



PROJECT ASSESSMENT REPORT			
<b>Unique Document ID and Revision No:</b>	ONR-COP-PAR-14-001	<b>TRIM Ref:</b>	2014/160907
<b>Project:</b>	<b>Determination of Sizewell Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR) off-site emergency planning area [Regulations 9(1) and 16(1)]</b>		
<b>Site:</b>	Magnox Ltd, Sizewell A EDF Energy Nuclear Generation Ltd, Sizewell B		
<b>Title:</b>	ONR's statutory determination of the off-site emergency planning and public information area for Sizewell A & B nuclear licensed sites in accordance with the requirements of the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR) Regulations 9 and 16.		
<b>Licence Instrument No:</b> (if applicable)	Not Applicable		
<b>Nuclear Site Licence No:</b>	Sizewell A [Nuclear Site Licence number 96] Sizewell B [Nuclear Site Licence number 63]		
<b>Licence Condition:</b>	Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR)  LC 11 Emergency Arrangements		

### Document Acceptance and Approval for Issue / Publication

Role	Name	Position	Signature	Date
Author	██████████	Inspector		17 April 2014
Reviewer	██████████	Principal Inspector		22 April 2014
Accepted by <sup>1</sup>	██████████	Superintending Inspector		23 April 2014
Approval for publication <sup>2</sup>	██████████	Superintending Inspector		23 April 2014


<sup>1</sup> Acceptance of the PAR to allow release of LI

<sup>2</sup> Approval is for publication on ONR web-site, after redaction where relevant

## Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description of Change
A	dd mm yyyy			n/a	1 <sup>st</sup> draft for AUH review
B	dd mm yyyy			n/a	2 <sup>nd</sup> draft incorporating AUH comments
0	dd mm yyyy				First accepted issue

## Circulation (latest issue)

Organisation	Name	Date
Office for Nuclear Regulation	 Files: Programme Report File Relevant Subject Files	23 April 2014
Local Authority	Suffolk County Council	25 April 2014
Licensee	Magnox Ltd (Sizewell A) EDF Energy Nuclear Generation Ltd (Sizewell B)	25 April 2014
Relevant competent authorities	Food Standards Agency Maritime and Coastguard Agency Environment Agency	25 April 2014

**ONR's statutory determination of the off-site emergency planning and public information area for Sizewell A & B nuclear licensed sites in accordance with the requirements of the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR) Regulations 9 and 16**

Project Assessment Report ONR-COP-PAR-14-001  
Revision 0  
23 April 2014

© Office for Nuclear Regulation, 2014

If you wish to reuse this information visit [www.onr.org.uk/copyright.htm](http://www.onr.org.uk/copyright.htm) for details.

Published 04/14

*For published documents, the electronic copy on the ONR website remains the most current publicly available version and copying or printing renders this document uncontrolled.*

## EXECUTIVE SUMMARY

### **ONR's statutory determination of the off-site emergency planning and public information area for Sizewell A & B nuclear licensed sites**

This Office for Nuclear Regulation (ONR) Project Assessment Report (PAR) describes and explains the basis for ONR's re-determination of the Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR) off-site emergency planning area and the area within which prior information is to be distributed around Sizewell A and B nuclear licensed sites.

Prior to 1st April 2014, ONR exercised the delegated authority of the Health and Safety Executive (HSE) to make such determinations in respect of nuclear licensed sites in the UK. From 1st April 2014, ONR is provided with the legal remit to make such determinations in its own right. It is noted that the majority of the assessment work leading up to this determination was conducted prior to 1<sup>st</sup> April 2014, whereas the determination itself was made after this date.

The determination of a REPPIR off-site emergency planning area defines the area around a site within which any member of the public is likely to be affected by a reasonably foreseeable radiation emergency (as defined in REPPIR), and constitutes an important component of the UK's overall emergency response framework.

In relation to this area, the local authority is required to prepare an adequate off-site emergency plan with the purpose of minimising, so far as is reasonably practicable, radiation exposures to those likely to be affected by such an emergency. This plan will reflect the potential need to implement appropriate countermeasures within all or part of this area.

REPPIR requires operators to undertake hazard identifications and risk evaluations (HIRE) in relation to work with ionising radiations (or where there are material changes to such work) as specified in REPPIR. These HIREs must identify all hazards on the sites with the potential to cause a radiation accident, and evaluate the nature and magnitude of the risks to employees and other persons (e.g. those who live or work nearby) arising from those hazards. REPPIR also requires operators to assess their HIRE and to 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 at least within three years from the last assessment. REPPIR also makes provision for ONR to request additional information. In practice, it is usual for the HIRE information itself to be requested to inform ONR's determinations.

Recently, ONR has been made aware of a potential source of confusion associated with the use of the terminology 'Detailed Emergency Planning Zone' (DEPZ). It appears that some stakeholders have used the term to refer to the REPPIR local authority 'off-site emergency planning area' (to which this determination relates), whereas others have used the same term to refer to the area within which the operator (in accordance with arrangements made under its nuclear site licence) has made plans to implement urgent uniform countermeasures in support of the wider off-site emergency response (i.e. a more restrictive interpretation).

In considering that REPPIR does not relate solely to the application of urgent countermeasures, nor requires that any countermeasures be applied uniformly across the off-site emergency planning area referred to in Regulation 9 of REPPIR, it is evident that, whilst the inferred areas may be the same in some instances, they need not necessarily be so. In the interests of legal clarity and to minimise potential confusion amongst stakeholders, this determination has adopted the terminology 'REPPIR off-site emergency planning area' to refer to the area under REPPIR Regulation 9 for which local authorities must prepare an adequate off-site emergency plan.

The off-site local authority emergency planning area around Sizewell A and B sites, as provided for in REPPiR Regulations 9(1) and 16(1), was first determined in 2002 - a short while after REPPiR came into force in 2001. The current area is represented by a single circular area around the two sites with a radius of 2.4 km.

This re-determination has been undertaken in response to the submission to ONR of a RoA by Magnox Limited in relation to the Sizewell A site. In its RoA, Magnox Limited reports a significant reduction in both the hazard and risk of a reasonably foreseeable radiation emergency at the Sizewell A site (as a consequence of it now being substantially defueled).

This report sets out the outcome of ONR's determination of the REPPiR off-site emergency planning area and the REPPiR prior information area for the Magnox Ltd (Sizewell A) and EDF Energy Nuclear Generation Ltd (NGL) (Sizewell B) nuclear licensed sites located at Sizewell in Suffolk. This determination has been undertaken in accordance with HSE regulatory processes, guidance associated with REPPiR itself, and the relevant ONR technical assessment guide (TAG).

