Office for Nuclear Regulation

This is the ONR process for assessment of REPPIR 2001 submissions and not the process ONR use for REPPIR 2019 assessments. It will inform development of a revised process for REPPIR 2019, intended for publication in 2020. In the meantime, assessments under REPPIR 2019 will be against the requirements of the Regulations and the associated ACoP and Guidance. If you have questions or queries please e-mail REPPIR19Compliance@onr.gov.uk

ONR GUIDE			
THE TECHNICAL ASSESSMENT OF REPPIR SUBMISSIONS and THE DETERMINATION OF DETAILED EMERGENCY PLANNING ZONES			
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1. INTRODUCTION

1.1 ONR has established its Safety Assessment Principles (SAPs) which apply to the assessment by ONR specialist inspectors of safety cases for nuclear facilities that may be operated by potential licensees, existing licensees, or other duty-holders. The principles presented in the SAPs are supported by a suite of guides to further assist ONR's inspectors in their technical assessment work in support of making regulatory judgements and decisions. This technical assessment guide is one of these guides.

2. PURPOSE AND SCOPE

2.1 The purpose of this TAG is to provide advice to ONR inspectors to assist their judgement in:

a) Determining whether an operator[1] has met the requirements of the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) [1] by providing appropriate technical information upon which emergency preparedness can be based; and

b) Application of ONR's principles for determining the area around nuclear facilities in the UK where an off-site emergency plan is required. This area is referred to as the Detailed Emergency Planning Zone (DEPZ).

2.2 The purpose of REPPIR is to provide a legal framework for proportionate emergency planning, for the protection of the public from reasonably foreseeable 'radiation emergencies'. However, radiation emergencies which are more severe than those considered to be reasonably foreseeable could in principle occur. It is good practice for the emergency plan to also provide the basis for dealing with radiation emergencies which are not reasonably foreseeable through the concept of extendibility. Adopting this approach will ensure arrangements are in place to respond to situations where the emergency may be more severe to that predicted and additional measures may be needed. The arrangements will not be as detailed as those for the reasonably foreseeable event but will provide a framework for extending the response.

2.3 There are broadly three parts to ONR assessing operators' compliance with REPPIR. They are:

a) A technical assessment to determine whether they have legal duties under REPPIR or not and, if so, to verify the identification and to characterise the likelihood, nature and magnitude of the radiation related hazards and risks that may result from a reasonably foreseeable radiation emergency;

b) Consideration of practical and strategic factors that should be taken into account when determining the extent of off-site emergency planning; and

[1] "Operator" for the purposes of REPPIR means, in relation to a site licensed under the Nuclear Installations Act 1965, the licensee, and in relation to all other sites the person who controls in the course of a business, trade or other undertaking, the operation of the premises. For this guidance references to the "operator" are to a licensee or an authorisee where the quantity of radioactive material held on the site exceeds the REPPIR thresholds.

c) Ensuring the provision of suitable emergency arrangements for reasonably foreseeable radiation emergencies.

2.4 This TAG addresses the first two of these three parts, by providing guidance to ONR inspectors for assessing Reports of Assessment (RoA).

2.5 If the operator has duties under REPPIR, it is the responsibility of the operator to undertake a HIRE and submit an RoA to ONR. The operator's RoA must include the details in Schedule 5 and this information will inform the off-site emergency plan, although the production of the off-site plan is the responsibility of the Local Authority (LA) (REPPIR Regulations 9 and 11).

Scope

2.6 REPPIR defines two categories of person as having duties to undertake REPPIR assessments under the Regulations, namely operators and carriers. Operators are defined as employers that have control of "premises", or are licensees under the Nuclear Installations Act 1965 (NIA65) [25] (Regulation 2(2)). For the purposes of this guidance this includes MoD authorised sites. Carriers are defined as employers that transport radioactive materials (Regulation 2(1)). This guidance does not address carriers or other transport operations between licensed sites by land, sea or air.

2.7 For the purposes of this guidance, premises includes fixed and mobile nuclear reactors, the facilities supporting fixed nuclear reactors, the shore facilities supporting mobile nuclear reactors when berthed or docked, facilities for producing, handling, reprocessing and storing fuel, facilities for the management of nuclear waste and those being decommissioned, and defence-related facilities using nuclear materials for the manufacture of weapons. It should be noted that the definition of premises used in this guidance also includes the transport of radioactive materials between facilities within a licensed site. The full definition for "premises" is to be found in REPPIR guidance [2]. It should be noted that REPPIR guidance [2] includes premises that are not licensed under the NIA65, such as hospitals, for which ONR is not the enforcing authority. These premises are therefore outside the scope of this TAG. Generally Reference [2] provides extensive guidance on the interpretation of the REPPIR legislation.

2.8 It should be noted that REPPIR also places legal duties on other organisations such as LAs, not just those who have REPPIR operators within their boundaries, and employers of people who intervene in a radiation emergency, such as the emergency services. However, the scope of this TAG is limited to considering the technical assessment which provides the basis upon which Detailed Emergency Planning Zone (DEPZ) is determined, and does not consider the nature of the subsequent off-site emergency plan.

3. RELATIONSHIP TO LICENCE AND OTHER RELEVANT LEGISLATION

3.1 The Nuclear Site Licence Conditions (LCs) place legal requirements on the licensee to make and implement arrangements to ensure that safety is being managed adequately.

3.2 The principal licence conditions relevant to REPPIR submissions and the provision of emergency arrangements are LC11 and LC9. LC11 (Emergency Arrangements)

requires the licensee to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects. LC11 also requires the licensee to consult with all other relevant persons or organisations where their assistance or co-operation is needed. In practice, this includes the relevant LAs, the emergency services and other adjacent hazardous installations. LC11 puts a requirement on the licensee to exercise its emergency arrangements at appropriate intervals, and to ensure that all employees of the licensee who have emergency arrangement duties are properly instructed and trained.

3.3 LC9 (Instructions to Persons on the Site) requires that every person authorised to be on the licensed site receives adequate instructions on the actions to be taken in the event of an accident or emergency on the site.

3.4 REPPIR presents the legal framework for protection of the public through emergency preparedness for all radiation accidents. REPPIR implements part of Council Directive 96/29 Euratom laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation [23], and Council Directive 89/618/Euratom on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency [24].

3.5 REPPIR addresses the need for both on-site and off-site emergency planning. For operators of nuclear licensed sites the requirement for an on-site emergency plan is also covered by the existing nuclear site licence conditions (LC11 and LC9). For operators of nuclear licensed sites, compliance with the LCs should satisfy equivalent provisions in REPPIR. For operators of nuclear licensed sites where the RoA concludes a reasonably foreseeable emergency exists REPPIR mandates additional legal requirements for off-site emergency planning and the provision of information to the public.

