerations that ONR has given in undertaking its independent assessment of the Magnox RoA for the Trawsfynydd nuclear licensed site. It takes due account of the findings of the Magnox Ltd RoA/HIRE and of ONR's principles and guidance.

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 Trawsfynydd nuclear licensed site. It has been undertaken in accordance with the guidance on REPPIR (reference 3) and the supporting relevant ONR supporting Technical Assessment Guide (TAG) (reference 4) 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, 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 outwith 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 4). 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 4) 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 (referred to in reference 4 as the 'reference accident', and described in guidance as an event which is less than likely but realistically possible). Such an accident 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 5). 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.

Though REPPIR came into force in 2001, the current off-site emergency planning area was determined in 1995, at the outset of decommissioning at Trawsfynydd, to be a circle of

radius 1.3 km centred on the mid-point between the two reactors. The reference accident which dictated the extent of the emergency planning area at Trawsfynydd during electricity generation was a rupture of a bottom gas duct together with a single channel fire. This fault can no longer occur since both reactors were permanently shut down in 1991 and have been defueled since 1995 with all spent fuel removed from site. However, the emergency planning area was retained in light of the potential hazards that existed during the succeeding phases of the site's lifecycle.

The site is currently in the Care and Maintenance Preparations phase where activities are undertaken to progressively reduce the remaining hazards before entry into Care and Maintenance.

Magnox Ltd has submitted its hazard identification and risk evaluation (HIRE) and report of assessment (RoA) (reference 6), which form the basis of 'Step A' (see section 4.1) of the assessment and determination described in this report. It provides a detailed description of the remaining plant containing radioactive substances. The residual inventories of the Trawsfynydd site (which still exceed the levels specified in Schedule 2 of REPPiR) include the following stored materials:

- Approximately 90 m³ of sludges;
- Approximately 1,400 m³ of resins; and
- Approximately 400 m³ of Fuel Element Debris (FED).

In addition, the RoA/HIRE indicates that the remainder of the radioactivity inventory is mainly associated with the following activated and or structural materials, including, including:

- Approximately 3,400 m³ of graphite moderator - Intermediate Level Waste, (ILW);
- Approximately 5,900 m³ of reactor internals including control rods, thermocouples and activated stainless steel items; and
- Approximately 35,000 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 reasonably foreseeable accident.

As a consequence of the residual inventory, some (although not necessarily all) provisions of REPPiR continue to apply until such a time as the total inventory of radioactive material held on the Trawsfynydd site falls below the stringent levels specified in Schedule 2 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 3). 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 7).

4.3.2 SAFETY ASSESSMENT PRINCIPLES & LICENCE 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 REPIIR submissions, cognisance has been taken of SAP: AM.1 - Accident management and emergency preparedness (reference 8).

4.3.3 TECHNICAL ASSESSMENT GUIDES

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

- The technical assessment of REPIIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 2, 2013 (reference 4). This TAG incorporates ONR's principles for determination of REPIIR 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 3).

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 9).
- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 (reference 10).

5 ASSESSMENT OF TECHNICAL SUBMISSIONS

In accordance with regulation 6 of REPIIR, Magnox Ltd has submitted a combined RoA/HIRE to ONR (reference 6). An overview is provided in section 5.1 below. ONR has subjected this submission and the supporting documentation to expert and detailed technical assessment. The key findings of ONR's assessment (reference 11) are summarised in section 5.2 below.

5.1 MAGNOX ROA/HIRE

The operator describes that the reference accident for off-site emergency planning, assessed at a time when the site was generating electricity, involved a rupture of a bottom gas duct, together with a single channel fire. This same fault provided the hot-gas release, reactor damage and widespread collateral damage. This reference accident is no longer possible as the reactors are shut down, all fuel has been removed from site, and preparations for Care and Maintenance phase of the site lifecycle are being made. Hence the radiological hazard and risk has substantially reduced since the off-site planning reference accident described above was determined.

In order to identify and consider all current event and fault scenarios that are capable of causing a radiation accident, Magnox Ltd has undertaken a review (reference 12) of the current Trawsfynydd post defueling safety case. Those fault scenarios identified have been assessed using best estimate data and the public consequences have been assessed using the Nuclear Emergency Arrangements Forum (NEAF) methodology (reference 13).

The RoA/HIRE (reference 6) describes the three most significant fault scenarios that form the basis of the assessment. These faults are described below and their consequences are detailed in Table 1.