In conducting the re-determination of the REPPiR off-site emergency planning area for Sizewell, ONR has applied its recently published 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 insistence on and commitment to high standards of nuclear safety and security at nuclear installations, and its continual efforts to seek improvements to standards and to the consistency and transparency of its decision-making.

Sizewell is the first site where ONR has applied its revised principles to determine the extent of the REPPiR off-site emergency planning and the principles will, in due course, be successively deployed to all other UK nuclear facilities that ONR regulates.

ONR's determination process requires that:

(i) Technical assessments be undertaken, by ONR, of Magnox and NGL's Hazard Identification and Risk Evaluations (HIREs) and Reports of Assessment (RoAs) for the respective sites. These have been completed and are reported separately. These technical assessments conclude that areas of radius of at least 425 m and 234 m around the reference accident locations on Sizewell A and B sites respectively should be used as the foundation for defining the extent of the need for local authority off-site emergency planning under Regulation 9 of REPPiR.

(ii) In accordance with the relevant ONR Technical Assessment Guide, ONR also give appropriate consideration to practical and strategic factors relating to the planning and potential implementation of an 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 authority (as the duty holder within REPPiR to prepare the plan), and considers, amongst other factors, local demographic and geographical considerations. ONR's determination is therefore informed by a range of practical and common-sense factors which have the effect, in this case, of extending the area identified in (i) above.

ONR's 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 necessary in the interests of public safety. As a consequence, the ultimate determination of the REPPiR off-site emergency planning area represents ONR's best regulatory judgement, and is not formed solely on the basis of technical considerations or criteria.

The outcome of ONR's review of the technical submissions made by licensees, taking into account the relevant practical and strategic considerations relating specifically to the Sizewell area, is that both the REPPiR off-site emergency planning area and the REPPiR prior

information area for the Sizewell A and B nuclear licensed sites will be re-defined to be the enhanced single area shown within the blue line on the map contained at Appendix B to this report.

The increase to the planning area (i.e. an increase in the extent of the previously defined area to include the whole of the town of Leiston and the majority of the adjoining community of Aldringham) does not mean that ONR has identified a greater risk for those living near the site (in fact, ONR is satisfied that the overall risk from the two nuclear sites has reduced); but recognises the 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.

The report recommends that:

- ONR should notify the Local Authority (Suffolk County Council) of the need to produce an adequate detailed emergency plan for this new and enhanced REPPiR off-site emergency planning area; and that
- The operators (NGL and Magnox Limited) be notified that the REPPiR prior information area, for which they must ensure the appropriate provision of prior information to the public, is enhanced to cover the same area.

## LIST OF ABBREVIATIONS USED

CCA	Civil Contingencies Act (2004)
DEPZ	Detailed Emergency Planning Zone (Ref: REPPIR Regulation 9(1))
EURATOM	European Atomic Energy Committee
FSA	Food Standards Agency
HIRE	Hazard Identification and Risk Evaluation
HSE	The Health and Safety Executive
IAEA	The International Atomic Energy Agency
MCA	Maritime and Coastguard Agency
NGL	EDF Energy Nuclear Generation Ltd
NRPB	National Radiological Protection Board (who became Public health England on 1 April 2013)
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PAZ	Precautionary Action Zone (IAEA terminology)
PIZ	Public Information Zone (Ref: REPPIR Regulation 16(1))
PHE	Public Health England
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RoA	Report of Assessment
SAPs	Safety Assessment Principles
SCC	Suffolk County Council
TAG	(ONR) Technical Assessment Guide
UPZ	Urgent (protective action) Planning Zone (IAEA terminology)



## TABLE OF CONTENTS

1. PERMISSION REQUESTED .....	10
2. INTRODUCTION .....	10
2.1 Background .....	10
2.2 Scope .....	11
2.3 Methodology .....	12
3 ASSESSMENT STRATEGY .....	13
3.1 Basis of assessment .....	13
3.2 Standards and Criteria .....	14
4 ASSESSMENT OF TECHNICAL SUBMISSIONS .....	14
5 ASSESSMENT OF PRACTICAL AND STRATEGIC CONSIDERATIONS .....	16
6 CONCLUSIONS AND RECOMMENDATIONS .....	25
6.1 Conclusions .....	25
6.2 Recommendations .....	27
7 REFERENCES .....	28
 Appendix A: Demographic data for the area around Sizewell .....	 30
Appendix B: ONR determination of the REPPiR off-site emergency planning and public information area .....	31

## 1 PERMISSION REQUESTED

This report sets out the outcome and justification for the determination of the revised Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR) off-site emergency planning and prior information areas for Sizewell A and B nuclear licensed sites, in accordance with the requirements of REPPiR (reference 1) Regulations 9(1) and 16(1) respectively.

## 2 INTRODUCTION

### 2.1 Background

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

In relation to emergency planning, REPPiR requires operators, in this case Magnox Ltd (Sizewell A) and EDF Energy Nuclear Generation Ltd (NGL) (Sizewell B), to undertake hazard identification and risk evaluation of all hazards arising from their work with the potential to cause a radiation accident on their respective sites. The assessment must be sufficient to demonstrate that all such hazards have been identified and the nature and magnitude of the risks to employees and other persons arising from those hazards have been evaluated. REPPiR also requires that operators submit a report of the assessment (RoA) of this hazard identification and risk evaluation (HIRE) to the Office for Nuclear Regulation (ONR) prior to commencement of the work, following any material change, and at least every 3 years.

Prior to 1st April 2014, ONR exercised the delegated authority of the Health and Safety Executive (HSE) to make such determinations in respect of nuclear licensed sites in the UK. From 1st April 2014, ONR is provided with the legal remit to make such determinations in its own right. It is noted that the majority of the assessment work leading up to this determination was conducted prior to 1<sup>st</sup> April 2014, whereas the determination itself was made after this date.

Where it is reasonably foreseeable that a radiation emergency (as defined in REPPiR) could arise, REPPiR requires ONR to define 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)) without it having to be requested.

The off-site emergency plan should include such countermeasures (and other protection measures) as are relevant, reasonably practicable, and proportionate to the radiological risk in the event of a reasonably foreseeable radiation emergency at the Sizewell A or B nuclear licensed sites. However, it is not a requirement of REPPiR that countermeasures necessarily be applied uniformly within this area or that they be applied to the entirety of the area.

ONR also notes that, whilst some stakeholders have historically referred to the area determined under Regulation 9(1) (i.e. the area determined by ONR which, in its opinion, members of the public are likely to be affected by reasonably foreseeable radiation emergencies) as a Detailed Emergency Planning Zone (DEPZ), others appear to have applied the same terminology with a more restrictive meaning (i.e. to represent the area within which the operator, in accordance with arrangements made under its nuclear site licence, has plans to implement urgent and uniform countermeasures).