4. RELATIONSHIP TO SAPS, WENRA REFERENCE LEVELS AND IAEA SAFETY STANDARDS ADDRESSED

ONR Safety Assessment Principles (SAPs) [3]

4.1 Principles FP.7 (Emergency Preparedness and Response) and AM.1 (Accident Management and Emergency Preparedness) are relevant to support the demonstration of compliance with LC11 and REPPIR. These Principles state that a nuclear facility should be designed and operated to ensure that it meets the needs of accident management and emergency preparedness. Emergency preparedness provides the final level of defence-in-depth to ensure that all reasonably practicable measures have been taken to safeguard individuals and society from nuclear accidents. This is highlighted as Level 5 defence-in-depth in Table 1 Principle EKP.3 (Defence in Depth) [3]. For new nuclear facilities, the Principles ST.3 to ST.6 [3] which describe the expectations for the siting of these plants, will also be relevant to emergency planning.

4.2 It should be noted that this guidance is not concerned with the assessment of accident management information, but assumes this is in place via the safety case. It is the appropriate use of this information to produce an adequate HIRE that is discussed.

4.3 The operator's safety case for a nuclear facility may be the source of most of the information needed to inform the contents of a HIRE. Therefore many of the SAPs associated with safety cases are relevant. This includes the SAPs for severe accidents and Probabilistic Safety Assessment (PSA). Severe accident analysis, proportionate to the complexity of the plant, processes and fault sequences, will be

needed to characterise off-site releases, and PSA will provide information on the likelihood of these releases and the radiation doses to the public. This information is important for informing a HIRE. For this TAG it is assumed that the safety case methods used and their validation has been judged adequate. However, inspectors may wish to question the basis for this, should the application of relevant safety case information to a HIRE appear unsuitable. The following ONR TAGs are particularly relevant: NS-TAST-GD-030 (Probabilistic Safety Analysis) [4], NS-TAST-GD-042 (Validation of Computer Codes and Calculation Methods) [5] and NS-TAST-GD-045 (Radiological Analysis – Fault Conditions) [6].

4.4 The full range of applicable SAPs is not listed here, although the following SAPs are noted to be particularly relevant to an adequate HIRE:

- FA.2 (Identification of Initiating Faults) and FA.3 (Fault Sequences). It is important that a comprehensive review of potential fault sequences is undertaken to identify those that could give rise to a radiation emergency.

- AV.1 (Theoretical Models), AV.2 (Calculation Methods), and AV.4 (Computer Models). For HIRE documents, these SAPs relate to the use of dispersion modelling and estimates of radiation dose to the public.

- AV.6 (Sensitivity Studies). The exploration of cliff-edge effects on fault sequences is important to inform the judgement of what is a reasonably foreseeable accident.

- SC.7 (Safety Case Maintenance). It is important to understand the implications of any shortfalls against modern standards that may apply to facilities built to earlier standards. These shortfalls may significantly influence the judgement of what fault sequences are reasonably foreseeable. The process of Periodic Safety Review (PSR), as discussed under SAP SC.7 and required by LC15 (Periodic Review) may assist this understanding of any shortfalls. ONR TAG NS-TAST-GD-050 (Periodic Safety Reviews) [7] is thus also relevant here.

WENRA Reference Levels

4.5 The Reactor Harmonization Working Group of the Western European Nuclear Regulators Association (WENRA) updated its Reactor Safety Reference Levels in 2014 [8], incorporating lessons learned from Fukushima Dai-ichi accident (Issue R). This does not include information relevant to off-site emergency preparedness, only on-site emergency preparedness.

IAEA Standards

4.6 There are a number of IAEA publications that are highly relevant to emergency preparedness [9], [10] and [11]. These documents contain a very broad scope of information covering all aspects of emergency planning and preparedness. However, the following aspects of these documents are directly relevant to this guidance which addresses the technical basis of the work used to guide emergency planners.

4.7 Principle 9 from [9] (Emergency Preparedness and Response) states that when developing the emergency response arrangements, consideration must be given to all reasonably foreseeable accidents, such that the consequences from radiation

risks would be minor, and for any incidents that do occur, practical measures must be taken to mitigate any consequences that may arise.

4.8 Reference [10] outlines a series of high level requirements for preparedness and response for a nuclear or radiological emergency that includes consideration of "very low probability" events, and a proportionate approach to emergency preparedness which is commensurate with the potential magnitude of the hazard.

4.9 This guidance reflects IAEA safety standards in describing how a proportionate approach is applied, addresses ONR's interpretation of reasonably foreseeable, and presents our expectations for the comprehensiveness of the hazard review relevant to RoA and HIREs.

4.10 The IAEA Safety Standards were used to benchmark the 2014 review of ONR's SAPs, and were also used to derive the WENRA reference levels discussed above.

4.11 IAEA guidance [11] describes two emergency planning zones and associates a range of radial distances with these two zones. These two zones, a Precautionary action zone (PAZ) and an Urgent protective action planning zone (UPZ), have certain features similar to the area affected by a radiation emergency, the DEPZ required by REPPIR, and a more extensive area which relevant good practice in the UK may use to address the extendibility of detailed plans.

4.12 ONR's determination of the area affected within REPPIR acknowledges this IAEA guidance but may conclude that the area affected should differ from the range of distances outlined in the IAEA guidance [11]. This is because the technical basis for REPPIR differs from that used by the IAEA, as follows:

- The IAEA approach is based on restricting severe deterministic effects from high radiation doses incurred off the site, typically doses in excess of 1 Gy. Whereas REPPIR is based on restricting off-site effective doses in excess of 5 mSv.
- The IAEA approach addresses very unlikely high consequence events, whereas REPPIR is based on the concept of reasonably foreseeable radiation emergencies It is this concept of extendibility within the UK framework for nuclear emergency planning which provides the basis for dealing with the very unlikely high consequence events which affect a large area and is covered in REPPIR guidance..
- The IAEA approach [11] (Table 8 footnote a) contains the provisions for use of alternative distances if substantiated by a detailed safety analysis. REPPIR requires such detailed analysis for UK nuclear facilities.
- The IAEA Integrated Regulatory Review Service acknowledged in 2009 [12] (and in 2013 [26]) that "the UK's planning zones achieve an equivalent capability to those of IAEA, but the terminology used is different."

Both the IAEA guidance and ONR's principles for determining the area for emergency planning around nuclear facilities (Annex 2) require consideration of local and relevant strategic factors that will often result in planning zones that are not perfectly circular. In addition, the extent of this area may be affected by the need to secure consistency with the principles described in Annex 2.

5. ADVICE TO INSPECTORS

5.1 The key principles and guidance presented below should be read in conjunction with the supporting information presented in Annexes 1 and 2. All the Regulations quoted below refer to REPPIR.

Main Duties of ONR

5.2 ONR has the following key duties:

- ONR is empowered under Regulations 9(1) and 16(1) to determine the areas of the Detailed Emergency planning Zone (DEPZ) and Public Information Zone (PIZ). ONR will liaise with relevant organisations on this issue prior to informing the Local Authority of the area of the DEPZ and the operator of the area of the PIZ. ONR's technical assessment of the operator's RoA is important for informing these decisions, with specific guidance for this included in Annex 1. ONR will also ensure that, in determining any DEPZ, that it considers and applies the principles and guidance set out in Annex 2. Although the area of the PIZ could be larger than the DEPZ, the assessment parameters are usually the same and in practice the areas defined are usually the same.