- Fault Scenario A: *Fire in the North Fuel Element Debris (FED) Vault*. The FED comprises pieces of cladding stripped from the spent fuel elements before they were dispatched to Sellafield for reprocessing. There are two FED vaults at Trawsfynydd – North and South. Each vault is below ground and has 16 cells (constructed of reinforced concrete) within it. Cell 1 of the North vault provides the bounding FED fault scenario as it has the largest inventory. The fault is considered to occur on the introduction of a flammable substance, during a vault intrusion, which then comes into contact with a local source of ignition. The resulting fire results in elevated levels of airborne contamination.
- Fault Scenario B: *Large aircraft crash affecting the Intermediate Level Waste (ILW) store*. This considers an air force tanker or large airliner impacting on the ILW store. The consequences are based on a breach in the roof shielding slab with fuel draining into the storage bays and accumulating around stacks of containers of encapsulated waste. A fire is then assumed to occur which results in elevated levels of airborne contamination.
- Fault Scenario C: *Fire at Mixing Station at the Resin Solidification Plant*. This considers a fire occurring at the Resin Solidification Plant mixing station that consumes the entire volume of resin within the resin hopper leading to all the contained volatile species being dispersed into the atmosphere and an elevated level of airborne contamination.

Table 1 - Magnox Ltd assessment of Trawsfynydd fault scenarios

Fault scenario	Description of event	Public dose* at site boundary (based on NEAF Methodology)** (mSv)	Fault scenario frequency (per year)
A	Fire within the North Fuel Element Debris (FED) Vault	0.9 mSv (~75 m from the vault)	1 x10 ⁻⁵ per year
B	Large aircraft crash into the Intermediate Level Waste (ILW) store	1.8 mSv (~35 m from the store)	less than 1.2 x10 ⁻⁶ per year
C	Fire at Mixing Station at the Resin Solidification Plant	0.02 mSv (~35 m from the store)	“Reasonably foreseeable” (no estimate of frequency)

* 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 REPIR Schedule 1

Magnox Ltd concludes that none of the faults in Table 1 could lead to a radiation emergency as defined by REPIR, i.e. each fault scenario has likely public doses of less than 5 mSv in the following 12 months. There are therefore no reasonably foreseeable events that could lead to significant potential off-site equivalent doses from any fault sequence that exceed the thresholds in REPIR schedule 1.

5.2 ONR TECHNICAL ASSESSMENT OF THE MAGNOX HIRE/ROA

ONR undertook a detailed technical assessment (reference 11) of the RoA/HIRE, during the course of which ONR sought clarification on aspects of the information provided and further information regarding some elements of the assessed dose consequences.

Magnox Ltd has presented three fault scenarios (Table 1) within the RoA/HIRE that it has identified as the most significant reasonably foreseeable events with an off-site public dose consequence. ONR's specialist technical inspector is satisfied that these fault scenarios represent the most significant of those that could be considered to be both reasonably foreseeable and have the potential to lead to an off-site dose consequence of all those that could occur at Trawsfynydd.

ONR's specialist technical inspector has conducted a detailed review of these scenarios to establish whether appropriate calculation methods and supporting data have been used. This is to assess whether there is likelihood that these fault scenarios could exceed the REPPiR threshold that requires an off-site emergency planning and prior information area.

REPPiR and ONR guidance (references 3 and 8) specifies 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.

Fault scenario A considers a fire within cell 1 of the North Fuel Element Debris (FED) vault. In the RoA/ HIRE Magnox Ltd assess that this would lead to a maximum off-site dose of 0.9 mSv. ONR's specialist technical inspector has considered the method and assumptions that Magnox Ltd has used in reaching this figure. 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 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 (reference 14 and 15). Its analysis for fault scenario A demonstrates that when the additional dose factors are considered there is the potential for a maximum off-site dose of up to 2.24 mSv. ONR considers that this additional analysis provided by Magnox Ltd has been carried out using appropriate method and assumptions. Therefore ONR is satisfied that it is not likely that fault scenario A would lead to a reasonably foreseeable radiation emergency as defined in REPPiR.

Although fault A is a fire only in Cell 1, the Magnox Ltd assessment concludes that a fire involving all cells in the vault (not considered reasonably foreseeable due to its robust concrete and steel construction) is still likely to result in off-site doses less than 5 mSv. Cell 1 contains the majority of the FED inventory and scaling of the off-site dose to include the entire inventory, still results in less than 5 mSv. ONR is satisfied with this conclusion.

