



Office for  
Nuclear Regulation

**Determination of the Off-Site Emergency Planning and Prior  
Information Areas for the Loch Ewe Operational Berth**

**Radiation (Emergency Preparedness and Public Information)  
Regulations 2001**

Project Assessment Report ONR-COP-PAR-16-025  
Revision 0  
5<sup>th</sup> July 2017

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Published 07/17

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## EXECUTIVE SUMMARY

### **Determination of the Off-site Emergency Planning and Prior Information Areas for the Loch Ewe Operational Berth: Radiation (Emergency Preparedness and Public Information) Regulations 2001**

The Office for Nuclear Regulation (ONR) is responsible for regulating the GB nuclear industry in order to protect the health and safety of employees and the public against risks of harm arising from ionising radiations. ONR is the regulatory authority for Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPPIR) on nuclear licensed sites, Ministry of Defence (MOD) Authorised nuclear sites and nuclear warship sites.

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 REPPPIR), to determine an off-site emergency planning area (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 area within which prior information is to be distributed to the public. A radiation emergency is defined in REPPPIR as an event where a person off-site is likely to receive a radiation dose in excess of the thresholds in REPPPIR (typically an effective dose in excess of 5 milliSieverts (mSv)) in the 12 months following the radiation emergency. It therefore constitutes an important component of the UK's overall emergency response framework.

This Project Assessment Report describes and explains the basis for ONR's re-determination, in accordance with REPPPIR, of the off-site emergency planning area and the area within which prior information is to be distributed around the Loch Ewe Operational Berth.

In relation to the off-site emergency planning area, the responsible local authority, in this case The Highland Council, is required to prepare an off-site emergency plan with the purpose of minimising, so far as is reasonably practicable, radiation exposures to those likely to be affected by a reasonably foreseeable radiation 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.

REPPPIR requires operators who carry out work involving quantities of radioactive materials at or beyond those specified by REPPPIR, in this case the MOD, to undertake a Hazard Identification and Risk Evaluation (HIRE) in relation to their work with ionising radiations. The HIRE must identify all hazards 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. REPPPIR also requires that operators must assess their HIRE and send 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. MOD HIREs and RoAs relate to the radiological hazard presented by a berthed nuclear powered submarine at the relevant berth.

The off-site local authority emergency planning and prior information areas around the Loch Ewe Operational Berth, as provided for in REPPPIR regulations 9(1) and 16(1), were first determined in 2002 - a short while after REPPPIR came into force in 2001. In 2002 the area was determined by ONR as being a circular area radius 2 km from the submarine. In 2008 ONR re-determined the area as a circular area with a radius of 1.5 km.

Although, the risk from the naval reactor plant has not increased, in order to provide further improvements in protection of the public, a change to what populations are included within the emergency planning area is required by REPPPIR as a result of the application of ONR's revised principles for the determination of such areas.

ONR's re-determination of the REPIIR off-site emergency planning area and the REPIIR prior information area around the Loch Ewe Operational Berth has been undertaken in accordance with ONR's regulatory processes, guidance associated with REPIIR itself, and the relevant ONR Technical Assessment Guide (TAG). In particular, the TAG, published in 2014, includes ONR's determination principles and associated guidance for the determination of such areas. These principles recognise the learning that has emerged from global events such as occurred at Fukushima and the 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 measures to secure public safety and to the consistency and transparency of its decision-making.

ONR's determination process requires that:

- ONR undertakes a technical assessment of MOD's HIRE and RoA.
- In accordance with the relevant ONR TAG, ONR also gives appropriate consideration to practical and strategic factors relating to the planning and potential implementation of a credible off-site emergency plan, and other pragmatic factors appropriate to secure confidence as regards protection of the public. This aspect of the process includes; dialogue with the relevant local authorities, in this case, The Highland Council, as the dutyholder within REPIIR as regards the off-site plan; and considers, amongst other factors, local population (including vulnerable groups), geographical considerations, and existing good practice where the local authority emergency plan already extends beyond the minimum required distance. This informs ONR's determination so as to define more practical emergency planning and prior information areas than would be the case from purely technical considerations.

The outcome of ONR's technical assessments concludes that an area of radius of at least 1.5 km from the berth point should continue to be used as the foundation for defining the extent of the need for local authority off-site emergency planning under regulation 9 of REPIIR in relation to the Loch Ewe Operational Berth.

ONR's regulatory principles emphasise the importance of ensuring that an appropriate balance is achieved between the assessment of technical submissions provided by the operator and other practical and strategic considerations judged to be appropriate in the interests of public safety. As a consequence, the ultimate determination of the REPIIR off-site emergency planning area represents ONR's regulatory judgement, and is not formed solely on the basis of technical considerations or criteria.

The outcome of ONR's review, taking into account the relevant practical and strategic considerations relating specifically to the Loch Ewe Operational Berth, is that:

- both the REPIIR off-site emergency planning area and the REPIIR prior information area for the Loch Ewe Operational Berth have been re-defined to include the village of Aultbea, and the enhanced area shown within the red line on map contained in annex B to this report.

The enhancement of the planning area (from a 1.5 km circle to the shape indicated at annex B) reflect factors which ONR judges to be relevant in securing confidence as regards protection of the public during a reasonably foreseeable radiation emergency, the learning that has emerged from global events such as occurred at Fukushima, and the need to review the scope of off-site emergency planning, noting the risk from the naval reactor plant has not increased.

The recommendations of this report are that ONR write to:

- The Highland Council, being the responsible local authority, to advise that the REPPiR off-site emergency planning area has been determined as the area within the red line on map at annex B. This information should be copied to Navy Command acting as the MOD Operational Berth duty holder.
- The Highland Council, being the responsible local authority confirming the need to update, as required, its detailed off-site emergency plan to adequately cover the area defined in annex B.
- Navy Command acting as the MOD Operational Berth duty holder confirming the requirement to ensure the appropriate provision of prior information to the public within the area defined in annex B. This should also be copied to The Highland Council.
- Inform by copy of its letter to, Naval Base Commander (Clyde), The Defence Nuclear Safety Regulator, Highland Council Ports Authority, Maritime and Coastguard Agency, Environment Agency, Scottish Environment Protection Agency, Food Standards Agency, Food Standards Scotland, Department of Business, Energy and Industrial Strategy and the Scottish Government of the revised REPPiR off-site emergency planning and information areas.

## LIST OF ABBREVIATIONS

ACPO	Association of Chief Police Officers
BSS	Berth Safety Statement
COMAH	Control of Major Accident Hazards
DEPZ	Detailed Emergency Planning Zone (Ref: REPPiR regulation 9(1))
DNSR	Defence Nuclear Safety Regulator
EURATOM	European Atomic Energy Community
FEPA	Food and Environment Protection Act 1985
FSA	Food Standards Agency
FSS	Food Standards Scotland
GB	Great Britain
HIRE	Hazard Identification and Risk Evaluation
HM	Harbour Master
HMNB	H.M. Naval Base
HSL	Health and Safety Laboratories
IAEA	The International Atomic Energy Agency
MCA	Maritime and Coastguard Agency
MHWM	Mean High Water Mark
MLWM	Mean Low Water Mark
MOD	Ministry of Defence
mSv	milliSievert
NIA	Nuclear Installations Act 1965
NII	Nuclear Installations Inspectorate
NRP	Naval Reactor Plant
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
REPPiR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RoA	Report of Assessment
RPC	Representative Patrol Cycle
SAPs	(ONR) Safety Assessment Principles
SEPA	Scottish Environment Protection Agency
TAG	(ONR) Technical Assessment Guide

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## 1 REGULATORY CONTEXT

The UK 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 nuclear sites, including through:

- securing the health, safety and welfare of persons at work on GB nuclear sites; and
- 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 efficient and effective regulation of the nuclear industry, holding it to account on behalf of the public, and, in particular, ensuring that appropriate arrangements are put in place to deal with a nuclear emergency.