- The operator is required under Regulation 16(6) to make the RoA available to the public. However, certain information within the operator's REPPIR submission may be withheld, for example, where national defence, public security, commercial or personal confidentiality may be compromised if it were published. The withholding of information is subject to the approval of ONR.

- Regulation 6(5) provides ONR with the legal authority to require further work to be undertaken by the operator if required to assess the hazard identification and risk evaluation to which Regulation 4 applies.

Main Duties of an Operator/Licensee

5.3 The main duties of an operator addressed in this guidance are:

- Determine whether the operators "work with ionising radiation" (within the meaning of REPPIR) requires having on the premises radioactive substances containing more than the threshold amounts of radionuclides specified in Schedule 2 to REPPIR, or in the case of fissile material, more than the mass of material specified in Schedule 3 to REPPIR. If so, then REPPIR applies. This consideration also applies to an operator providing facilities for future work with ionising radiation of the specified amounts.

- If REPPIR applies then the operator is required to undertake a HIRE (Regulation 4) of its work with ionising radiation and determine whether there is the potential for a radiation emergency.

- If the HIRE shows that a radiation emergency can occur, then determine whether a radiation emergency is reasonably foreseeable.

- If a reasonably foreseeable radiation emergency might arise, an on-site and off-site emergency plan is required. The operator must provide appropriate

information to the LA who will formulate the off-site emergency plan (to cover the extent of the DEPZ determined by ONR).

- The operator is also required to submit an RoA summarising the HIRE to ONR in accordance with Regulation 6 and Schedule 5.

- The operator is required to review its REPPIR submission where there are material changes to the work with ionising radiation, or otherwise within 3 years of the previous RoA, and provide the results of this review to ONR (Regulation 5).

Technical Assessment of REPPIR Submissions

5.4 The information provided in the RoA should enable ONR to form a view that a detailed emergency plan for reasonably foreseeable radiation emergencies is required.

5.5 ONR considers that the ROA informs, rather than prescribes, emergency planning decisions because of the uncertainties associated with the completeness, likelihood and consequences inherent within accident analysis.

5.6 ONR expects that RoAs shall cover all the particulars required under Schedule 5 (Regulation 6(4)), and that HIREs shall:

- Provide sufficient information for ONR to be able to confirm the conclusions reached ([2], paragraph 465).

- Determine whether a Radiation Emergency can occur on the premises.

- Determine whether a Radiation Emergency is Reasonably Foreseeable.

- Address the full range of potential radiation accidents that could occur – plant hazards, internal hazards, external hazards and unauthorised behaviour of employees or the public. Consider dependent failures, uncertainty, sensitivity studies, cliff-edge effects and the potential for multiple releases.

- Provide information on the likely area to be affected by the dispersal of any radioactive substance as a result of any radiation emergency and the period of time over which such dispersal is likely to take place.

5.7 Under Regulation 6(5) the ONR technical assessor may request additional assessments by the operator of the particulars specified in Schedule 6.

Determining the Detailed Emergency Planning Zone (DEPZ) and Public Information Zone (PIZ).

5.8 To determine the size of the DEPZ and PIZ ONR will take the following approach:

- Review the RoA, or the statement of no change, using the guidance contained in Annex 1, to determine the adequacy of the technical argument supporting

the extent to which any member of the public is likely to receive a radiation dose equivalent to or greater than the doses specified in Schedule 1. The ONR specialist inspector assessing the RoA will make a recommendation on the minimum size of the DEPZ, based on the technical argument, to the ONR Emergency Preparedness and Response (EP&R) team.

- The ONR EP&R team will also review the recommended size of the DEPZ in accordance with its principles and guidance of their application contained in Annex 2, and will modify any initial recommendation as it judges necessary to secure compliance with these principles.

- The ONR EP&R team will liaise with the LA and such other relevant organisations as it may see fit prior to determining the DEPZ and PIZ.

5.9 Upon completion of the above process ONR may judge the size of the DEPZ to be different to that which may have been proposed within the operator's submission, in order to achieve a workable and practical plan that complies with ONR's principles appropriate to secure confidence as regards protection of the public.

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7. GLOSSARY AND ABBREVIATIONS

Bq	Becquerel. The SI unit of activity, equal to one transformation per second.
CNS	The Civil Nuclear Security team within ONR.
DEPZ	Detailed Emergency Planning Zone. The area around a facility for which a detailed emergency plan is required to provide an effective response for the protection of the public from any radiation emergency which could be reasonably foreseen. The area is determined by an ONR judgement which combines technical assessment of the plant and its operating procedures, site specific factors, together with other factors considered by the ONR Emergency Preparedness and Response Team, including IAEA guidance.
DNSR	Defence Nuclear Safety Regulator. MoD's internal regulator for nuclear safety.
Extendibility	The principle of providing an emergency plan which can be used to extend countermeasures for radiation emergencies with consequences beyond the DEPZ. These accidents are larger, but less likely than those which define the DEPZ and are not reasonably foreseeable.
HIRE	Hazard Identification and Risk Evaluation. The identification of hazards and their evaluation to comply with regulation 4 of REPPIR 2001.
HSE	Health and Safety Executive.
IAEA	International Atomic Energy Agency.
IRR	Ionising Radiation Regulations, 2017.
Licensee	The body corporate that has been granted a Nuclear Site Licence under the Nuclear Installations Act 1965 (as amended), which permits it to carry out a defined scope of activities in a delineated site.
LCs	Licence Conditions. The set of conditions attached to a Nuclear Site Licence.
LA	Local Authority. REPPIR 2001 requires the LA to prepare a written off-site emergency plan to address reasonably foreseeable radiation emergencies (regulation 9(1)).