In addition, it is noted that Magnox Ltd intend that all the FED stored in the vaults will be retrieved and encapsulated in preparation for the site entering Care and Maintenance.

Fault scenario B considers a large aircraft crash affecting the Intermediate Level Waste (ILW) store. The maximum off-site dose reported in the RoA/HIRE is 1.8 mSv. As described in relation to fault scenario A, this has subsequently been revised to 4.33 mSv. This remains

below the REPPiR threshold for a radiation emergency. ONR's specialist technical inspector identified that the assumptions Magnox Ltd made in respect to the dose calculation could be improved. However it is considered that further assessment of this fault is not required as Magnox Ltd have provided sufficient argument (as described in the paragraph below) to satisfy the claim that this fault scenario is not reasonably foreseeable.

The aircraft crash frequency used as the basis of fault scenario B is the estimated frequency of all types/sizes of aircraft collisions into the footprint of the Reactor Safestores (the two old reactor buildings) and is 1.2×10^{-6} per year. The ILW has a smaller footprint than, and is located to one side of, the Reactor Safestores. Magnox Ltd have provided a number of arguments (ILW store has a smaller footprint, is flanked by the Reactor Safestores and could withstand small aircraft impact) as to why the frequency of a large aircraft collision with the ILW (specific to fault scenario B) store would be lower than 1.2×10^{-6} per year and, therefore, should not be considered as reasonably foreseeable. They estimate that the fault frequency is likely to be at least one order of magnitude lower than 1×10^{-6} per year i.e. equal to or less than 1×10^{-7} per year. ONR's specialist technical inspector has considered the appropriate ONR guidance (reference 4) which cautions against using a strict numerical argument to judge what might be considered as reasonably foreseeable as it implies unwarranted precision within best-estimate risk assessments, which are inherently imprecise. Therefore, in order to come to a view as to whether this fault should be considered as reasonably foreseeable, those factors highlighted in Magnox Ltd supporting documentation, but have not been included in the numerical estimate, have been taken into account. In this case, ONR's specialist technical inspector is content to accept the arguments put forward by Magnox Ltd and concurs that this fault should not be considered as reasonably foreseeable.

Fault scenario C considers a fire at the mixing station in the Resin Solidification Plant. The Magnox Ltd assessment of this presents a dose of 0.02 mSv to an adult located at the site fence. Since this dose is significantly below the REPPiR threshold of 5 mSv Magnox Ltd have not carried out a detailed assessment of the frequency of this event. ONR's specialist technical inspector has sought and received confirmation from Magnox Ltd of the conservative assumptions made in reaching the assessed off-site dose, as a result an in-depth assessment was as not required. Consequently ONR's specialist technical inspector is content that this fault does not represent a potential radiation emergency, as defined by REPPiR.

For each of the above fault scenarios Magnox have provided an effective dose for comparison with the 5 mSv effective dose threshold prescribed in REPPiR schedule 1. As has been shown, all of these faults results in an effective dose of less than 5 mSv in the year following the event when all appropriate exposure pathways have been considered. REPPiR schedule 1 also prescribes specific limits for dose to the lens of the eye and to skin. Magnox Ltd have provided information (reference 14) that shows that dose received in respect of these specific limits of REPPiR schedule 1 will not be exceeded. Therefore ONR is satisfied that there is no reasonably foreseeable event that could lead to an off-site dose that exceeds the equivalent dose thresholds of schedule 1 in REPPiR.

Within the technical assessment report (reference 11), ONR's specialist technical inspector states that:

"Based upon the information presented in the HIRE and supporting references, I am satisfied that Magnox have undertaken an appropriate review of the safety case to identify potential faults for off-site emergency planning, but that none of these faults could lead to a reasonably foreseeable radiation emergency, as defined by REPPiR."

"I am content to support the conclusion made by Magnox in Ref. 1 (the Magnox Ltd HIRE/RoA (reference 6)) that it is not reasonably foreseeable that any fault at Trawsfynydd could lead to a radiation emergency. Therefore there is no requirement for an off-site emergency planning area."

6 OFF-SITE EMERGENCY ARRANGEMENTS

Local authority off-site emergency planning and prior information areas are no longer required as a radiation emergency is no longer reasonably foreseeable. However, the remaining radioactive inventory of Trawsfynydd is such that under REPPIR regulations 5(1) and 5(2), the licensee continues to be required to review their HIRE and submit a RoA following a material change in the work with ionising radiation or every three years, whichever is shorter. Whilst not anticipated, should such a re-submission suggest any material increase in the risk profile of the site, ONR will make a further redetermination to consider whether further measures under REPPIR to protect the public in the event of a reasonably foreseeable radiation emergency would be justified.