Ministry of Defence (MOD) nuclear sites and facilities are Crown exempt from licensing requirements under the Nuclear Installations Act 1965 (NIA) (reference 2). These sites are referred to as Authorised sites and Nuclear Warship sites. Nuclear Warship sites are referred to by the MOD as Operational Berths and Anchorages.

The NIA additionally explicitly exempts a reactor 'comprised in a means of transport' from its requirements (i.e. submarines are not licenced by ONR under the NIA).

The MOD internal regulator, the Defence Nuclear Safety Regulator (DNSR), authorises and regulates the Authorised sites through the use of authorisation conditions, which are closely aligned to ONR Licence Conditions. Similar conditions are placed on Operational Berths.

The MOD is not however exempt from the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR) (reference 3), and ONR are the enforcing authority for REPPiR on their Authorised sites and Nuclear Warship sites (reference 4).

The term Operational Berth is defined as a berth or anchorage outside of an Authorised or Licenced site and is not covered by Authorisation or Licence conditions of the site at which a Nuclear Powered Warship may be berthed or anchored.

The MOD / ONR General Agreement and Letter of Understanding (references 5 and 6) describe the overall regulatory working relationship between the MOD and ONR. DNSR works closely with ONR in a process of joint regulation of relevant areas to minimise the impact on operators and ensure, so far as is practicable, that they are not subject to differing requirements or processes. ONR looks to DNSR as the "Competent Authority" in respect of Naval Reactor Plant (NRP) design and DNSR provides ONR with any clarification it requires on hazards arising from it.

In relation to REPPiR, DNSR acts as the Competent Authority in providing assurance to ONR that the detailed Naval Nuclear Propulsion Programme design information contained within the MOD REPPiR Hazard Identification and Risk Evaluation (HIRE) is valid and has been used appropriately.

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 REPPiR) 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 emergency<sup>1</sup>. 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

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<sup>1</sup> 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'.

be distributed to the public<sup>2</sup>. A radiation emergency is defined in REPIR as an event where a person off-site is likely to receive a radiation dose in excess of the thresholds in REPIR (typically an effective dose in excess of 5 milliSieverts (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 Loch Ewe Operational Berth in accordance with the requirements of REPIR regulations 9(1) and 16(1) respectively (reference 3).

ONR is of the opinion that the extent of areas for local authority off-site planning and for the provision of prior information by the operator should usually be the same. This is a reflection of the fact that the factors considered by ONR for determination of these areas are the same. As a consequence, and for simplicity, where the term 'REPIR off-site emergency planning area' is used in this report, it should be assumed to refer equally to the off-site emergency planning and prior information areas.

## 2 BACKGROUND

The UK regulatory system requires that each duty holder demonstrates 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 operator's provisions are robust, and that any risks are reduced so far as is reasonably practicable.

In the case of the Operational Berth at Loch Ewe, the hazards and risks are associated with the NRP within the submarine. All references in this report to submarine are interchangeable with the definition of Nuclear Powered Warship.

In relation to emergency planning, REPIR regulation 6 requires operators, and in the case of nuclear warship sites the dutyholder, to undertake a HIRE of hazards arising from their work with the potential to cause a radiation accident from the submarine. The duty holder for the nuclear warship sites is the MOD. The HIRE 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. REPIR also requires that operators submit a Report of the Assessment (RoA) of their HIRE to ONR prior to commencement of the work, following any material change, and at least every three years, whichever is the shorter.

REPIR regulation 5(2) provides for the operator to make a declaration of no change if there is no change of circumstances which would affect the last report of the assessment required by regulation 6.

Where it is reasonably foreseeable that a radiation emergency (as defined in REPIR) could arise, REPIR 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

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<sup>2</sup> 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 'REPIR prior information area'.

reactors, including NRP), and other protection measures that are relevant, reasonably practicable, and proportionate to the radiological risk.

Following the determination by ONR, the relevant local authority (in this case The Highland Council) is required to prepare an adequate off-site emergency plan. In so doing, the local authority has a legal obligation to consult a range of persons (including the Operational Berth duty holder, ONR, the emergency services, the relevant health authority, and such other persons, bodies and authorities and members of the public as they consider appropriate). This plan must then be reviewed, revised where necessary, and tested at least every three years.

## 2.1 TIMELINE OF MOD HIRE / ROA SUBMISSIONS

In February 2008 the MOD submitted HIREs and associated RoAs (reference 7) covering operations at the following sites:

- HMNB Clyde (comprising Coulport and Faslane)
- HMNB Devonport (including Plymouth Sound buoys)
- Devonport Royal Dockyard
- UK Operational Berths (Portsmouth, Southampton, Portland, B4 Anchorage, Loch Goil, and Loch Ewe and Broadford Bay)

ONR (then the Nuclear Installations Inspectorate (NII)) and DNSR put in place a regulatory strategy to assess the HIREs and RoAs, with DNSR providing the detailed technical assessment. NII completed the regulatory assessment requirements of REPPiR with a joint regulatory position statement being issued in April 2009.

NII determined that it was appropriate to consider the cliff edge fault event as the bounding fault, and that the area within which members of the public are likely to be affected by a reasonably foreseeable radiation emergency was a distance of 1.5 km from the berth in any direction (reference 8).

In 2011 the MOD REPPiR submissions (through DNSR) (reference 9) were supported by significantly updated Berth Safety Statements (BSS) (reference 10) that considered site specific hazards. The 2011 submission constituted No Change Declarations (reference 9) for the Operational Berths, supported by revised BSS for:

- HMNB Clyde (including Faslane and Coulport Sites)
- HMNB Devonport (including Plymouth Sound buoys)
- UK Operational Berths (Portsmouth, Southampton, Portland, B4 Anchorage, Loch Goil, Loch Ewe and Ramsden Dock Basin)

The MOD REPPiR submission (through DNSR) in January 2014 (reference 11) was again a Declaration of No Change. The totality of the MOD submissions comprised of individual submissions from each Naval Base and Navy Command Headquarters, which covered the following:

- HMNB Clyde - Faslane and Coulport Sites
- HMNB Devonport (including Plymouth Sound buoys)
- UK Operational Berths (Portsmouth, Southampton, Portland, Ramsden Dock Basin, Loch Goil, and Loch Ewe)

DNSR, as the competent authority on the NRP, confirmed its support of the no-change submissions in 2011 and 2014 (references 9 & 11).