ONR notes that the term 'DEPZ' is not used in REPPIR itself (although it is referred to in some of the HSE/ONR guidance referenced in this report), and that REPPIR neither relates solely to urgent countermeasures, nor requires that countermeasures be applied uniformly across the REPPIR off-site emergency planning area referred to in Regulation 9. Consequently, it is evident that, whilst the inferred areas may be the same in some instances, they need not necessarily be so.

Hence, to ensure legal clarity and for the avoidance of misunderstanding, this report refers to the areas determined by ONR in this report (under REPPIR Regulations 9 and 16) as the 'REPPIR off-site emergency planning area' and the 'REPPIR prior information area' respectively.

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 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 'REPPIR 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.

The off-site local authority emergency planning and prior information area around Sizewell A and B sites, as provided for in REPPIR Regulations 9(1) and 16(1), was first determined in 2002 - a short while after REPPIR came into force in 2001. The current area is represented by a single circular area around the two sites with a radius of 2.4 km. This report describes the re-determination of these areas.

Following the determination by ONR, the local authority 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 operators, ONR, the Emergency Services, the relevant health authority, and such other persons, bodies and authorities and members of the public as it considers appropriate). This plan must then be reviewed and, where necessary, revised at least every three years, with an equivalent requirement to test the plan.

This report sets out the main considerations that ONR has undergone in determining revised REPPIR off-site emergency planning and prior information areas for the Sizewell nuclear licensed sites. It takes due account of the findings of the Magnox and NGL HIREs and RoAs and of ONR's recently revised principles and guidance.

## **2.2 Scope**

This assessment sets out the basis for, and conclusions of, the re-determination of the REPPIR off-site emergency planning and prior information area relating to the adjacent Sizewell A and B nuclear licensed sites. This has been undertaken in accordance with HSE's guidance on REPPIR (reference 1) and the supporting relevant technical assessment guide (TAG) (reference 2), which incorporates ONR's recently revised principles for determination of REPPIR areas, and related guidance.

ONR's revised 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 insistence on, and commitment to, high standards of nuclear safety and security at nuclear installations, and its continual efforts to seek improvements to standards and to the consistency and transparency of its decision making.

The Sizewell re-determination is the first application of these revised principles to determine the extent of off-site emergency planning under REPPIR. The principles will, in due course, be successively deployed to all other UK nuclear facilities that ONR regulates.

Where this report refers to 'Sizewell', it relates to the area adjacent to and containing both the Sizewell A and B nuclear licensed sites unless otherwise indicated.

For the purposes of determining the REPPIR off-site emergency planning area, ONR is of the opinion that it would be neither appropriate nor proportionate to include, within the REPPIR

off-site emergency planning area, the extent of potential long term health protection recovery measures associated with the restriction of food. The provisions for the implementation of food restrictions are contained in the Food and Environment Protection Act 1985 (FEPA) and are determined and enforced by the Food Standards Agency (FSA). As these provisions are addressed by separate legislation, may be exercised in a broad range of circumstances (i.e. not restricted to a radiological event), and are subject to existing planned implementation arrangements made by the FSA, this is viewed as being independent of the local authority off-site emergency plan under REPPiR.

### 2.3 Methodology

ONR's process for determining a REPPiR off-site emergency planning area require that it:

- A. Conduct an initial technical assessment of the information provided by the licensees in the Sizewell A and B HIREs and RoAs; and
- B. Establish and consider any other relevant practical and strategic factors (e.g. relating to the planning and practical implementation of measures to restrict public exposure so far as is reasonably practicable (e.g. countermeasures) for those persons who are likely to be affected by a radiation emergency etc).

**Step A:** requires ONR to assess the operators determination of whether he does, or does not, have legal duties under REPPiR and, if so, to identify and characterise the likelihood, nature and magnitude of the radiation related risks that may result from a reasonably foreseeable radiation emergency. ONR reviews the content and findings of the operators' HIREs and RoAs and considers the likely extent of the area within which the dose criteria contained within Schedule 1 of REPPiR may be met or exceeded. This indicates the minimum distance for consideration in step B, and is usually presented in operators' HIRE reports as a circle with a specified radius centred at the source of a potential release.

Whilst Step B applies additional factors to the ONR determination, and whilst the determined REPPiR off-site emergency planning area need not be circular, it cannot be smaller than that arising from the technical assessment under Step A.

**Step B:** requires the consideration of a range of pragmatic, demographic, geographical and practical factors, and includes dialogue with the relevant local authority. The nature of the relevant practical and strategic factors considered is set out in detail in the relevant ONR Technical Assessment Guide (reference 2).

ONR's principles relating to practical and strategic considerations (reference 2) emphasise that, in the undertaking of the determination, it is important to ensure that a sensible balance is achieved between the assessment of the technical report provided by the licensee and such additional practical and strategic considerations that, in ONR's opinion, are judged necessary in the interests of confidence in public safety. As a consequence, the extent of the REPPiR off-site emergency planning area represents a regulatory judgement of the significance of all of these factors, and is made on a case-by-case basis.

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

- local geographic, demographic and practical implementation factors;
- avoidance of bisection of local communities where sensible to do so;
- inclusion of immediately adjacent groups of vulnerable people;
- the credibility and confidence in the extent of REPPiR off-site emergency planning area for the purposes of public protection;
- 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, potential dis-benefits associated with immediate/urgent countermeasures);

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

The purpose of the ONR determination is to define the area for which the local authority must prepare off-site emergency plans (under REPPiR, for the purpose of securing, so far as is reasonably practicable, the restriction of exposure to ionising radiation and the health and safety of persons who may be affected by a reasonably foreseeable emergency,) and across which the operator must provide prior information to the public without their having to request it. The area is based on the most significant reasonably foreseeable event (referred to in reference 2 as the 'reference accident', and described as an event which is less than likely but realistically possible) such as possible plant and equipment failures, breakdown of administrative arrangements, and potential unauthorised behaviour of employees or the public.

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

The most commonly referenced off-site countermeasures available in the early stages of a nuclear emergency in order to reduce radiation doses to members of the public are sheltering, evacuation and, in the case of operating nuclear power reactors, the administration of iodine prophylaxis (potassium iodate tablets).

In determining a REPPiR off-site emergency planning area, ONR acknowledges that the implementation of countermeasures can, in some circumstances, convey a risk to individuals to whom they are applied. For example, in relation to the countermeasures taken 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 3). As, within a REPPiR off-site emergency planning area, the local authority may expect some countermeasures to be applied immediately or urgently across at least a part of the area, it is important that the area within which they may be applied in this manner is not excessive in order to ensure that overall risks to those affected are reduced so far as is reasonably practicable.