mSv	millisievert. One thousandth of a sievert (Sv). The sievert is the standard international unit of absorbed radiation dose which takes into account the different biological effects of different types of radiation. As the sievert is a very large unit, the millisievert is usually a more practical unit to work with.
MHSWR	The Management of Health and Safety at Work Regulations, 1999.
NEPLG	Nuclear Emergency Planning Liaison Group.
NII	Nuclear Installations Inspectorate.
ONR	Office for Nuclear Regulation (includes former NII).
Operator	REPPIR 2001 regulation 2(3): "In these Regulations, any reference to an operator is a reference to: (a) in relation to any premises other than a licensed site, the person who is, in the course of a trade, business or other undertaking carried on by him, in control of the operation of premises, and (b) in relation to a licensed site, the licensee …".
Premises	One or more installations, such as buildings or facilities where radioactivesubstances are produced, used, handled or stored, or a licensed site. The definition is amplified in paragraphs 36 to 45 of REPPIR 2001.
PIZ	Public Information Zone. The area around a facility for which an operator is required to ensure the provision of specified prior information to the public, without them having to ask for it. Like the DEPZ, the area is determined by an ONR judgement which combines technical assessment of the plant and its operating procedures, site specific factors, together with other factors considered by the ONR Emergency Preparedness and Response Team, including IAEA guidance.
Radiation Emergency	Any event (other than a pre-existing situation) which is likely to result in any member of the public being exposed to ionising radiation arising from that event in excess of any of the doses set out in Schedule 1 to REPPIR and for this purpose, any health protection measure to be taken during the 24 hours immediately following the event shall be disregarded. Schedule 1 specifies an effective dose of 5 mSv over a period of one year immediately following the radiation emergency. The full definition in Schedule 1 includes equivalent dose to the lens of the eye and skin.
Reasonably Foreseeable	In the context of a radiation emergency, a reasonably foreseeable event is one which is less than likely but realistically possible.
Reference Accident	One of a spectrum of reasonably foreseeable radiation emergencies that gives rise to the most significant off-site consequences.
RoA	Report of Assessment. A written report which must be sent to ONR under regulation 6(1) of REPPIR at least 12 months before beginning work with ionising radiation. The RoA must, among other things, conclude whether a radiation emergency is reasonably foreseeable, and whether an off-site emergency plan is needed.
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001.

SINS	The Security Informed Nuclear Safety team within ONR.
Source Term	A source term defines the amount of radioactive material released, including other associated characteristics such as the containment failure mode, timing, duration and elevation above ground level.
TAG	Technical Assessment Guide. ONR internal guidance to inspectors.
WENRA	Western European Nuclear Regulators' Association.

8. APPENDICES

ANNEX 1

ONR's TECHNICAL ASSESSMENT OF REPPIR SUBMISSIONS – DETAILED ADVICE TO INSPECTORS

HIRE and Report of Assessment (RoA)

A1 Regulations 4(1), 5(1) and 5(2) require operators to carry out a Hazard Identification and Risk Evaluation (HIRE) of their work with ionising radiation and review this where there is a material change, or at least every 3 years. Regulation 6 requires the operator to send an RoA to ONR. It also requires operators to make available to ONR any further detailed assessments which may be requested as described in Schedule 6.

Confidentiality of REPPIR Technical Information

A2 The operator is required under Regulation 16(6) to make the RoA available to the public. The RoA must include the particulars listed in Schedule 5. However, certain information within the operator's REPPIR submission may be withheld, for example, where national defence, public security, commercial or personal confidentiality may be compromised if it were published. The onus is on the operator to justify the need to keep information confidential (Regulation 16(6)). Operators should identify such information and obtain ONR approval for it to be withheld.

The Role of REPPIR Submissions

A3 ONR considers that an operator's RoA and ONR's technical assessment of them inform, rather than prescribe, emergency planning decisions. This view arises because of the uncertainties associated with the completeness, frequency and consequences of severe accident analysis. The assessment approach described below recognises uncertainty and ensures that sufficient technical information is available to support emergency preparedness decisions.

To Whom Does REPPIR Apply?

A4 To decide if REPPIR applies, operators working with ionising radiation (as defined by REPPIR) will initially need to identify the quantities of radionuclides or fissile material present, or for which facilities are provided for there to be present, and compare them with threshold quantities given in Schedules 2 and 3 for premises (Schedule 4 applies to transport operations which is outside the scope of this guidance).

A5 The threshold values are derived in [13] which estimates the amount of radioactive material needed to be released to cause any member of the public to receive a radiation dose equivalent to or greater that the doses specified in Schedule 1. ONR would expect the member of the public to be located at the nearest approach to the release consistent with the position of the site boundary. If the threshold quantities are exceeded, there is the potential for an off-site radiation hazard of significance, and the regulations relating to emergency planning will apply. (If the threshold values are not exceeded a demonstration of this should be submitted to ONR within the RoA, including the management arrangements that ensure this will be achieved.)

A6 The threshold values, given in units of Becquerels in REPPIR Schedules 2 and 3 for premises, arise from quantities of radioactive material of the order a few grammes. Therefore it is to be expected that most Licensees will have legal duties under REPPIR.

A7 When undertaking the assessment required by regulation 4(1), regulation 3(4) [2] makes clear that certain radioactive sources or radioactive substances can be disregarded. These include:

- non-dispersible sources, within the meaning in REPPIR Regulation 2(1). This is discussed further in A10 to A12 below
- any radioactive substances which have an activity concentration less than 100 Bq/g. (However, for operators working with unirradiated natural or depleted uranium, [2] guidance paragraphs 84 to 87 should be considered by inspectors, as the activity concentrations of radioactive daughters need to be accounted for when considering the application of REPPIR.)

Non-Dispersible Sources

A8 A “non-dispersible source” for the purposes of REPPIR is a sealed source or radioactive substance which, by virtue of its physical and chemical form, is incapable of a significant release into the atmosphere, water courses or sewers and cannot cause a reasonably foreseeable radiation emergency. A non-dispersible source does not include any radioactive substance inside a nuclear reactor or any nuclear fuel element.

A9 If an operator considers that all the radioactive substances used satisfy the requirements of non-dispersibility, it must complete an assessment to confirm this conclusion. This is a general requirement of the Management of Health and Safety at Work Regulations 1999 (MHSWR) [14]. In particular, ONR expects operators to be able to confirm that it is the robustness and/or chemical inertness of the radioactive substances they use that make them non-dispersible rather than the low public exposure risk that results from a ‘dispersive’ event such as a fire, although this is a relevant factor. Inspectors can refer to additional guidance for addressing such assessments, which is contained in Regulation 2(1) paragraphs 32 to 35 and Figures 1 and 2 in Appendix 1 of [2].

A10 Operators need not take into account such sources when calculating whether REPPIR apply to their premises. However, non-dispersible sources can still give rise to direct shine hazards and should be dealt with under the Ionising Radiations Regulations 2017 (IRR17) [22] and the Management of Health and Safety at Work Regulations 1999 [14].

Radiation Emergency

A11 REPPIR (Regulation 2(1) and Schedule 1) and also Reference [2] (Regulation 2(1) paragraphs 47, 52-54 and Schedule 1) provide the definition of a radiation emergency. This can be summarised as an event that is likely to result in a member of the public receiving a radiation dose equivalent to or greater than the doses specified in Schedule 1 during the year immediately following the emergency. Health protection measures during the 24 hours immediately following the event must be disregarded. The accrued dose should include the sum of direct external radiation, internal radiation and/or ingesting contaminated food or drink. ONR expects each pathway to be included unless it can be demonstrated that it is insignificant.

A12 The doses specified in Schedule 1 of the REPPIR guidance [2] includes additional criteria for equivalent dose to the lens of the eye or skin. ONR experience to date shows that it would be unlikely for equivalent dose to the lens of the eye or skin to be the reason for identifying a radiation emergency. However, the operator will need to have considered this possibility.