In January 2017, MOD (Naval Base Commander Clyde and Navy Command) submitted a further Declaration of No Change of circumstances (references 12 & 13). The Naval Reactor Plant Authorisee also undertook an assessment to support the review and 2017 submission. The submission covered the following:

- HMNB Clyde – Faslane and Coulport sites

- UK Operational Berths (HMNB Portsmouth and Solent Anchorages, Loch Ewe, Loch Goil, Portland Port, Ramsden Dock Basin, and Southampton Eastern Docks)

### 3 SCOPE

The assessment described in this report sets out the basis for, and conclusions of, the re-determination of the REPIIR off-site emergency planning and prior information area relating to the Loch Ewe Operational Berth. This has been undertaken in accordance with the guidance on REPIIR (reference 14) and the relevant ONR supporting Technical Assessment Guide (TAG) (reference 15), which incorporates ONR's principles for determination of REPIIR 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 not relevant to the process of determining the REPIIR off-site emergency planning area on the basis that they are provided separately (Food and Environment Protection Act 1985 (FEPA) (reference 16) and are under the legal jurisdiction of the Food Standards Agency (FSA) and Food Standards Scotland (FSS). These provisions are therefore addressed by separate legislation other than REPIIR, 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 out-with the scope of this report.

### 4 METHODOLOGY

#### 4.1 ONR'S PROCESS FOR DETERMINING A REPIIR OFF-SITE EMERGENCY PLANNING AREA

This process requires that ONR:

- A. Conduct an initial independent technical assessment of the information provided by the operator in their HIRE and RoA seeking and using additional information as appropriate; and
- B. Where the potential for a REPIIR defined reasonably foreseeable radiation emergency exists, establish and consider any other relevant practical and strategic factors relating to the planning and practical implementation of 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 REPIIR may be met or exceeded. This indicates the minimum distance for further consideration in Step B, and is usually presented in the operator's HIRE reports 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 15). 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 15) emphasise that, in the undertaking of the determination, it is important to ensure that a balance is achieved between the assessment of the technical report provided by the operator, 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 determining the off-site emergency planning area is the most significant reasonably foreseeable event (referred to in ONR's TAG, reference 15, 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, external hazards such as earthquakes, 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, extendibility 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 are the urgent countermeasures available in the early stages of a nuclear emergency of sheltering, evacuation and, in the case of NRP, the administration of stable iodine (potassium iodate tablets).

In determining a REPPIR off-site emergency planning area, ONR acknowledges that the implementation of some protection measures can convey a risk of harm to individuals to whom they are applied. For example, following the Fukushima accident in Japan in March 2011, Koichi Tanigawa et al. report in the Lancet journal on the loss of life that occurred as a result

of the implementation of evacuation (reference 17). Within a REPIR off-site emergency planning area, the local authority may expect some protection measures to be applied immediately or urgently across at least a part of the area and it is important that the area within which they may be 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 REPIR off-site emergency planning area must, as a minimum, include all of the area around the site, in this case the Operational Berth, 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 REPIR Schedule 1). When assessing the extent of exposure, REPIR requires that operators, in the case of the Loch Ewe Operational Berth, the MOD, assess the potential doses to members of the public from all exposure routes and, for this purpose, must disregard any health protection countermeasures 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.

ONR undertook a review of the original 2008 REPIR submission along with the subsequent No Change submissions (reference 18) to ensure that they are considered appropriate in response to REPIR requirements and to provide an up to date assessment for the REPIR off-site emergency planning and prior information areas determination to be undertaken. This forms the basis of 'Step A' (see section 4.1) of the assessment and determination described in this report. The findings of ONR's review are detailed in section 5.2.

## **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 REPIR (reference 3) and its associated guidance (reference 14). REPIR are regulations created 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 (European Atomic Energy Committee) - Basic Safety Standards for the Protection of the Health of Workers and Members of the Public against the Dangers from Ionising Radiation (reference 19).

### **4.3.2 SAFETY ASSESSMENT PRINCIPLES**

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 REPIR submissions, the guidance within SAP: AM.1 - Accident management and emergency preparedness (reference 20) has been taken into account.

### **4.3.3 TECHNICAL ASSESSMENT GUIDES**

The SAPs are supported by a suite of internal TAGs, with the following TAG being applied in this assessment:

- The technical assessment of REPIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 3 2016 (reference 15). This TAG incorporates ONR's principles for determination of REPIR 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 the conduct of this assessment:

- A guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (reference 14).

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

- The International Atomic Energy Agency (IAEA) Safety Standard Series – Preparedness and Response for a Nuclear or Radiological Emergency GSR Part 7 (reference 21).
- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 (reference 22).

## 5 ASSESSMENT OF TECHNICAL SUBMISSIONS

The HIRE and RoA, in their current issue, for the NRP were submitted to ONR (then NII) in 2008. MOD has made declarations of no change in relation to the RoA's in 2011, 2014, and 2017 in line with REPPIR regulation 5(2).

A summary of the MOD's submissions and ONR's technical assessment of them (references 11, 12 & 23) are detailed in sections 5.1 and 5.2 respectively.

### 5.1 MOD REPORT OF ASSESSMENT

The 2008 submitted RoA is a generic HIRE carried out to evaluate the risks and hazards from the Nuclear Reactor Plant (NRP) fitted in each of the UK's three main types of nuclear powered submarines (all of which have the potential to be berthed at the Loch Ewe Operational Berth). This generic HIRE contains classified information and as such any reference to the material it contains has been kept sufficiently high level in order to negate the need for similar classification of this document.

The Reference Accident in the generic RoA is defined as a leak in the primary cooling circuit of the NRP, which cannot be isolated and is beyond the capacity of coolant make-up systems. This primary coolant leak, coupled with engineering and other failures, leads to damage to the fuel within the reactor, which, in turn, releases some radioactive material from the reactor. This leak is largely contained within the submarine, although a small part of this inventory may be released to the environment.

In accordance with REPPIR regulation 5, MOD has undertaken a review of their HIRE for all UK Operational Berths (Portsmouth, Southampton, Portland, Ramsden Dock Basin, Loch Goil, and Loch Ewe) and HMNB Clyde (Faslane and Coulport).

The review of the extant HIREs for the NRP at the berths identified that there have been no material changes to the work with ionising radiation carried out by MOD since the last submission. The review did however highlight a minor change to the Representative Patrol Cycle (RPC) that supports the Reference Accident. The submission included a consideration of the amendment to the RPC, and confirmed that it does not affect the extant RoAs.

Additionally, the submission stated that any reasonably foreseeable malicious act would not result in consequences greater than those of the Reference Accident at any UK Operational Berth.

The 2014 MOD submission, supported by DNSR, constituted a Declaration of No Change for all the UK Operational Berths and HMNB Clyde (Faslane and Coulport) Authorised Sites, and stated that the 2008 RoA remained valid. MOD stated that all facets comprising the MOD REPPIR 2014 submission had been independently reviewed by an external contractor to determine if the evidence supports a "no-change" submission. The contractor advised that a "no-change" position remains valid.

The 2017 MOD submissions, which constituted a Declaration of No Change for all the UK Operational Berths and the HMNB Clyde (Faslane and Coulport) Authorised Sites, stated that a review of the suite of Site Safety Justification documentation supporting operations at each of the Operational Berths had been carried out in accordance with Navy Command and HMNB Clyde due process. The Naval Reactor Plant Authorisee also undertook an assessment of the NRP HIRE to support this review.