### **3 ASSESSMENT STRATEGY**

The assessment strategy for the determination of the REPPiR off-site emergency planning area is summarised as follows:

#### **3.1 Basis of assessment**

Although the Sizewell site is comprised of the immediately adjacent Sizewell A (Magnox Ltd) and Sizewell B (EDF Energy Nuclear Generation Ltd) licensed sites, this assessment relates to the determination of a single REPPiR off-site emergency planning area around the two adjacent sites as provided for in REPPiR. A single area serves to aid the practicality and integration of emergency preparedness and response on the ground.

The REPPiR 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). [NB. Note that REPPiR requires that when operators assess the doses to members of the public, they must assess the potential doses from all exposure routes and, for this purpose, must disregard any health protection measures that may be taken during the first 24 hours immediately following the event].

Since REPPIR came into force in 2001, the REPPIR off-site emergency planning area around Sizewell has comprised of a circle of radius 2.4 km. The extent of this area was primarily the result of the larger radiological risk associated, at the time, with the operational Sizewell A reactor site. However, the Sizewell A reactors were closed in 2006 and, by December 2013, almost 75% of the nuclear fuel had been removed from the site. [NB. The current target date for the removal of all of the nuclear fuel is September 2014].

Magnox Limited (Sizewell A) and EDF Energy Nuclear Generation Ltd (Sizewell B) have submitted their hazard identification and risk evaluations (HIREs) and reports of assessment (RoAs) which form the basis of 'Step A' (see Section 2.3) of the assessment and determination described in this report.

## **3.2 Standards and Criteria**

### **3.2.1 Acts, Regulations and guidance**

The relevant standards and criteria considered within this assessment are those contained within the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) (reference 1) and its associated guidance. REPPIR is made under the Health and Safety at Work Act 1974 and implements the articles on intervention in cases of radiation emergencies contained in the European Council Directive 96/29/EURATOM - Basic Safety Standards for the Protection of the Health of Workers and Members of the Public against the Dangers from Ionising Radiation (reference 4).

### **3.2.2 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 REPPIR submissions, cognisance has been taken of SAP: AM.1 - Accident management and emergency preparedness (reference 5).

### **3.2.3 Technical Assessment Guides**

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

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

### **3.2.4 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 1).

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

- IAEA Safety Standard Series – Preparedness and Response for a Nuclear or Radiological Emergency GS-R-2 (reference 6).
- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 (reference 7).

## **4 ASSESSMENT OF TECHNICAL SUBMISSIONS**

Magnox Limited (Sizewell A) and EDF Energy Nuclear Generation Ltd (Sizewell B) have submitted their hazard identification and risk evaluations (HIREs) and reports of assessment (ROAs) for their respective sites to ONR (references 8, 9a, 9b and 9c).



ONR has subjected these submissions and supporting documentation to expert technical assessment and the conclusions are reported separately in references 10, 11a and 11b. These conclusions may be summarised as follows:

#### 4.1 Magnox HIRE/RoA (Sizewell A Site)

The current REPIR off-site emergency planning area extends to 2.4 km and is based on a reasonably foreseeable nuclear emergency postulated at a time when the Sizewell A reactors were fully fuelled and operational. However, the last operational Sizewell A reactor ceased generation in December 2006, with the reactors being approximately 75% defueled at the time of writing of this report (with defueling due to be completed later in 2014).

As a consequence of the time that has elapsed since the reactors were shut down, the remaining fuel on this site no longer produces significant residual decay heat. In addition, the dominant contributors to radiation exposures in the event of an emergency during the operational lifetime of the plant, (i.e. short-lived radioactive isotopes of iodine) have decayed away. The most significant hazard now presented by this site would arise from [REDACTED] (which would, in the highly unlikely event of its occurrence, result in a loss of shielding with a resultant increase in gamma doses from the site and minor contributions from other exposure pathways). As a consequence, and until defueling is completed, the potential for public exposure to meet or exceed the REPIR schedule 1 dose criteria remains, to a distance of no greater than approximately 425 m. However, this distance is informed solely by the technical assessment and does not consider the application of strategic and practical factors (which ONR undertakes in section 5 below).

ONR's assessment of the Magnox Ltd RoA concurs with Magnox's view that there has been a substantial reduction in the hazard on the site and of the risk of a radiation emergency associated with the Sizewell A site.

Based on ONR's technical assessment (referenced 10) of the Magnox Ltd REPIR submissions for the Sizewell A Site (reference 8), ONR agrees that the identification and consequences of the reference accident (being [REDACTED]) would reach or exceed 5 mSv accrued over the year following the postulated event, to a distance of no greater than **425 m**. It is notable that the technical assessment (reference 10) also concludes that for other reasonably foreseeable but more frequent faults identified in the REPIR submission, off-site doses at this distance would be an order of magnitude (or more) lower.

#### 4.2 NGL HIRE/ ROA (SIZEWELL B SITE)

NGL's initial 2002 REPIR submission for the Sizewell B Site (reference 9a) concludes that the reference accident is that "fuel fails and a release pathway occurs". "The assessment of radiation accidents for Sizewell B predicts that in the highly unlikely event of such an accident, and disregarding any health protection measures taken in the first 24 hours, members of the public [at a distance of less than 1000m] from the site could be exposed to doses in excess of 5 mSv in the ensuing 12 months". It also recommended that the historical situation, prior to REPIR coming into force in 2001, should continue, with the DEPZ remaining at 2.4 km from the centre of the site. The ONR 2002 technical assessment of this submission (reference 11a) agrees with these conclusions. [NB. Historically, HSE 1994 guidance (reference 12) recommended general DEPZs of 1.6 to 2.4 km for earlier series Magnox reactors (re Sizewell A) and DEPZs of less than this for modern plants (re Sizewell B).]

As part of its three yearly review in 2011, NGL supplied a letter stating that there had been no significant material change to the risk presented by the Sizewell B site, but, due to changes in the company and management structure, provided an updated HIRE/RoA (reference 9b). This contains the same statement as the 2002 submission of the distance to which members of the public could be affected by a reasonably foreseeable radiation emergency.

In the light of the decreasing hazard associated with Sizewell A and following requests from ONR, NGL has provided additional information (reference 9c) relating to its assessment of the

Sizewell B radiation hazards with a view to refining the distance assessed, in 2002, to which the public may be exposed to greater than 5 mSv in the 12 months following a reasonably foreseeable radiation emergency (assuming that any health protection measures taken in the first 24 hours are disregarded). This was carried out in March 2014 (reference 9c) and has concluded that the reference accident is [REDACTED]. In the highly unlikely event of such an accident, and disregarding any health protection measures taken in the first 24 hours, members of the public could be exposed to doses of 5 mSv in the ensuing 12 months to a distance of approximately **234 m**. ONR's technical assessment of this submission (reference 11b) concurs with this conclusion. However, this distance is informed solely by the technical assessment and does not consider the application of strategic and practical factors (which ONR undertakes in section 5 below).