A13 If ONR agrees that the site or facility-specific HIRE shows that a radiation emergency cannot occur, even though the quantities of radioactive substances exceeds Schedules 2 and 3, detailed off-site emergency planning is not required.

A14 If the site or facility-specific HIRE shows that a radiation emergency can occur, then there is a need for the operator to prepare further technical assessments to address whether the likelihood of a radiation emergency is "reasonably foreseeable". The concept of a reasonably foreseeable radiation emergency is discussed below.

Reasonably Foreseeable Radiation Emergency

A15 REPPIR uses the term "reasonably foreseeable radiation emergency" but does not provide a specific definition for "reasonably foreseeable". However, REPPIR guidance states HSE's view that "in the context of a radiation emergency, a reasonably foreseeable event would be one which was less than likely but realistically possible" (see paragraphs 50 and 51 [2]).

A16 It should be noted that there is no case law from within the nuclear industry or REPPIR which interprets this definition. However, it is noted that this same approach has been used in decided cases outside the nuclear industry, for example in Regina versus Electric Gate Services Ltd [15] and Chargot [16]. Case law outside the nuclear industry and REPPIR suggests that risks which are "too remote", "fanciful" or "trivial" are not "material" and so are too small to be considered reasonably foreseeable. Instead duty holders need to think about material risks, that is those "which any reasonable person would appreciate and take steps to guard against". This view was upheld in the defining judgement in this area, for the case of Regina v Tangerine Confectionery Ltd. and Veolia ES (UK) Ltd. [17], where the judge stressed that duty holders need to "think deliberately about things which are not obvious".

A17 Determining what are the material risks for a complex nuclear plant will not necessarily be an easy matter. The technical information provided by the operator in its REPPIR submissions will therefore perform a key role in determining whether a radiation emergency is reasonably foreseeable or not within the meaning of REPPIR. The content of this aspect of the operator's submission should be consistent with the following guidance.

A18 Historically, HIRE and RoAs have relied on a numerical criterion to identify accidents that are reasonably foreseeable for the purposes of REPPIR. For instance, some operators have assumed that a frequency of 10^{-5}/year or greater is sufficient to define what is reasonably foreseeable. This approach appears to be based upon the view that all internal faults with an initiating frequency $\geq 10^{-5}$/year should be included in the design basis for a modern standards facility. Therefore the likelihood of a modern standards facility (or operation) giving rise to a large radiological consequence with a wide geographical extent should be below 10^{-5}/year.

A19 This approach may have arisen from Principle FA.5 (Initiating Faults) in the SAPs [3]. Principle FA.5 [3] is intended to assist ONR in judging whether a suitable scope of initiating faults has been used within the design basis. In combination with the initiating frequency, the resulting fault sequences will then be analysed conservatively. It should be noted that a HIRE is not a design basis analysis. It should use the existing

safety case information to present a best estimate view of which radiation emergencies are reasonably foreseeable. Because of the best estimate approach, uncertainty analysis requires addressing separately.

A20 ONR considers that reliance upon a particular numerical value to define what is reasonably foreseeable, although appealing to the technical community, is not consistent with the definition of reasonably foreseeable provided in REPPIR guidance, which is not numerically based. It also implies unwarranted precision within best estimate technical risk assessments which are inherently imprecise. It should be noted that some potential radiation emergencies are not amenable to numerical treatment within PSAs, for example those due to unauthorised behaviour of the public or employees. Omission of these hazards can significantly restrict the range of potential accident scenarios that are considered to support emergency planning and undermine the defence in depth philosophy set out in SAPs [3]. It also fails to consider the impact of uncertainty.

A21 ONR therefore considers that technical risk assessments can be used as broad guidance to operators on what accident scenarios are to be considered. The impact of uncertainties to inform the selection of reasonably foreseeable fault sequences should be addressed within HIREs. REPPIR submissions based upon a limited numerical approach should be closely questioned by ONR.

A22 Uncertainty in technical risk assessments applies to both the predicted likelihood of an accident and its consequences. Therefore ONR expects that:

- Fault sequences with a wide range of frequencies should be reviewed to understand whether they can give rise to a radiation emergency. A range of two or three orders of magnitude, potentially more, may be needed to scope the potential accidents that could give rise to a radiation emergency. The range considered should be sufficient to clarify accidents which are reasonably foreseeable and those that are not.

  For example, a risk assessment may identify fault sequences of frequency between 10^{-5}/year and 10^{-6}/year that give rise to public doses ≥ 5 mSv, but no fault sequences with a frequency ≥ 10^{-5}/year (eg. 10^{-4}/year) that could given rise to doses ≥ 5 mSv. In this case ONR would expect that the fault sequences with a frequency smaller than 10^{-5}/year are considered as candidate Reference Accidents, rather than rely upon a single numerical criterion to conclude that no candidate Reference Accidents apply.

- Fault sequences are reviewed to determine whether any “cliff-edge” effects apply to the design of the plant or analysis used, that would change the nature or magnitude of the accident, or the required off-site response - especially just beyond the design basis. Fault sequences that show cliff-edge effects that make the off-site response more severe should be considered as candidate Reference Accidents.

  For example, a facility may rely on containment isolation to reduce the magnitude of the fission products released to the public. Failure to isolate the containment may give rise to a step change in the location of the 5 mSv dose contour. In this case ONR would expect failure of containment isolation to be considered as a candidate Reference Accident. Evidence of the likelihood of containment isolation failing, the robustness of the measures in place, the magnitude of the cliff-edge effect on dose, the impact upon a proportional emergency plan and the overall likelihood of the fault sequences would be

relevant factors ONR would consider to determine whether the radiation emergency was reasonably foreseeable.

A23 ONR considers it important that evidence is provided in RoAs demonstrating that the above process has been undertaken and the observations arising are discussed.

A24 It is important to acknowledge that there are ageing nuclear facilities in the UK which may not have a design which conforms to modern standards, but are operated on the basis that risks are as low as reasonably practicable. ONR would expect that full scrutiny of any shortfalls with respect to modern standards is undertaken when informing the choice of candidate Reference Accidents. This information should be presented in the RoA. An example would be an ageing facility not designed to modern standards for seismic events. The likelihood with which a seismically induced release could occur would need to be determined, and analysis of whether this could give rise to public doses equivalent to or greater than the doses specified in Schedule 1. Understanding cliff-edge effects is also important here because the impact on buildings from a seismic event can range from little damage to collapse.

Reference Accident Philosophy

A25 The concept of a Reference Accident does not explicitly appear in REPPIR. However, it is discussed in REPPIR guidance [2], and current industry practice is to use the Reference Accident approach. ONR's experience of current industry practice lends support to the use of the Reference Accident approach to inform the size of the affected area for radiation emergencies.