## 5.2 ONR TECHNICAL ASSESSMENT

ONR (then NII) conducted a technical assessment of the generic submarine HIRE when it was submitted in 2008. Following a detailed review of the various fault scenarios it concluded that a more significant event than that proposed by the MOD in their RoA was reasonably foreseeable and that as a result the minimum distance for emergency planning should be 1.5 km from each submarine berth. This assessment did not do an in-depth review of the site specific hazards at the Operational Berth site, but made the judgement that any site specific fault scenario would be bounded by fault relating to the NRP.

Given the time that had elapsed since the 2008 ONR assessment and the subsequent Declarations of No Change, following the 2014 submission, it was deemed appropriate to review any other factors that may affect the conclusions of the 2008 assessment (such as changes in modelling techniques and assumptions in the intervening years). It has also sought to confirm that the NRP remains the bounding fault in relation to specific site activities at each Operational Berth.

As part of the assessment of the 2014 submission, DNSR as the competent authority on the NRP, confirmed that there has been no change in the basis for assessment and provided additional confirmation that:

- The current assessment bounds any variation in the positioning of the submarine (e.g. as a result of tidal movements) and hence the positioning of the reactor plant in relation to the stated berthing location.
- The sensitivity of the variations (modelling software differences, inventory and dose exposure) outlined in the Representative Patrol Cycle assessment do not affect the 5 mSv dose contour as determined by the original 2008 assessment.
- Modelling disregarded health protection measures in the first year with 2 exceptions (ingestion of foodstuffs over the first 24 hours and food restrictions under a FEPA order from 24 hours onwards). DNSR advice was that these exceptions would have no impact upon the conclusions of the assessment, particularly given inherent pessimisms in the modelling.
- The assessment included all dose accrued in the year following the event.
- Additional site hazards that could affect the overall REPIR emergency planning area have been considered and are bounded by the current 5 mSv contour from the submarine.

The review noted that the detailed assessment includes a number of pessimistic assumptions. For example, dose assessment modelling was carried out using two separate modelling codes (PC COSYMA by the duty holder and CONDOR by DNSR/Nuclear Department), and the more pessimistic assessment (CONDOR) was taken forward. Assessment was based on the worst case Submarine Class (which is in fact the least frequent visitor to an Operational Berth); other classes are bounded by this worst case consequence. Additionally the modelling was based on pessimistic inventory and decay heat (end of life, high power) assumptions.

ONR's assessment (reference 18) concluded that the most significant reasonably foreseeable radiation emergency from the NRP had not changed from the 2008 assessment and that a distance of 1.5 km from each berth in all directions should continue to be the basis for off-site emergency planning.

Following the 2017 Declaration of No Change submission by MOD, ONR confirmed that the Declarations of No Change for the Operational Berths were appropriate submissions in response to REPPiR requirements and that the 2014 ONR Assessment (reference 18) remains extant and that a distance of 1.5 km from each berth remains the basis for off-site emergency planning (reference 23).

### 5.3 CONCLUSIONS OF TECHNICAL ASSESSMENTS

ONR's technical assessor concluded (reference 18) that MOD's submissions adequately meet the requirements of REPPiR with respect to:

- the representation of a reasonably foreseeable radiation emergency; and
- the assessment of the distance from the relevant locations to the 5 mSv contour.

The ONR technical assessment recommends that the determination of the REPPiR off-site emergency planning area should continue to be based on the 1.5 km contour from the berth. ONR's technical assessor agreed this distance was supported by appropriate technical analysis. However, this distance is informed solely by the technical assessment and does not consider the application of strategic and practical factors (as described in section 6 below).

**Conclusion 1:** ONR is satisfied that the technical submissions made by MOD demonstrate that members of the public would not be likely (the legal test provided by REPPiR) to be exposed to effective doses in excess of 5 mSv (or other dose criteria defined in REPPiR Schedule 1), in the year following a reasonably foreseeable radiation emergency, beyond a radial distance of 1.5 km from the Operational Berth at Loch Ewe.

## 6 ASSESSMENT OF PRACTICAL AND STRATEGIC CONSIDERATIONS FOR THE DETERMINATION OF THE REPPiR OFF-SITE EMERGENCY PLANNING AND PRIOR INFORMATION AREAS

The purpose of the REPPiR off-site emergency planning area is to define the area for which the local authority must prepare an off-site emergency plan which is adequate to restrict exposures to the public, so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency.

In accordance with ONR's TAG (reference 15) and the principles incorporated within it, ONR must also give consideration to the practicality (in an emergency planning sense) of the REPPiR off-site emergency planning area by considering a number of pragmatic factors considered to be relevant in securing its confidence regarding the effectiveness and credibility of the plans to deliver protection of the public.

In the course of considering these factors, ONR has consulted with The Highland Council as the lead organisation responsible under REPPiR for preparation of the off-site emergency plan for the Loch Ewe Operational Berth, and with the MOD in relation to the prior information area (reference 24). ONR has also consulted the Highland Council Harbours Authority (reference 25) who controls the water and jetties in the off-site emergency planning and prior information area.

The initial stage in this determination process was the application of the 1.5 km radial distance to the Operational Berth to provide the initial area against, and beyond which, the practical and strategic factors should be considered. Details of the location (grid references) of the UK Operational Berth was obtained directly from the MOD.

The Operational Berth at Loch Ewe is a single berth positioned at the Petroleum, Oil and Lubricants (POL) pier. The area encompassed by the 1.5 km radial distance is essentially

farm and scrubland, the marine environment of the loch and a small part of the Isle of Ewe. The area includes a number of residential properties in the village of Aultbea.

To inform the application of the practical and strategic factors, which is discussed in sections 6.1 to 6.7 below, relevant information and significant features with respect to the Loch Ewe Operational Berth area have been identified. These are described in annex A.

**Conclusion 2:** The single berth at the Petroleum, Oil and Lubricants pier at Loch Ewe will form the basis of a single emergency planning area of 1.5 km radius.

## 6.1 LOCAL GEOGRAPHIC, POPULATION AND PRACTICAL IMPLEMENTATION FACTORS

The ONR TAG (reference 15) states that:

*“The relevant local authority is consulted on the basis that it has significant ‘local’ knowledge and has the responsibility for development and, in the highly unlikely event that it is ever necessary, implementation of the off-site emergency plan. (Note: The local authority also has the legal duty to undertake consultation in relation to the off-site emergency plan as provided for under REPPiR regulation 9(12).)”*

The Highland Council have been consulted (reference 24) with regard to what features should be used to define the boundary of the area determined. The default is to use infrastructure or geographical features such as, roads, railways, rivers and streams unless it is locally convenient to use other boundaries, such as postcode or electoral ward boundaries. In the case of the Loch Ewe Operational Berth, due to the nature of the geography of the surrounding countryside it may not be possible to use geographical or infrastructure features to define the boundary without creating an excessively large and disproportionate area. For areas where there is no definable geographical feature to use as the boundary, a radial distance from the berth point will be used.

**Conclusion 3:** The REPPiR off-site emergency planning area boundary should be defined on land, so far as is sensible, using physical infrastructure and geographical features, such as roads, rivers or farmland boundaries. For areas where there is no definable geographical feature to use as a boundary, a radial distance from the berth point will be used.

For the marine areas, the Highland Council Harbours Authority was consulted (reference 25) as to the best way to define the boundary area. They were of the opinion that, for simplicity of radio communication with relevant marine vessels in the area during an emergency, boundary is best defined as a distance from a single point (creating a radial boundary). This is consistent with other REPPiR off-site emergency planning area determinations where the area extends over the marine environment.