### **4.3 Conclusions of technical assessments**

ONR is satisfied that there has been a significant reduction of risk of a radiation emergency associated with the Sizewell A site, and that the hazard associated with the Sizewell B station is essentially unchanged. ONR is therefore satisfied that the overall risk presented by the two adjacent licensed sites has reduced.

Based on ONR's assessment reports relating to the Magnox Ltd and NGL RoA submissions (references 10, 11a and 11b), ONR is satisfied that the technical case has been made to demonstrate that members of the public would not be exposed to effective doses in excess of 5mSv in the year following a reasonable radiation emergency beyond radial distances of 425 m and 234 m from either reference accident location on Sizewell A and B sites respectively.

**Conclusion 1:** ONR is satisfied that the overall risk from the Sizewell A and B sites has reduced, and that the technical submissions made by Magnox Limited and EDF Energy Nuclear Generation Ltd (NGL) demonstrate that members of the public would not be exposed to effective doses in excess of 5mSv, in the year following a reasonably foreseeable radiation emergency, beyond radial distances of 425 m and 234 m respectively.

## **5 ASSESSMENT OF PRACTICAL AND STRATEGIC CONSIDERATIONS FOR THE DETERMINATION OF THE SIZEWELL REPPIR OFF-SITE EMERGENCY PLANNING AREA AND THE REPPIR PRIOR INFORMATION AREA**

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.

The ONR assessment reports of the licensee's submissions to ONR (references 10 and 11b) conclude that the REPPIR off-site emergency planning area should extend at least to a radial distance of 425 m and 234 m from the respective locations of the reference accident releases for Sizewell A and B. These distances represent the areas within which the technical assessments indicate that persons may be exposed to 5 mSv or more in the 12 months following a reasonably foreseeable radiation emergency (assuming that any health protection measures taken in the first 24 hours are disregarded).

In accordance with ONR's Technical assessment guidance and the principles incorporated therein (reference 2), ONR must also give consideration to the practicality (in an emergency planning sense) and pragmatism of the REPPIR off-site emergency planning area by considering a number of pragmatic factors considered to be relevant in securing confidence regarding the effectiveness of the plans to deliver protection of the public.



In the course of considering these factors, ONR has engaged in dialogue with Suffolk County Council, which is the duty holder under REPIR for the off-site emergency plan for Sizewell.

The significance of these factors is discussed below.

## 5.1 Local Geographic, Demographic and Practical Implementation Factors

ONR technical assessment guide (TAG) (reference 2) indicates 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 REPIR Regulation 9(12).)”*

Sizewell is located on the Suffolk coast approximately 35 km northeast of Ipswich and 31 km south of Lowestoft. It is a predominantly rural area with the nearest settlements being the adjacent village of Sizewell itself (population 30), the town of Leiston (population 6,751: 3 km west), Thorpness (population 300 approx: 4 km south), Aldringham (population 700: 4 km south-west), and Aldeburgh (population 2,800 approx: 7 km south). Other nearby features of note are itinerant locations in the form of the Sizewell Beach, a holiday park, three campsites, Sizewell Hall conference facility, a public house, and the RSPB Minsmere nature reserve (9.7 km<sup>2</sup>). The prevailing wind direction is from the south-west.

I have consulted Suffolk County Council (SCC) on a number of local geographic, demographic and practical implementation factors and the responses received are reflected below, in the appendices, and throughout this section of the report. I am also aware that the Suffolk Resilience Forum conducted a public consultation in early 2013 on ‘Proposed Improvements to Sizewell Emergency Arrangements’, and that the results of this consultation have been used by the County Council to help inform its response to ONR.

SCC has advised ONR that it is of the view (references 13a and 13b) that the REPIR off-site emergency planning area should be defined using 6-figure postcode areas in order to enhance delivery of effective emergency planning and its implementation around Sizewell. ONR accepts SCC’s advice in this respect.

**Conclusion 2:** That the REPIR off-site emergency planning area boundary will be defined, so far as is sensible, using 6-figure post code areas.

Whilst the land component of this area identified can be defined by the use of postcodes or geographical features, neither option exists for the seaward component. Whilst the seaward component could continue to be defined as a broadly semi circular area (which would preclude continuity with a postcode based land component), it is ONR’s opinion that the land and marine components should meet at the same points on the coast, thereby avoiding discontinuities.

As part of SCC’s off-site emergency plan, the Maritime and Coastguard Agency (MCA) (which is responsible for coordinating the exclusion of maritime traffic during a radiation emergency) was consulted. The MCA has recommended (reference 14) that, in terms of being able to notify vessels (unambiguously and simply) of an exclusion zone in the event of an emergency, the most effective options for the marine component of the area would be either a semi-circle (of defined centre coordinate and radius) or a rectangle (with defined corner coordinates). Since a post-code defined land component of the REPIR off-site emergency planning area would not meet the coast at equal distances from the Sizewell nuclear licensed sites, it was decided to discount the semi-circle option on pragmatic grounds. Consequently, in my opinion, the extent of the marine area should be defined as a rectangle that commences at the

points where the land area meets the coastline. MCA advice indicates that, since the coast at Sizewell generally follows the longitudinal grid lines (north-south), the simplest description of the marine area would be the area bounded by two latitudinal coordinates at a fixed integer distance from the coast. This would readily allow MCA to advise vessels to take appropriate countermeasures within a clearly defined area.

In accepting this advice, I am of the opinion that the area should extend, perpendicularly, 2.0 km out to sea, between the latitudes 52 deg 11.26 N and 52 deg 14.64 N. This is an approximate rectangular area of circa 14 km<sup>2</sup>.

**Conclusion 3:** That the extent of the marine area should be defined as a rectangle that commences at the points where the land area meets the coastline, and should extend, perpendicularly, 2.0 km out to sea, between the latitudes 52 deg 11.26 N and 52 deg 14.64 N

## 5.2 Credibility and Confidence in the Extent of the REPPiR Off-Site Emergency Planning Area

ONR technical assessment guide (TAG) (reference 2) indicates that:

*“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.”*

The result of the technical assessments of the RoAs submitted by duty holders confirms that the limit of the extent to which members of the public may be exposed to ‘5 mSv in the year following a reasonably foreseeable radiation emergency’ is a distance of no greater than 425 m from the sites.

However, 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.

Hence, a REPPiR off-site emergency planning area of the small size implied by the contour equating to public exposures of ‘5 mSv over the year after such an emergency’ would not, in my opinion, provide a sufficient off-site planning area for the purposes of REPPiR dose restriction, noting the proximity of the significant conurbation of Leiston to the sites.

To examine the extent of the area necessary to provide for a meaningful off-site planning area, I have considered the off-site emergency planning challenge that would be presented by an area, defined by 6-figure postcodes (references 15 and 16) around Sizewell which lie all or in part within 1 km of the site boundaries.