A26 The REPPIR guidance [2] under Regulation 16(1) (paragraph 398) states; "Where a recognised reference accident exists for emergency planning for a nuclear licensed site, then this should be taken as the worst reasonably foreseeable radiation emergency." ONR interprets this as a single bounding accident which is taken from a spectrum of reasonably foreseeable accidents that may apply at a particular site. Although a single bounding reference accident needs to be identified, the response to the accident should it occur would need to be tailored to the specific characteristics of the hazard – for example a gamma shine hazard, a uranium or plutonium airborne release or the presence/absence of, say, radioactive iodine.

A27 A spectrum of reasonably foreseeable accidents may be possible at a single site. This is because there may be a collection of different facilities that display a range of accident characteristics. The range of characteristics may include the amount and mix of radioactive substances, the driving force behind the release, containment failure modes, the potential for elevated or ground level releases which give rise to different plume characteristics, or different distances from the boundary fence or local population. ONR therefore expects HIREs to systematically review all facilities and operations on site to identify a bounding Reference Accident that encompasses the others. The bounding Reference Accident should then be used to determine the extend to which any member of the member of the public is likely toreceive a radiation dose equivalent to or greater than the doses specified in Schedule 1.

A28 Common cause failure needs to be considered if this could give rise to more than one candidate Reference Accidents occurring together. An example would be a seismic event, or a large fire, that causes multiple facilities to release radioactive material. The bounding Reference Accident would need to define an appropriate summation of the consequences. HIREs should present the approach and results for identifying both the candidate Reference Accidents and the bounding Reference Accident.

Review of the Operations and Safety Case for Potential Radiation Emergencies

A29 It is important for a HIRE that a comprehensive description of faults and hazards is available for review. If the site or facility in question possesses a modern standard safety case, the fault and hazard identification provided should be acceptable, although this should be confirmed. In the event that a modern standard safety case is not available, a review of shortfalls should have been undertaken by the operator to inform the HIRE. This should be available from a Periodic Review of Safety. Significant shortfalls should be considered in the HIRE and the impact on the choice of candidate Reference Accidents and their consequences discussed.

A30 ONR expects that the full range of potential accidents should be available for informing the HIRE. This should include plant hazards arising from its design and operations, administrative and operator failures, internal hazards and external hazards. External hazards should address both man-made and natural hazards, including those within and outside of the operator's control; this includes seismic events and unauthorised behaviour of employees or the public.

Unauthorised Behaviour of Employees or the Public

A31 It should be noted that REPPIR guidance [2] Regulation 4(1) paragraph 101 states that "potential unauthorised behaviour of employees or the public" should be included in HIRE and RoA. Therefore ONR expects that terrorist and sabotage events should be considered as potential causes of reasonably foreseeable radiation emergencies. This is consistent with the treatment of external hazards within the SAPs [3] (paragraph 208).

A32 It should be noted that robust measures are taken by operators to prevent design basis terrorist or sabotage threats against nuclear facilities being successful. This is regulated by the Civil Nuclear Security (CNS) team within ONR, with advice provided by the ONR Security Informed Nuclear Safety (SINS) team. Although the initiation of a terrorist or sabotage threat may be reasonably foreseeable, ONR is prepared to consider that a successful attack which results in a significant off-site release greater than that from the safety related reference accident is not reasonably foreseeable. However, arguments following this approach would need to be confirmed by liaison with the CNS and SINS teams for particular cases where ONR is the regulator, or by liaison with the Defence Nuclear Safety Regulator (DNSR) where MoD internal security arrangements apply. As a matter of good practice, however, a significant release from a terrorist or sabotage event can be addressed by extendibility. ONR expects that the licensee/authorisee should provide a statement on the approach taken, and conclusions of its assessment of unauthorised behaviour of employees or the public.

Tailoring of the Operator's HIRE and RoA

A33 The methods for the identification of faults and hazards, and the assessment of accident frequencies and consequences are well developed for the safety assessment of nuclear facilities. This guidance assumes that these areas of work are properly represented within the safety cases used to support REPPIR submissions, and they have undergone appropriate due process. ONR expects that a modern standard approach should be used for the technical analysis that supports REPPIR submissions. Guidance on these aspects of safety assessment can be found in other TAGs, notably T/AST/030[4] and T/AST/045[6]. However, a number of key issues for supporting REPPIR submissions are discussed below.

Safety Measures that Reduce the Likelihood of Accidents and/or Radiological Consequences

A34 ONR considers that the operator's HIRE should be undertaken using a suitable best estimate approach where possible. This is because unwarranted conservatism can give rise to a disproportionately extensive emergency plan. It is therefore the mitigated frequency and mitigated consequence that should be used to judge whether a particular fault sequence gives rise to a radiation emergency, or is reasonably foreseeable. This requires appropriate credit to be taken for the safety measures available, both to reduce the frequency of accidents and to reduce their consequences. Only if there is no frequency mitigation available is the likelihood of the accident equal to the initiating event frequency.

The Use of Best Estimate Analysis

A35 It should be noted that conservatism in technical analysis may be used within the safety cases that provide important supporting information for HIRE, for example to simplify analysis or where its use has little impact on the overall safety justification. However, this conservatism may adversely affect the assessment of particular accident sequences relevant to REPPIR submissions. Hence, evidence should be presented that unwarranted conservatism is not being used. Where conservatism is removed for a HIRE assessment, this should be explained and justified.

The Identification of a Radiation Emergency

A36 The definition of a radiation emergency requires the identification of doses equivalent to or greater than the doses specified in Schedule 1 or more to the public. It should be noted that some safety cases may be tailored to suit the licensees numerical criteria and may not specifically address in detail doses of this magnitude. This will depend on the characteristics of the facility, the dominant risks and the risk targets that are applied. It is ONR's expectation that the consequence assessment in the supporting safety case will be appropriately modified to address REPPIR requirements to characterise the extent of the 5 mSv dose contour.

A37 The total radiation exposure to the public will depend upon the magnitude of the release and how long the release lasts until it is brought under control. The facility safety case will make assumptions about the release profile and how long the release will last. This may not be consistent with the requirements of REPPIR guidance [2] which requires a public radiation dose over one year to be derived, with any health protection measures to be taken during the 24 hours immediately following the event disregarded. The hazard analysis of the facility may need to be modified to address this issue. The assumptions regarding occupancy times and location under the plume would need to be justified.

The Use of Consequence Parameters Specified in REPPIR

A38 REPPIR guidance[2] discusses two parameters relevant to the assessment of public dose, and states that:

- The age group giving rise to the highest dose should be chosen (Regulation 2(1) paragraph 61).

- The use of Pasquill Category D weather is common in the UK and suitable for REPPIR application (Regulation 2(1) paragraph 62).

ONR expects the use of these parameters within the HIRE and details of them within the RoA.