**Conclusion 4:** The extent of the marine area should preferably be described as radii from a defined point, this being the Loch Ewe Operation Berth point.

Where the boundary of the defined area runs along a coast line or significant waterway, such as a loch, consideration needs to be given as to what aspect of the coast or shore is used as the defining feature. It is noted that Association of Chief Police Officers/Maritime & Coastguard Agency (ACPO/MCA) national agreement uses the Mean High Water Mark (MHWM) as the demarcation for co-ordination of operational response to incidents i.e. if the incident is on the seaward side of the MHWM the co-ordination is undertaken by the MCA (or the Harbours

Master in the case of the Loch Ewe Operational Berth); conversely if it is landward side co-ordination is with the Police. However for the Loch Ewe Operational Berth, I consider that use of the Mean Low Water Mark (MLWM) is more appropriate for the definition of the boundary planning area where it meets the coast line (water line in this case) as it either fully includes, or excludes, those persons who may be in between the MHW and the MLWM and whose primary means of shelter or evacuation is likely to be via land rather than sea – i.e. people at the water's edge.

**Conclusion 5:** At the water's edge the REPPIR off-site emergency planning area boundary should be defined, so far as is sensible, using the Mean Low Water Mark.

## 6.2 CREDIBILITY AND CONFIDENCE IN THE EXTENT OF THE REPPIR OFF-SITE EMERGENCY PLANNING AREA

The ONR TAG (reference 15) states that:

*“Although REPPIR places the duty on the independent regulator to make an objective and unbiased regulatory determination of the extent of the REPPIR off-site emergency planning area (formerly DEPZ), ONR considers that, in the interests of confidence in public safety (noting the assumptions and estimations used to determine the 5 mSv contour), the DEPZ should be of sufficient extent so as to provide for a meaningful off-site emergency plan. It should, therefore, incorporate an appropriate degree of conservatism and pragmatism, and provide for a credible and effective response in the event of a reasonably foreseeable radiation emergency.”*

REPPIR states that the safety objective of the planning undertaken by local authorities with the REPPIR offsite emergency planning area is to ‘...secure, so far as is reasonably practicable, the restriction of exposure...’ to ‘...persons who may be affected...’ by a reasonably foreseeable radiation emergency, rather than simply to restrict public exposures in such an event to 5 mSv over the following year.

Therefore, although it has been concluded (section 5.3) that the limit of the extent to which members of the public are likely to be exposed to ‘5 mSv in the year following a reasonably foreseeable radiation emergency’ is a distance of 1.5 km from any Operational Berth point, a REPPIR off-site emergency planning area based on a contour equating to that distance must also provide a sufficient off-site planning area for the purposes of satisfying this broader REPPIR dose restriction intention, noting the proximity of any significant conurbations to the relevant berth or anchorage.

In this context, ONR is mindful that, whilst dutyholders are typically conservative in their approach to nuclear safety, complex technical assessments of potential emergency situations must inevitably rely on a range of assumptions, judgements and estimates.

Whilst ONR is satisfied that the REPPIR submissions made by the MOD demonstrate the overall risk from the NRP has been conservatively estimated, ONR is of the opinion that it is appropriate, where public safety is at stake, that it acts with reasonable conservatism in its own right, in the interests of confidence in securing the public safety objective of REPPIR.

Within the 1.5 km radial area from the Loch Ewe Operational Berth, there are a small number of residential properties with a day-time population of 91 and a night-time population of 135. Also within the area are a number of rental holiday homes and self-catering loges, along with two small hotels. The area also includes a single care home (up to 23 residents).

To the north of the berth is the village of Aultbea, which is bisected by the 1.5 km radial boundary. Between Aultbea and Mellon Charles in the north are the small populations of Tighnafiline (2.0 km from the berth), Bualnaluib (2.4 km from the berth), and Ormiscaig (3.0 km from the berth). Mellon Charles, population of approximately 100, lies between 3.6 and 5.6

km north from the berth point. There are a number of small areas of populations ranging from 4 to 7.8 km from the berth point. Further details are contained in annex A.

Due to the sparsely populated area surrounding the Loch Ewe Operational Berth, to extend the emergency planning area to capture the populations of Bualnaluib, Ormiscaig and Mellon Charles would result in an excessively large and disproportionate area, and which would result in only a small number of additional residents being included in the emergency planning area.

Consideration is required if the single plan for Loch Ewe, which contains a very small population, could be flexible enough to accommodate significant numbers in the event the highly unlikely event that the effects of reasonably foreseeable radiation emergencies had been underestimated, or that any assumptions and judgements in the licensee submissions were challenged in practice.

There are no significant centres of large population within 10 km of the berth. There are a number of small hamlets and villages within a radial distance of 8 km of the berth, with a total combined population of approximately 500.

The closest centres of any significant population are at Gairloch (approximate population 740) 12 km from the berth and Ullapool (approximate population 1500) some 26 km from the berth.

It is recognised that where a comprehensive plan covers only a part of a densely populated area, it may be significantly challenged in the extremely unlikely event that the area required for public protection extends further than that determined as it would include a large number of additional residents. REPPIR<sup>3</sup> and the National Nuclear Emergency Planning and Response Guidance state that it is good practice for the emergency plan to provide the basis for dealing with radiation emergencies that are not reasonably foreseeable through the concept of extendibility.

The berth is not near any densely populated area, with the nearest centre of significant population is 26 km from the berth. In the event of an extension to the planning area resulting from a more severe event, the number of people affected remains small.

The current off-site emergency plan (reference 26) provides for extendibility of the plan. In addition, The Highland Council have undertaken an extendibility exercise (reference 27) and have confidence that the existing off-site emergency plan (reference 26) is adequate for dealing with an extension to the current area in the event of lower probability but potentially more severe accident.

I consider that the plan would provide sufficient flexibility to take all reasonably practicable measures to restrict exposure, in the highly unlikely event that the effects of reasonably foreseeable radiation emergencies had been underestimated, or that any assumptions and judgements in the licensee submissions were challenged in practice.

Therefore, I am of the opinion that emergency planning for the Loch Ewe Operational Berth does not need to be extended beyond 1.5 km from the berth for the provision of credibility and confidence in the off-site plan. Therefore this distance will form the basis for determining the REPPIR off-site emergency planning area following the ONR principles (reference 15).

**Conclusion 6:** A REPPIR off-site emergency planning area based on a minimum radial distance of 1.5 km from the Loch Ewe Operational Berth will provide for a credible and effective plan to secure the protection of the public and restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency.

<sup>3</sup> Paragraph 138 of A guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001

### 6.3 AVOIDANCE OF BISECTION OF LOCAL COMMUNITIES

The ONR TAG (reference 15) states that:

*“Whilst accepting that it may sometimes be unavoidable, ONR’s preference is to avoid the bisection of small settlements or communities, on the basis that any REPPiR off-site emergency planning area (formerly DEPZ) determination is based on some unavoidable assumptions and estimates, and is therefore not precise. Bisection of small communities has raised concerns in terms of public perception, and also has the potential to affect the effectiveness of implementation of countermeasures.”*

The minimum radial distance of 1.5 km from the Loch Ewe Operational Berth bisects the small village of Aultbea and the Isle of Ewe. The area encompasses the entire small hamlet of Drumchork.