Information, provided by the local authority, on the population within such an area (appendix A) indicates:

- a permanent population of 104 and estimated transient (nature reserve visitors) population of up to 400-500;
- that it contains 53 private and 9 commercial properties;

- that there are four vulnerable groups close to this area (i.e. three camping/caravan sites located at a distance of 1-2 km and one small disabled care home located 2-3 km from sites); and
- that the nearest significant population is Leiston town (with approx 7500 inhabitants and commencing 2 km or so from the Sizewell nuclear sites).

In this context, ONR is mindful that, whilst UK licensees are typically conservative in their approach to nuclear safety, that 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 licensees demonstrate that the overall risk from the two sites has reduced, ONR is of the opinion that it is appropriate, where public safety is at stake, that it act with reasonable conservatism in its own right, in the interests of confidence in securing the public safety objective of REPPiR.

As a consequence, ONR's principles recognise that a very small off-site emergency planning area, which demands very little by way of an emergency plan in practice, may not be capable of providing sufficient flexibility in the (albeit extremely unlikely) event that the technical assumptions, judgements or estimates made by licensees are challenged in practice. It is my judgement that this is a relevant consideration in the case of Sizewell due to the relatively close proximity of the significant populations of Leiston and Aldringham. As a consequence, I am of the opinion that the extent of the plan should be such that it necessarily provides for a credible and effective off-site emergency response plan.

The geographical area considered above, which is based primarily on postcodes on or within 1 km from the site boundaries, represents a small area of only low population density. This would not, in my opinion, be sufficient in nature to provide for a credible and effective off-site emergency plan to secure protection of the public in the event of a reasonably foreseeable radiation emergency at Sizewell, noting the close proximity of the significant population centre of Leiston.

I have also considered an area extending to 2 km from the Sizewell sites (being the greatest distance possible without including any part of the town of Leiston). This area contains permanent and transient populations of up to 120 and 500-600 respectively, and 59 private and 10 commercial properties. These population values are not substantially different from those relating to the 1 km postcode area described above. Therefore, and for the same reason as above, it is my opinion that this would also not be sufficient to provide for a credible and effective off-site emergency plan to secure protection of the public in the event of a reasonably foreseeable radiation emergency at Sizewell, again noting the close proximity of the population centre of Leiston.

In conclusion, due to the small populations within the 1 km and 2 km radial zones from the sites, and the comparatively large and immediately adjacent population of Leiston, it is my opinion that a REPPiR off-site emergency planning area based on a radius of 2 km or less, may not provide for a credible and effective REPPiR off-site emergency plan in the context of the proximity of the significant population of Leiston.

As a consequence, it is my opinion that the area should extend beyond to include at least, a part of Leiston (as per the extant defined REPPiR off-site emergency planning area).

**Conclusion 4:** It is my opinion, and given the immediate proximity of Leiston, that a REPPiR off-site emergency planning area of 2 km or less would not provide for a credible or effective plan to secure the protection of the public, or restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency. Consequently, the REPPiR off-site emergency planning area should extend to include at least a part of Leiston.

### 5.3 Avoidance of Bisection of Local Communities

ONR technical assessment guide (TAG) (reference 2) indicates 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 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.”*

ONR is aware that the current circular REPIR off-site emergency planning area (of radius 2.4 km) already presents the situation whereby it bisects the town of Leiston. This has the effect that, as things stand, neighbours may find themselves inside and outside of the area respectively. ONR is aware that this has resulted in expressions of concern from some members of the community that such an outcome is not only confusing, but results in practical differences in the levels of emergency planning provided to immediate neighbours.

In this respect, ONR notes that SCC has expressed an opinion that the:

- Ongoing bisection of Leiston would be illogical and non-pragmatic in terms of development and delivery of the REPIR off-site emergency plan that it would need to put into place; and
- The majority of the village of Aldringham, which for the most part is effectively continuous with Leiston, should be treated as part of the same community as Leiston (Reference 13b) [NB. As described in section 5.1 above, the populations of Leiston and Aldringham are respectively approximately 6,750 and 700].

It is also considered that the avoidance of bisection of Leiston would avoid confusion and ongoing concerns amongst members of this community as regards the action to be taken in the event of a reasonably foreseeable radiation emergency.

It is my opinion that, in this specific case, it would be neither sensible, justifiable, nor appropriate, from the perspective of emergency planning or of public confidence in its own safety, for the REPIR off-site emergency planning area and prior information area to continue to bisect the joint conurbation of Leiston and the majority of the village of Aldringham.

Noting ‘Conclusion 4’ above (to the effect that REPIR off-site emergency planning area should include at least part of Leiston), it is my opinion that the provision of emergency planning, and of prior public information, should extend to encompass the population of Leiston/ Aldringham. It is my opinion that this would act in the best interests of securing confidence in public safety and require the local authority to consider all reasonably practicable planning measures to restrict exposure in the event of such a reasonably foreseeable radiation emergency from the Sizewell A and B sites.

In addition, it is my opinion that the associated costs and dis-benefits of including the entirety of this community would not be grossly disproportionate to the benefits in this particular case.

Considering all of these arguments, it is my opinion that ONR should include the joint conurbation of Leiston/ Aldringham within the revised REPIR off-site emergency planning area.

Given this conclusion, the extent of the REPIR off-site emergency planning area in other directions than Leiston/ Aldringham must be considered. In my opinion it would not be in the best interests of public confidence were the distance to other points on the boundary of the REPIR off-site emergency planning area be substantially less than the 2 km referred to in section 5.2. Were I to do so, the situation would prevail where residences on the Western edge of Leiston would be substantially further from the site than residences in other directions.

Conversely, in my opinion, it would be disproportionate to extend the area in all directions so as to equate to the Western edge of Leiston (approximately 4 km from the Sizewell site) as the whole of Leiston was included solely to avoid its illogical bisection.

Other, much smaller communities and residencies outside of Leiston/Aldringham are not bisected, and are therefore not affected by the principle of avoidance of bisection.

As a consequence, it is my judgement that the extent of the REPPiR off-site emergency planning area, in directions other than Leiston/ Aldringham, should be defined as a post-code bounded area varying between approximately 2-3 km from the sites.

**Conclusion 5:** I conclude that it would be appropriate and reasonably practicable to include the joint conurbation of Leiston/ Aldringham within the determination of a revised REPPiR off-site emergency planning area for Sizewell. The boundary of the off-site emergency planning area that does not extend to include Leiston/ Aldringham is defined in this report as a post-code bounded area reaching the Eastern edge of Leiston, varying between approximately 2-3 km from the sites.

#### 5.4 Inclusion of Immediately Adjacent Vulnerable Groups

ONR technical assessment guide (TAG) (reference 2) indicates that:

*“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.)