Screening Analysis for Multi-Facility Sites

A39 There are sites in GB which comprise many facilities each of which undertake nuclear operations, and nuclear reactor sites which contain multiple plants. Not all these facilities or plants will be capable of giving rise to a radiation emergency. Subject to the need to assess multiple releases at a site (subject to para 41), ONR considers it acceptable for screening analysis to be used to ensure that effort is efficiently concentrated on those facilities that present the greatest hazard. The following approaches are appropriate:

- Screening on very low frequency, providing this does not compromise the understanding of how uncertainty and cliff-edge effects may influence the choice of the bounding reference accident.

- Screening on conservative public dose assessment. The screening criterion would need to be stated, and assurance provided in the RoA that potential radiation emergencies have not been omitted.

Further Technical Considerations

A40 The following issues should be considered when judging whether the technical analysis in a HIRE has been adequately tailored to support REPPIR:

- The available safety measures have been appropriately included.

- Evidence should be presented that unwarranted conservatism is not being used.

- Where conservatism is removed this should be explained and justified.

- The hazard analysis should be tailored to meet REPPIR guidance [2] requirements for the definition of a radiation emergency.

- The duration of the release should be justified, and the mechanism for recovery to achieve this should be consistent with the resources available after the accident.

- The appropriate population age group and weather stability have been used.

- Screening analysis, if used, has been applied appropriately.

Multiple Releases at a Single Site

A41 The potential impact of multiple plants or facilities on the same site should be considered, as well as neighbouring sites for the potential impact on the position of the 5 mSv contour. Common cause failure needs to be considered that may give rise to more than one reasonably foreseeable radiation emergency occurring simultaneously. This particularly applies to internal and external hazards, such as a seismic event, or a large fire/explosion, that causes multiple facilities to release radioactive material. The bounding reasonably foreseeable radiation emergency would need to appropriately encompass the range of off-site consequences.

Adjacent Nuclear Sites

A42 There are sites within GB which contain separate facilities located next to each other, but operated by different organisations. The need for an off-site plan and the size and location of the DEPZ will need to be determined by examination of all the facilities on the combined site, irrespective of who operates the facilities. ONR expects the operators and other employers at the site to cooperate with each other to provide a coherent and consistent presentation in accordance with Regulation 11.

Addressing Uncertainty within Supporting Technical Assessments

A43 There are a large number of parameters needed to model the release of radioactive material from a facility and the resulting doses arising from the dispersion of the material in the atmosphere. The most significant of these is the source term. This will be facility and accident sequence-specific and will often require judgements to be made regarding the containment failure modes, release fractions and decontamination factors. ONR considers it important that the impact of uncertainty in the source term is considered:

- For accident sequences with public doses around 5 mSv which may need to be considered as giving rise to a radiation emergency.

- On the potential for the distance of the 5 mSv contour to change for accidents giving rise to large releases.

A44 The RoA should demonstrate these aspects have been considered and the outcome of the assessment described.

A45 The approach to the treatment of uncertainties in the frequency assessment is discussed above with respect to interpreting the requirement to identify reasonably foreseeable accidents.

Determining the Size of the Detailed Emergency Planning Zone

A46 An RoA would normally present the operators view of where the centre of the DEPZ should be located, and its radius if circular, or its footprint if not. However, it is ONR's legal duty to review the RoA and to inform the LAs of the required size and location of the DEPZ. Therefore operators need not present a view on the characteristics of the DEPZ, but present the relevant information upon which ONR can make this judgement. To determine the DEPZ, ONR will take the following approach:

- Review the HIRE report to determine the adequacy of the technical argument: in particular with regard to the choice and extent of the worst case reasonably foreseeable radiation emergency. ONR will liaise with the operator as required to resolve any technical issues and queries that may arise.

- Review the proposed DEPZ in accordance with its principles and guidance on their application contained in annex 2. These principles are likely to impact on the extent and shape of the DEPZ.

- Write to the LA and operator stating the requirements for the DEPZ and PIZ respectively.

A47 This guidance primarily provides advice to ONR inspectors on the first of the points listed above. The ONR specialist inspector assessing the RoA will make a

recommendation on the minimum distance of the 5 mSv contour to the ONR EP&R team. The EP&R team will consider ONRs' principles referred to above and determine the size and location of the DEPZ and PIZ. This may be different to that within the operator's submission, but cannot be smaller than that arising from the technical assessment of the 5 mSv contour.

A48 The location of the 5 mSv contour is usually shown in RoA as a circle with a specified radius centred at the source of a potential release. However, the actual boundary of the DEPZ and PIZ need not be circular if this is required to address the factors listed above.

Extendibility

A49 Emergency preparedness policy in GB recognises that accidents which are not reasonably foreseeable could have consequences beyond the boundaries of the DEPZ (REPPIR guidance [2] on Emergency Plans in paragraph 138) and within Ref. [18] in paragraphs 4 and 27). This is due to uncertainties in the prediction of the severity of nuclear accidents, and also because the consequences of a radiation emergency can vary due to circumstances at the time, such as weather conditions.

A50 The Sizewell B [19] and Hinkley Point C [20] inquiries endorsed the principle of extendibility. Following the Hinkley Point C public inquiry Michael Barnes QC saw the concept of extendibility as a bridge for enhanced contingency planning between the detailed plans applicable to the DEPZ and national contingency plans. This would apply to accidents with consequences larger than those that may arise from reasonably foreseeable accidents.

A51 REPPIR guidance [2] advises that emergency plans provide the basis for dealing with accidents that are not reasonably foreseeable through the concept of extendibility. This is discussed in REPPIR guidance [2] under Regulations 6(5) (paragraph 138) and 9(1) (paragraphs 206 and 209). ONR therefore considers it relevant good practice that emergency plans incorporate arrangements for extendibility. In particular the detailed emergency plan produced under REPPIR should provide the basis for dealing with radiation emergencies that are not reasonably foreseeable. Further detail is provided in the Nuclear Emergency Planning and Response Guidance Part 1 – Preparedness [21].

A52 The safety cases for nuclear facilities show that, although accidents are unlikely, a very wide range of consequences can arise, and that of necessity the supporting information is subject to large uncertainties. It should therefore be noted that the measures which would be required to deal with consequences larger than those expected from a reasonably foreseeable radiation emergency cannot be precisely pre-planned, and the exact response must be based on an assessment made at the time. Therefore the arrangements described in the emergency plan to address extendibility are not expected to be as detailed as those for the reasonably foreseeable event, but will provide a framework for extending the response.

Generic HIRE and Reports of Assessment

A53 Some operators will have similar plant that are common to multiple sites. For example, this applies to nuclear powered submarines which move between sites. ONR considers that an operator may undertake a single generic HIRE that presents the technical information for similar plant. If this approach is adopted, it must be ensured that the RoA for each site addresses the relevant differences between the generic assessment and the site in question.

ANNEX 2

ONR PRINCIPLES FOR DETERMINATION OF DEPZ'S AND RELATED GUIDANCE – DETAILED ADVICE TO INSPECTORS

1. Introduction

This guidance contains a description of the process ONR uses to determine Detailed Emergency Planning Zones (DEPZs) around nuclear facilities in the UK, the principles used by ONR, and guidance related to their application.