There are a number of properties in Aultbea where the access and egress routes are bisected. In the event of evacuation of these properties, the only egress route would lead back into the 1.5 km emergency planning area.

On the Isle of Ewe the boundary bisects cultivated farmland and farm buildings.

To the east, the 1.5 km radial boundary bisects the Oil Storage Depot facility.

The area is sparsely populated, both within and beyond the 1.5 km boundary. Due to the sparseness of the area I consider it appropriate to include those communities that are bisected, and the whole of the Oil Storage Depot.

Inclusion of all of Aultbea and those properties whose egress route is back in the 1.5km boundary increases the number of those affected from approximately 135 to 295. This includes those properties in the area of Tighnafiline and Badfearn.

On the Isle of Ewe it is appropriate to include all the cultivated farmland, which will ensure all buildings are included.

It is important for me to note that the residents of Bualnaluib, Ormiscaig and Mellon Charles are only able to access their properties from a single road leading from Aultbea. It is recognised that an alternative method of reaching this area is by water access which has been confirmed as viable with the local authority (reference 24). To include these communities would result in the area extending to over 6 km from the berth resulting in an excessively large area.

I consider it appropriate and proportionate to include only those additional properties of Aultbea, Tighnafiline and Badfearn so avoiding bisection or segregation of specific communities and settlements.

**Conclusion 7:** To avoid bisection or segregation of small community groups or large facilities, I consider it appropriate to include additional properties in the village of Aultbea including Tighnafiline and Badfearn, the cultivated farm land on the Isle of Ewe, and the whole of the Oil Storage Depot in the emergency planning and prior information areas.

### 6.4 INCLUSION OF IMMEDIATELY ADJACENT VULNERABLE GROUPS

The ONR TAG (reference 15) states that:

*“ONR recognises that groups of vulnerable people (e.g. care homes, schools, camping and caravan sites, itinerant populations, etc.) located close to the REPPiR off-site emergency planning area (formerly DEPZ) should be provided for in the same manner as those located*

*within the zone.” (The definition of ‘vulnerable’ groups must be the definition adopted by the relevant local authority.)*

To support determination of the required emergency planning area, vulnerable groups in the area were discussed with The Highland Council (reference 24) and summarised in annex A, Table 1. There had been discussion with the local authority over what constitutes a vulnerable group. When considering this factor, ONRs intent is to be consistent with other aspects of council arrangements for vulnerable groups, therefore, as a default, it will use the relevant local authorities’ definition of what constitutes a vulnerable group when considering the extent of the planning area. It should be noted that there is Cabinet Office guidance<sup>4</sup> on this subject with a general definition of “vulnerability” to mean; “those that are less able to help themselves in the circumstances of the emergency” and include people with mobility difficulties, mental health issues, children/elderly, hearing and visual impaired.

For consistency with other determinations I have also considered the inclusion of groups who would be at risk of greater exposure (so in a sense could be considered as “vulnerable”) to the effects of any radiation emergency – examples include pleasure craft on the water, residents of tents, caravans and beach huts, or sites where members of the public may have restricted access to information, shelter or egress.

Data provided by Health and Safety Laboratories (HSL) indicated a single care home within the 1.5 km radial area boundary in Aultbea. Further investigation of the area has highlighted the Aultbea Nursery at 1.68 km from the berth point (0.2 km from the 1.5 km boundary). The nearest school is at Bualnaluib, some 2.5 km from the berth point (1.0 km from the 1.5 km boundary). There are no references to any vulnerable groups in the 2015 off-site emergency plan for Loch Ewe (reference 26). Confirmation of the groups was obtained from the local authority (reference 24).

There is the potential for fishing and pleasure boats, including canoes and kayaks to be on the water of the Loch, although there are no permanent marinas in the area. There is a jetty and pier located near Aird Point in Aultbea.

There are no caravan or camping sites within, or adjacent to the boundary. Access to Isle of Ewe is via boat and this runs solely to provide access for the residents on the Isle and does not provide tourist access.

For consideration of this practical and strategic factor it is necessary to consider those vulnerable groups beyond 1.5 km. How far beyond 1.5 km that should be considered is subjective as the term “immediately adjacent” does not have an additional distance associated with it. This is deliberate as what would be an appropriate distance for one nuclear site or Operational Berth may not be for another.

It is important to consider that when looking to incorporate an adjacent vulnerable group, resulting in possible extension of the boundary, this could result in additional vulnerable groups becoming adjacent to the extended boundary, which in turn could lead to boundary creep resulting in a disproportionate area.

I consider it appropriate not to include the school at Bualnaluib due to their distance of 2.5 km from the Operational Berth point, and which I consider would lead to excessive extension of the emergency planning area.

The Highland Council Off-site Emergency Plan (reference 26) states that the Harbourmaster (Highland Council Harbours Authority) in conjunction with the HM Coastguard will impose any necessary restrictions on vessel movements on the Loch if requested to do so. Additional confirmation was obtained from the Highland Council Ports Authority regarding the extent of their jurisdiction with regard to Loch Ewe (reference 28).

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4 <https://www.gov.uk/government/publications/emergency-preparedness> - chapter 5 & 7

**Conclusion 8:** I have considered the nature of the vulnerable groups, their size and distance from the boundary, and I consider that the nursery located in Aultbea should be included in the determined area. I consider it appropriate not to include the school at Bualnaluib due to its distance of 2.5 km from the Operational Berth, and which would lead to an excessively large and disproportionate area.

## 6.5 INTERNATIONAL GOOD PRACTICE

The ONR TAG (reference 15) states that:

*“ONR is of the view that its decisions should be informed by accepted international good practice.”*

Relevant international good practice relating to nuclear emergency planning is contained in International Atomic Energy Agency (IAEA) publications GSR Part 7 and GS-G-2.1 (references 21 and 22). The guidance document (GS-G-2.1) is non-binding, and provides one of many potential benchmarks for comparison.

In these documents, the IAEA identifies categories of reactor power output and potential ‘threat’, and advocates the adoption of two types of emergency planning zones: a Precautionary Action Zone (PAZ) and an Urgent Protective Action Planning Zone (UPZ). However, due to differences in the UK legal framework, and the assessment of reasonably foreseeable radiation emergencies on a case-by-case basis, neither of these zones are directly comparable with ONR’s determination of a REPPIR off-site emergency planning area.

In the UK, the legal framework for local off-site emergency planning is set out in REPPIR and, although ONR’s principles broadly align with (and meet the spirit of IAEA guidance), the IAEA guidance specifically allows for an approach based on case-by-case assessment (as happens in the UK). In addition, there are a number of similarities, but also important differences, between the UK legislative and IAEA regimes, which are summarised as follows:

- a) IAEA guidance document (GS-G-2.1) provides generic indicative radial distances around different categories of nuclear installations, but also states that ‘a different distance should be used when this is substantiated by a detailed safety analysis’. UK legislation, REPPIR, requires the off-site emergency planning area to be based on a robust site specific technical identification and evaluation of the hazards and risks presented by each individual site and, as such, these indicative generic distances are not applied in the UK (although they do provide a comparator, albeit of limited value).
- b) IAEA guidance is based on consideration of extreme accidents, whereas the UK legal framework, as set out in REPPIR, requires detailed planning areas to be based on reasonably foreseeable events (more frequent but less severe events).
- c) IAEA guidance is based on restricting severe deterministic doses (i.e. relatively high doses accrued over a shorter period), whereas REPPIR is based on restricting doses, so far as is reasonably practicable, to everyone who may be affected by a radiation emergency, where a radiation emergency is defined in the UK as an emergency with the potential for an accrued dose of 5 mSv or more in the year following the emergency (or other relatively low dose criteria). This is a far lower dose threshold in the range of stochastic (random or chance) effects only.
- d) The ‘5 mSv in the year following the emergency’ criteria, relating to the definition of a ‘...reasonably foreseeable radiation emergency’ in UK legislation (REPPIR), is based on European EURATOM Basic Safety Standards (reference 17) and is broadly supported (of the same order of magnitude) by Public Health England (PHE) (reference 28), which recommends that

significant countermeasures '....should be offset by a correspondingly significant level of anticipated dose averted (i.e. at least 10 mSv in the first year). Less disruptive or resource intensive measures could be considered for averting lower levels of dose.'