I have considered information provided by SCC relating to the communities in and around the Sizewell sites at a number of distances for the sites in question (Reference 13b). This information is summarised in appendix A and identifies potential vulnerable groups that are included within each relevant radial distance. (NB. Camping/caravan sites are identified as vulnerable groups on the basis that the important countermeasure of sheltering could be considerably less effective for those occupying a caravan when compared to the protection offered to those who are able to shelter in a more substantial and permanent structure.)

Noting ‘Conclusion 5’ (that the entirety of Leiston/ Aldringham should be included within the re-defined REPPiR off-site emergency planning area), SCC has advised ONR (reference 13b) that there are no additional vulnerable groups within a 100 m wide zone of the area determined by this report in Section 6.1, and only 14 properties of any description within this distance.

**Conclusion 6:** I conclude that the adoption of a REPPiR off-site emergency planning area that included the whole of the joint conurbation of Leiston/ Aldringham and 2-3 km elsewhere on land, would not need further modification to incorporate adjacent vulnerable groups.

#### 5.5 International Good Practice

ONR technical assessment guide (TAG) (reference 2) indicates 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 Agency (IAEA) publications GS-R-2 and GS-G-2.1 (references 6 and 7).



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 as follows:

- i) **'Precautionary Action Zone' (PAZ)** - for which arrangements shall be made with the goal of taking precautionary urgent protective action before or shortly after the release of radioactive material occurs, in order to substantially reduce the risk of severe deterministic effects. In relation to a generic power station with reactor powers equivalent to that of the Sizewell B station, and in the absence of substantiated detailed safety analysis, the radius of this zone is suggested to be in the range of 3-5 km. [NB. Due to differences in the UK legal framework, and the assessment of reasonably foreseeable radiation emergencies on a case-by-case basis, this zone is not directly comparable with ONR's determination of a REPPIR off-site emergency planning area].
- ii) **'Urgent protective action Planning Zone' (UPZ)** - for which arrangements shall be made for protective action to be taken promptly, in order to avert doses off the site in accordance with international standards. This is the practical limit of the radial distance within which to conduct monitoring and to implement appropriate urgent protective actions within a few hours. In relation to a generic power station with reactor powers equivalent to that of the Sizewell B station, and in the absence of substantiated detailed safety analysis, the radius of this zone is indicated to be in the range of 5-30 km. [NB. Again, due to differences in the UK legal framework, and the assessment of reasonably foreseeable radiation emergencies on a case-by-case basis, this zone is not 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 accrual of an unmitigated exposure 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 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 4) and is broadly supported by Public Health England (PHE) (reference 17), which recommends that

significant countermeasures '....should be offset by a correspondingly significant level of anticipated dose averted (ie. 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 revised Principles for Determination of DEPZs (and Related Guidance) (references 6 and 2) indicate that areas should not be simple circles, but should take account of a range of factors such (e.g. geographical factors and political boundaries etc). This aspect of international guidance is reflected in ONR's principles for the determination of REPPIR off-site emergency planning areas.
- f) UK radiological emergency planning arrangements are complemented by arrangements available under the Civil Contingencies Act (2004) (CCA) (reference 18), 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 guidance recommends that off-site plans prepared under REPPIR should include a framework for such scalability.

I am aware that the existing SCC Sizewell Off-Site Emergency Plan contains voluntary arrangements that are supplementary to the REPPIR off-site emergency planning area, and which reflect a tiered approach to off-site emergency planning that has analogies with the IAEA concepts and principle of extendibility as described above. SCC has informed me of its intention to retain these voluntary additional arrangements in the context of the re-determination of the REPPIR off-site emergency planning area in this report. However, ONR is not the enforcing authority for CCA and has no legal powers in relation to 'extendibility'.

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 that the limited relevance given the legislative approach taken in the UK, it is of interest the area determined within this report is broadly consistent with international good practice.

## **5.6 Benefits and Dis-benefits of Dose Reduction Measures (including Countermeasures)**

ONR technical assessment guide (TAG) (reference 2) indicates 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 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 other benefits and dis-benefits associated with an increase or decrease in the size of the REPPIR off-site emergency planning area. For completeness, these were identified and considered.

A smaller (e.g. reduced) area might be beneficial in that emergency responders would be able to focus their efforts on delivering dose reduction measures (including countermeasures) in a more concentrated manner across a smaller geographical area.

Conversely, a larger area (e.g. that includes the communities of Leiston and Aldringham within the REPPIR off-site emergency planning 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).

Both cases allow the flexibility to avoid bisection of Leiston, to avoid concerns relating to those who live on either side of the REPPIR off-site plan area, and potential confusions as to who was subject to what level of protection.

However, 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 with the REPPIR off-site emergency planning area, and allows the targeting of specific dose reduction measures to specific sub-populations within the area.

As a consequence, it is my judgement that the determination of a larger area neither necessarily implies any detrimental dilution of the arrangements that SCC may put in place as regards the REPPIR off-site emergency planning area, nor the need to apply unnecessary (dis-beneficial) countermeasures.

However, as described in paragraph 5.3 above, key to my conclusion is that inclusion of the conurbation of Leiston/ Aldringham would be appropriately conservative in the interests of public safety (and in restricting exposures so far as is reasonably practicable), and would require the establishment of sufficient capability for the plan to be credible (i.e. to provide sufficient flexibility to take all reasonably practicable measures to restrict exposure, and 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).

Finally, it is recognised that any extension to the REPPIR off-site emergency planning area may incur some additional costs. However, REPPIR provides sufficient flexibility to the local authority to ensure that measures to restrict exposures so far as is reasonably practicable (in the event of a reasonably foreseeable radiation emergency) are necessary, can be well targeted, and are proportionate. As a consequence, it is my opinion that the associated costs and dis-benefits of including the entirety of this community would not be grossly disproportionate to the benefits in this particular case.

Taking these considerations into account, and on balance, it is my opinion that the safety benefits associated with increasing the REPPIR off-site emergency planning area (for reasonably foreseeable radiation emergencies) to include Leiston, outweighs the benefits of excluding or bisecting Leiston.

**Conclusion 7:** Taking into account the benefits and dis-benefits of the application of emergency dose reduction measures (and noting the flexibility offered by REPPIR to the local authority to target such measures to specific sub-populations or areas), it is judged on balance that the benefits of including Leiston/ Aldringham outweigh the benefits of its exclusion.

## 5.7 Other site specific factors of which ONR is aware

ONR's technical assessment guide (TAG) (reference 2) indicates that:

*"ONR will also consider, in determining DEPZs, any additional site-specific factors that it considers relevant on a case-by-case basis."*

One such factor that has been considered relates to the potential that the construction of one or more new nuclear power stations at Sizewell might affect the extent of the Sizewell REPPIR off-site emergency planning area. However, in the absence of a RoA for such a development, ONR is unable to take account of any proposed development of additional reactors at this location.