2. The Detailed Emergency Planning Zone

This is the area around a facility for which the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) requires that the local authority prepare a detailed off-site emergency plan with the purpose of restricting, so far as is reasonably practicable, public exposure in the event of a reasonably foreseeable radiation emergency.

A radiation emergency is defined in REPPIR[1] as any event likely to result in any member of the public being exposed to ionising radiations in excess of any of the dose levels set out in Schedule 1 in the Regulations (the most commonly discussed level being 5 mSv over the year immediately following such a radiation emergency).

The off-site emergency plan describes arrangements to prevent or restrict radiation exposure of both the public and emergency workers in the zone and includes, for example, advice on aid and countermeasures such as sheltering, evacuation and, in the case of operational reactor sites, the administration of stable potassium iodate tablets.
Local authorities are responsible for the development, consultation and implementation of the plans.

3. Responsibility for Determination of DEPZ's

REPPIR 2001 Regulation 9(1) places the duty to determine the extent of DEPZs on the Health and Safety Executive (HSE), with authority in this area currently delegated to the Office for Nuclear Regulation (ONR) for nuclear facilities. DEPZ's include the area where, in the opinion of HSE/ONR, members of the public or emergency workers are likely to be affected by a reasonably foreseeable radiation emergency.

4. The DEPZ Determination Process

In order to provide a consistent approach to the determination of DEPZ's, ONR applies a defined regulatory process and clear principles. These are contained in the following two-step approach:

- The undertaking of an assessment (Annex 1 refers), by ONR, of the licensee's RoA relating to the area in which members of the public or emergency workers are likely to be affected by a radiation emergency, as defined in REPPIR.

- Consideration of case specific practical and strategic factors related to the implementation of countermeasures to those members of the public or emergency workers who are likely to be affected by a radiation emergency.

In the determination of a DEPZ, ONR considers it to be important that an appropriate balance is struck between its assessment of the RoA submitted by the licensee and

other practical and strategic considerations judged necessary in the interests of confidence in securing public safety in the unlikely event of the occurrence of a reasonably foreseeable radiation emergency. As a consequence, the extent of DEPZs reflect ONR's regulatory judgement as regards specific local circumstances and its consideration of international standards/ guidance, rather than being determined purely by objective technical rules or criteria.

5. The Technical Assessment of Reports of Assessment

REPPIR Regulation 4 requires the operator of, in relation to this guidance, a nuclear facility, to undertake a HIRE, which considers all hazards on the site with the potential to cause a radiation accident; ranging from small occurrences to radiation emergencies. The evaluation should include possible plant and equipment failures, breakdown of administrative arrangements and potential unauthorised behaviour of employees or the public. The HIRE will show whether there is a potential for a reasonably foreseeable radiation emergency.

REPPIR also requires the HIRE to be reviewed by the operator at a period not exceeding three years or upon a material change to the risk profile of the nuclear facility in question (e.g. use of different radioactive substances, use of different quantities of the same radioactive substances, changes in physical form of the radioactive substances in use, use of new or different technologies, or changes in safety management or safety critical administrative procedures).

REPPIR Regulation 6 then requires the operator to produce an RoA of the HIRE and submit this to ONR at least twelve months either before the commencement of the work with ionising radiation, or within 28 days of any further 'material change', otherwise within three years of the previous RoA.

In an RoA the operator will identify a radiological 'footprint' or zone that it believes corresponds to doses to members of the public from a reasonably foreseeable radiation emergency that relate to the dose thresholds in Schedule 1 of REPPIR.
ONR's technical assessment is a detailed analysis and evaluation of the content and accuracy of these RoAs.

ONR will assess the RoA and may request a more detailed assessment of further specific details (as provided for in REPPIR) to determine its concurrence or otherwise with the operator's technical radiological footprint or zone. The operator's HIRE must reflect the safety case and fault schedules for the particular plant(s) and site(s) in question.

The output of ONR's technical assessment is an assessment report that verifies that the operator has fulfilled their REPPIR requirements, adequately assessed all of the relevant hazards, and provided a reasonable estimate of the radiological footprint and contour within which members of the public are likely to receive radiation exposures greater than those in Schedule 1 of REPPIR (most commonly 5 mSv during the year following a reasonably foreseeable radiation emergency). However, ONR considers that the operator's RoA, and ONR's technical assessment of it, inform, rather than prescribe the final extent of the DEPZ.

ONR then considers how this 5 mSv contour might, in our opinion, be modified to secure confidence in protection of the public by consideration of other relevant practical and strategic factors in order to determine the DEPZ.

6. Consideration of Practical and Strategic factors

The purpose of the DEPZ is to define the area for which detailed planning by the relevant local authority must be undertaken in order to ensure the protection of the public in the event of a reasonably foreseeable radiation emergency. Consequently, in addition to the area identified by the technical assessment, due consideration is also given to matters relating to the practical implementation of an off-site emergency plan, and other pragmatic factors appropriate to secure confidence as regards protection of the public.

The following practical and strategic factors are considered by ONR to be relevant in determining the extent of the DEPZ:

A. **Local geographic, demographic and practical implementation factors** - 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).)

B. **Avoidance of bisecting local communities** - 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 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.

C. **Inclusion of immediately adjacent vulnerable groups** - ONR recognises that groups of vulnerable people (e.g. care homes, schools, camping and caravan sites, itinerant populations, etc) located close to the 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.)

D. **International standards and guidance** - ONR is of the view that its decisions need to be informed by accepted international good practice.

E. **Credibility and confidence in the extent of the DEPZ** - Although REPPIR places the duty on the independent regulator to make an objective and unbiased regulatory determination of the extent of the 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.

F. **Benefits and dis-benefits of countermeasures** – Countermeasures can, in some circumstances, convey risks as well as benefits to the individuals to whom they may be applied. ONR considers that the 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.

G. **Other site specific factors of which ONR is aware** - ONR will also consider, in determining DEPZs, any additional site-specific factors that it considers relevant on a case-by-case basis.

Upon completion of the DEPZ determination process, ONR will produce and publish a Project Assessment Report that details the basis for our determination of the DEPZ in question, and also sets out a description or map of the geographical area concerned.

7. Implementation of a DEPZ

The DEPZ is implemented by a formal letter from ONR to the relevant local authority notifying it of the extent of the DEPZ and of the need for the local authority in question to prepare or update their off-site emergency plan accordingly within a period of six months (or longer if ONR agree). Copies of these letters are also sent to the relevant operator(s). Details of DEPZs for all UK nuclear facilities are contained on the ONR website.

8. Reviews of DEPZs

REPPIR requires operators to review their HIREs at least every three years, or sooner if there has been or will be a material change to the hazard or risk presented by the nuclear facilities in question. The operator is then required to submit the outcome of this review to ONR in the form of a new RoA or a declaration of no change to the previous RoA..

As a consequence, ONR therefore reviews the appropriateness of DEPZs for each nuclear site at least once every three years.