Whilst there is no longer a direct requirement under REPPIR for a local authority off-site plan, an operators plan, or for the provision of prior information by the operator in respect of the Magnox Ltd Trawsfynydd site, both local authority and operator continue to have relevant legal duties under other legislation that are not directly affected by this determination.

Specifically, bodies such as local authorities have residual duties relating to emergency arrangements under other legislation such as the Civil Contingencies Act (reference 16).

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 (reference 17) as appropriate.

Whilst ONR is not an enforcing authority for the Civil Contingencies Act, 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 (reference 6) for Trawsfynydd 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 1.3 km around the Trawsfynydd nuclear licensed site.

The conclusion of this assessment is that:

- Following a review of the RoA/HIRE and additional information supplied by Magnox Ltd, ONR is satisfied that their assessment of hazards at Trawsfynydd is based on reasonable assumptions and that appropriate methods have been used in the calculation of potential off-site doses.
- ONR is satisfied that the technical submissions made by Magnox Ltd demonstrate that members of the public are not likely to be exposed to doses in excess of the values of REPPiR Schedule 1. In consequence, a radiation emergency (as defined in REPPiR) is no longer judged to be reasonably foreseeable for the Trawsfynydd site.
- The requirements under REPPiR regulation 9, that ONR determines an off-site emergency planning area for the purposes of public protection, no longer apply.
- There is no longer a requirement under REPPiR regulation 9 for the local authority to produce, maintain and test an off-site emergency plan.
- There is no longer a requirement under REPPiR regulation 16 for the provision of public information by the operator.
- ONR notes that both the local authority and operator have obligations under other legislation relevant to emergency and contingency planning with which they must continue to comply.

8 RECOMMENDATIONS

As a result of the conclusions of this report, the recommendations are as follows:

- Recommendation 1: ONR write to Gwynedd Council and Magnox Ltd to notify them that a REPPiR off-site emergency planning area is no longer required for the Trawsfynydd licensed site.
- Recommendation 2: ONR write to Gwynedd Council to notify it that there is no longer a requirement under REPPiR for the local authority to prepare an off-site emergency plan.
- Recommendation 3: ONR write to Magnox Ltd to notify it that the requirement to ensure the appropriate provision of prior information to the public is no longer required under REPPiR. This notification should be copied to Gwynedd Council.
- Recommendation 4: ONR write to Magnox Ltd to notify it that there is no longer a requirement under REPPiR for an operator's emergency plan.
- Recommendation 5: ONR write to the Nuclear Decommissioning Authority, the National Assembly for Wales, Natural Resources Wales and the Food Standards Agency notifying them of the outcome of this assessment and the removal of the REPPiR off-site planning and prior information areas for the Trawsfynydd 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 proportionate emergency arrangements for the Trawsfynydd 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.

9 REFERENCES

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- 2 Radiation (Emergency Preparedness and Public Information) Regulations 2001
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- 4 The technical assessment of REPPiR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 2 2013. www.onr.org.uk/depz-onr-principles
- 5 Koichi Tanigawa et al. Loss of life after evacuation: lessons learned from the Fukushima accident: Lancet: Volume 379 Issue 9819 889-891, 10 March 2012.
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- 6 Magnox Ltd: M/EF/TRA/REP/0003/13 Issue 2, dated September 2013, Trawsfynydd Site: REPPiR Regulation 6(4) Hazard Identification and Risk Evaluation Assessment Report
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- 12 Magnox Ltd: M/EF/TRA/REP/0002/13 Issue 1, dated June 2013. Trawsfynydd Site: Review of Safety Case Fault Schedules in Support of the REPPiR HIRE Report of Assessment
- 13 Nuclear Emergency Arrangements Forum 1989 Paper I Revision 2, November 2005
- 14 Magnox Ltd Letter: MXL32212/R, dated 22 May 2014. Additional public dose estimates in support of Magnox Limited HIREs
- 15 Magnox Ltd Letter: 198/ONR/GR/05412, dated 16th December 2014. Additional public dose estimates in support of Trawsfynydd Site HIRE Report of Assessment
- 16 Civil Contingencies Act (2004): Chapter 36, 13 November 2004, Her Majesty's Stationary Office
- 17 Ionising Radiations Regulations 1999. Statutory Instrument 1999 No. 3232. The Stationery Office. ISBN 0 11 085614 7