- e) Both the IAEA guidance and ONR's principles for determination of the REPPIR off-site emergency planning area (and related guidance) (references 21, 22 and 15) indicate that areas should take account of a range of factors (e.g. geographical factors and electoral boundaries etc.).
- f) UK radiological emergency planning arrangements are complemented by arrangements available under the Civil Contingencies Act (2004) (reference 29), and the developing concept of extendibility (i.e. the concept of planning for emergencies beyond those that are reasonably foreseeable, with the possibility of outline planning to implement dose reduction measures beyond the REPPIR off-site emergency planning area in the highly improbable event of a more severe emergency). UK regulatory guidance states that off-site plans prepared under REPPIR should include a framework for such scalability

In summary, whilst UK legislation (in the form of REPPIR) does not seek to adopt the prescriptive aspects of GS-G-2.1, and noting its limited relevance given the legislative approach taken in the UK, it is of interest that the areas determined within this report falls within the international good practice ranges.

## **6.6 CONSIDERATION OF BENEFITS AND DIS-BENEFITS OF DOSE REDUCTION MEASURES (INCLUDING COUNTERMEASURES)**

The ONR TAG (reference 15) states that:

*“Countermeasures can, in some circumstances, convey risks as well as benefits to the individuals to whom they may be applied. ONR considers that the REPPIR off-site emergency planning area (formerly DEPZ) should consider an appropriate balance between the benefits of dose aversion and the potential dis-benefits associated with implementing immediate countermeasures in a radiation emergency across too wide an area.”*

ONR acknowledges that there are benefits and dis-benefits associated with an increase or decrease in the size of the REPPIR off-site emergency planning area. These were identified and considered as follows:

Noting that REPPIR requires that the off-site emergency planning area must, as a minimum, include all of the area around the sites 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) the considerations are:

- an area of the minimum size might be beneficial as emergency responders would be able to focus their efforts on delivering dose reduction measures (including countermeasures) in a concentrated manner across a smaller population and geographical area;
- a larger area (e.g. that, for instance, extended to avoid bisection of local communities or to include a vulnerable group) might be perceived as providing safety benefits to a larger population;
- however, a larger area would be judged to have the potential to compromise the effectiveness and timeliness of some of the emergency arrangements; and
- a larger area might be perceived as requiring the application of countermeasures across more people than may be necessary (with any risks that could be presented by such measures). This notwithstanding, REPPIR provides the local authority with the flexibility to determine (in consultation with others) exactly what countermeasures and dose restriction measures should be

planned for in a proportionate and targeted manner. REPPIR does not require that identical measures be applied to everyone within the REPPIR off-site emergency planning area, and allows the targeting of specific dose reduction measures to specific sub-populations within the area.

The area around the Loch Ewe Operational Berth is scrubland and the waters of Loch Ewe, and is sparsely populated. To extend the area to include a significantly greater number of residents would result in a significant increase in the area covered to some 6 km from the berth point. Extending this area, would result in around 1000 additional people being addressed in the off-site emergency plan compared to the current 135 within the 1.5km radial area.

**Conclusion 9:** Taking into account the benefits and dis-benefits of the application of emergency dose reduction measures it is judged that extension of the REPPIR off-site emergency planning area to include the adjacent residential dwellings only is appropriate. I consider that any further extension of the area is not appropriate and would result in an excessive and disproportionately large area.

## 6.7 OTHER SITE SPECIFIC FACTORS OF WHICH ONR IS AWARE

The ONR TAG (reference 15) states that:

*“ONR will also consider, in determining REPPIR off-site emergency planning areas (formerly DEPZs), any additional site-specific factors that it considers relevant on a case-by-case basis.”*

I have considered local planning applications for the Aultbea area that could have an effect on the emergency planning area. I have noted that planning permission was granted on 17<sup>th</sup> February 2016 for the erection of a community centre (reference 15/02864/FUL) on land to the South West of the existing Aultbea village hall.

Taking this application into account, I consider it appropriate to include the land and the car park that the proposed development will cover in the off-site emergency planning area.

I also note planning permission was granted (reference 15/02409/FUL) on 14<sup>th</sup> October 2015 for the erection of a house on the Isle of Ewe. This development is close to an existing dwelling and is within the cultivated land area, and approximately 350 metres from the 1.5km boundary. I have consulted the COMAH Off-site Emergency Plan (reference 30) for the Oil Storage Depot to ensure any properties detailed within that plan are also included in the REPPIR emergency planning area. There were no additional properties that were required to be included.

ONR has not been advised, by the relevant local authority or the Operational Berth duty holder of any other site specific factors that it considers relevant to the determination of the REPPIR off-site emergency planning area.

**Conclusion 10:** I consider it appropriate to take into account permitted planning applications in the Aultbea and Isle of Ewe areas and the COMAH Off-site Emergency Plan for the Oil Storage Depot in the determination of the REPPIR off-site emergency planning area for the Loch Ewe Operational Berth.

## 7 CONCLUSIONS

This report sets out the main considerations that ONR has given to determining revised REPPIR off-site emergency planning and prior information areas for the Loch Ewe Operational Berth. It takes due account of the findings of the latest MOD RoA/ HIRE for the NRP, DNSR's

and ONR's detailed assessments of it, and of ONR's principles and guidance for undertaking such determinations.

The process of determination of a REPPIR off-site emergency planning area requires regulatory judgement to balance a broad range of technical, practical, and strategic factors (which may, of themselves, require that judgements, estimations, and assumptions be made).

In summary, the conclusions of this report are that:

- ONR is satisfied that the technical submissions made by MOD demonstrate that members of the public would not be likely (the legal test provided by REPPIR) to be exposed to effective doses in excess of 5 mSv (or other dose criteria defined in REPPIR Schedule 1), in the year following a reasonably foreseeable radiation emergency, beyond a radial distance of 1.5 km from the Operational Berth at Loch Ewe.
- The single berth at the Petroleum, Oil and Lubricants pier at Loch Ewe will form the basis of a single emergency planning area of 1.5 km radius.
- The REPPIR off-site emergency planning area boundary should be defined on land, so far as is sensible, using physical infrastructure and geographical features, such as roads, rivers or farmland boundaries. For areas where there is no definable geographical feature to use as a boundary, a radial distance from the berth point will be used.
- The extent of the marine area should preferably be described as radii from a defined point, this being the Loch Ewe Operation Berth point.
- At the water's edge the REPPIR off-site emergency planning area boundary should be defined, so far as is sensible, using the Mean Low Water Mark.
- A REPPIR off-site emergency planning area based on a minimum radial distance of 1.5 km from the Loch Ewe Operational Berth will provide for a credible and effective plan to secure the protection of the public and restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency.
- To avoid bisection or segregation of small community groups or large facilities, I consider it appropriate to include additional properties in the village of Aultbea including Tighnafiline and Badfearn, the cultivated farm land on the Isle of Ewe, and the whole of the Oil Storage Depot in the emergency planning and prior information areas.
- I have considered the nature of the vulnerable groups, their size and distance from the boundary, and I consider that the nursery located in Aultbea should be included in the determined area. I consider it appropriate not to include the school at Bualnaluib due to its distance of 2.5 km from the Operational Berth, and which would lead to an excessively large and disproportionate area.
- Taking into account the benefits and dis-benefits of the application of emergency dose reduction measures it is judged that extension of the REPPIR off-site emergency planning area to include the adjacent residential dwellings only is appropriate. I consider that any further extension of the area is not appropriate and would result in an excessive and disproportionately large area.
- I consider it appropriate to take into account permitted planning applications in the Aultbea and Isle of Ewe areas and the COMAH Off-site Emergency Plan for the Oil Storage Depot in the determination of the REPPIR off-site emergency planning area for the Loch Ewe Operational Berth

Consequently, for emergency planning purposes and in order to ensure appropriate conservatism as regards the protection of the public in the unlikely event of a reasonably foreseeable radiation emergency, the REPPIR off-site emergency planning areas (and the

areas within which prior information must be distributed in accordance with REPPiR regulation 16(1)) are defined as:

The area described by the red line on the map in annex B and generally described as:

*Generally a circular area of 1.5 km radius from the Operational Berth over the marine and non-cultivated land environments. Extending to include those properties lying adjacent to the 1.5 km minimum boundary in Aultbea including properties at Tighnafiline and Badfearn. The area extends to include the cultivated farm land on the Isle of Ewe and the Oil Storage Depot.*

## 8 RECOMMENDATIONS

As a result of the conclusions of this report, the recommendations are that ONR write to:

- Recommendation 1: The Highland Council being the lead local authority to advise that the REPPiR off-site emergency planning area has been determined as the area within the red line on map at annex B. This information should be copied to Navy Command acting as the MOD Operational Berth duty holder.
- Recommendation 2: The Highland Council as the lead local authority confirming the need to update, as required, its detailed emergency plan to adequately cover the areas defined in annex B.
- Recommendation 3: Navy Command acting as the MOD Operational Berth duty holder confirming the requirement to ensure the appropriate provision of prior information to the public within the area defined in annex B. This information should also be copied to The Highland Council as the lead local authority.
- Recommendation 4: Inform by copy of its letter to, Naval Base Commander (Clyde), The Defence Nuclear Safety Regulator, Highland Council Ports Authority, Maritime and Coastguard Agency, Environment Agency, Scottish Environment Protection Agency, Food Standards Agency, Food Standards Scotland, Department of Business, Energy and Industrial Strategy and the Scottish Government of the revised REPPiR off-site emergency planning and information areas.

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## ANNEX A – RELEVANT INFORMATION AND SIGNIFICANT FEATURES

The Loch Ewe Operational Berth is located on the waters of Loch Ewe, within Wester Ross, (Wester Ross, Strathpeffer and Lochalsh council ward) in the Northwest of Scotland. The Loch is within the county boundaries of The Highland Council.

The area encompassed by the 1.5 km radial distance from the berth point is sparsely populated, and includes a small number of residential properties of Aultbea, Drumchork, and a proportion of the farm on the Isle of Ewe. The boundary bisects the Oil and Pipelines Agency oil storage depot, which is an Upper tier COMAH site. Approximately half of the encompassed area is over the waters of Loch Ewe.

Local population, facilities and features surrounding the Loch Ewe Operational Berth are detailed in the following tables.

**Table 1 – Populations within 1.5 km of the Loch Ewe Operational Berth Point**

Within 1.5 km of the Loch Ewe Berth point	
HSL supplied population data for the REPPiR emergency planning area of the Loch Ewe Operational Berth. All figures are approximate values.	
Residential Population (day time, term time)	85
Residential Population (day time, non-term time)	91
Residential Population (night time, term time)	135
Residential Population (night time, non-term time)	135
Care home population (number of properties)	23 (1)
Other features and facilities (Local Authority and ONR compiled) Any population figures are approximate.	
Oil Storage Depot which is an Upper tier COMAH site.	
Two small hotels – Aultbea Hotel (10 rooms) and the Drumchork Lodge Hotel.	
Loch Ewe Distillery – attached to the Drumchork Lodge Hotel.	
Aultbea Holiday Lodges – five holiday lodges.	
Aultbea Harbour – potential for small fishing boats to be present.	

**Table 2 - Populations within the area shown in annex B around the Loch Ewe Operational Berth Point**

Within the ONR determined area around the Loch Ewe Berth Point	
HSL supplied population data for the REPPiR emergency planning area of the Loch Ewe Operational Berth. All figures are approximate values.	
Residential Population - day time, term time	156
Residential Population - day time, non-term time	181
Residential Population - night time, term time	295
Residential Population - night time, non-term time	295
Care home population – (number of properties)	23 (1)
Aultbea Nursery – number of children	10

**Table 3 – Information of other features or facilities of interest within the area shown in annex B around the Loch Ewe Operational Berth Point**

There are no additional features or facilities of interest within the area shown in annex B that have not already been detailed.
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**Table 4 – Information of other features or facilities of interest in the Loch Ewe Area**

Other features for note in the Loch Ewe area.	
Population / Town / Feature / Facility of Interest	Comment
Bualnaluib Primary School	Small primary school (17 pupils) approximately 2.5 km from the berth.
Ormiscaig	Small area of distributed dwellings approximately 3.2 km from the berth
Mellon Charles	Small crofting and fishing hamlet stretching between 3.6 and 5.6 km from the berth. Approximate population of 100.
Ewe Canoe	Small canoe and kayak paddling adventure business operating from the shores of Loch Ewe
Tournaig	Small crofting and fishing hamlet approximately 4km from the berth
Inverasdale	Small hamlet approximately 4.8km from the berth
Laide	Small village of approximately 120 population, 5km from the berth
Midtown Brae	Small hamlet south of Inverasdale, 5.4km from the berth
Poolewe	Small village of approximately 230 population, 6.5km from the berth
Poolewe Hotel	Small hotel (12 rooms) with restaurant located in Poolewe.
Cove	Small hamlet, 7km from the berth
Gairloch	Large village of approximately 740 population, 7.8km from the berth
Gairloch Hotel	70 room hotel and restaurant located in Gairloch.

Population figures have been obtained from information publically available online and use of the 2011 Census data where available and are approximate. Population figures are not available for the very small hamlets due to the size of the postcode areas.

## ANNEX B - MAP

### Loch Ewe Area

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

*Generally a circular area of 1.5 km radius from the Operational Berth over the marine and non-cultivated land environments. Extending to include those properties lying adjacent to the 1.5 km minimum boundary in Aultbea including properties at Tighnafiline and Badfearn. The area extends to include the cultivated farm land on the Isle of Ewe and the Oil Storage Depot.*