REPPIR neither requires that a RoA exist for a potential Sizewell C at this stage, nor allows for it to be taken into account in a speculative manner,

However, REPPIR does require that a review (and re-determination if appropriate) of the REPPIR off-site emergency planning area be undertaken before the commencement of operation of any such new reactor(s). Further, REPPIR places a legal obligation on the



operator to submit a RoA to ONR at least 12 months before the commencement of work with ionising radiation.

ONR notes that, in addition to the radiological considerations relating to any proposed new reactor development at Sizewell, that emergency planning arrangements put in place by SCC would need to consider (at an appropriate time) the ability of the plan to protect the potentially large Sizewell C construction workforce which would be working, and possibly living, in the vicinity of the existing sites.

These issues have been 'flagged up' with Suffolk County Council, which is the duty holder for the off-site emergency plan (and is also involved in planning processes relating to some aspects of construction and related developments).

**Conclusion 8:** Whilst REPPIR would require a review and re-determination (if appropriate) of the REPPIR off-site emergency planning area prior to operation of any new nuclear reactors at Sizewell, it does not permit this to be taken into account at the time of this determination (i.e. speculatively).

## 6 CONCLUSIONS AND RECOMMENDATIONS

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 undertaking this determination, it has become evident that the term 'Detailed Emergency Planning Zone (DEPZ)' appears to have been assigned different meanings by different groups of stakeholders. Some stakeholders have used the term 'Detailed Emergency Planning Zone (DEPZ)' to refer to the REPPIR off-site emergency planning area as referred to under Regulation 9 of REPPIR, whereas others appear to have used it to refer specifically to the area within which the operator, in accordance with arrangements made under its nuclear site licence, has plans to implement uniform countermeasures.

In considering that REPPIR does not relate solely to urgent countermeasures, nor requires that countermeasures be applied uniformly across the REPPIR off-site emergency planning area referred to in Regulation 9 of REPPIR it is evident that, whilst the inferred areas may be the same in some instances, they need not necessarily be so.

The term 'Detailed Emergency Planning Zone (DEPZ)' is not explicitly used within REPPIR itself (although it is used in related guidance). Hence, for legal clarity and avoidance of confusion (see section 2.1), ONR has used the terminology 'REPPIR off-site emergency planning area' throughout this report when referring to the area within which people are likely to be affected by a reasonably foreseeable radiation emergency, and in relation to which the local authority must prepare an off-site emergency plan (and within which the operator must provide prior information) under REPPIR.

This report describes the re-determination of the REPPIR off-site emergency planning area (which was previously identified as an area, of radius 2.4 km around the Sizewell A and B sites).

### 6.1 Conclusions

In summary, the conclusions of this report are that:

- ONR is satisfied that the overall risk from the Sizewell A and B sites has reduced, and that the technical submissions made by Magnox Limited and EDF Energy Nuclear Generation Ltd (NGL) demonstrate that members of the public would not be exposed to doses in excess of 5 mSv in the year following a reasonably foreseeable radiation

emergency (or other relevant dose criteria in Schedule 1 of REPPiR) beyond radial distances of 425 m and 234 m respectively.

- The REPPiR off-site emergency planning area will be defined, so far as is sensible, using 6-figure post code areas (to assist Suffolk County Council in the preparation and implementation of off-site emergency plans);
- That the extent of the marine area should be defined as a rectangle that commences at the points where the land area meets the coastline, and should extend, perpendicularly, 2.0 km out to sea, between the latitudes 52 deg 11.26 N and 52 deg 14.64 N;
- Due to the small population within a 2 km radius of Sizewell and the comparatively large and immediately adjacent population of Leiston/Aldringham, it is my opinion that a REPPiR off-site emergency planning area of 2 km or less would not provide a credible or effective plan to secure the protection of the public, or restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency. Consequently, the REPPiR off-site emergency planning area should extend to include at least a part of Leiston.
- In this case, it would be both appropriate and reasonably practicable to include the joint conurbation of Leiston/Aldringham within the REPPiR off-site emergency planning area for Sizewell. In addition, the extent of the REPPiR off-site emergency planning area in directions other than Leiston/ Aldringham, is defined as a post-code bounded area varying between approximately 2-3 km from the sites;
- The adoption of a REPPiR off-site emergency planning area that included the joint conurbation of Leiston/ Aldringham and 2-3 km elsewhere on land would not need further modification to incorporate adjacent vulnerable groups;
- Taking into account the benefits and disbenefits of the application of emergency dose reduction measures (and noting the flexibility offered by REPPiR to the local authority to target such measures to specific sub-populations or areas), the benefits of including Leiston/ Aldringham within the REPPiR off-site emergency planning area outweigh any benefits that would arise from its exclusion; and
- Whilst REPPiR requires a review and re-determination (if appropriate) of the REPPiR off-site emergency planning area prior to operation of any new nuclear reactors at Sizewell, it does not permit this to be taken into account at the time of this determination (i.e. speculatively)

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, it is my conclusion that the REPPiR off-site emergency planning area (and the area within which prior information must be distributed in accordance with REPPiR Regulation 16(1)) be defined as the area around the combined Sizewell A and B nuclear licensed sites bounded by the blue line on the map at appendix B.

This area is generally described as:

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

However, it is important to note that the enhanced REPPiR off-site emergency planning area recommended by this report does not mean that ONR has identified a greater risk for those living near to the Sizewell A and B sites. In fact, and as is made clear in the main body of the report, ONR is satisfied that the overall risk presented by the nuclear sites at Sizewell A and B has reduced.

The enhanced REPPIR off-site emergency planning area is the result of the application of ONR's revised principles for the determination of such areas, which recognise the learning that has emerged from global events such as occurred at Fukushima and the resultant need to review the scope of off-site emergency planning.

This is consistent with ONR's insistence that high standards of nuclear safety and security at nuclear installations are maintained at all times, and reflects our commitment to implementing improvements where appropriate and proportionate to do so.

## **6.2 Recommendations**

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

- Recommendation 1: That ONR write to Suffolk County Council, Magnox Ltd (Sizewell A) and EDF Energy Nuclear Generation Ltd (Sizewell B) to advise that the REPPIR off-site emergency planning area has been determined as the area within the blue line on the map at appendix B.
- Recommendation 2: That ONR write to Suffolk County Council confirming the need to update, as required, its detailed emergency plan to adequately cover the area defined in recommendation 1.
- Recommendation 3: That ONR write to Magnox Ltd (Sizewell A) and EDF Energy Nuclear Generation Ltd (Sizewell B) confirming the requirement to ensure the appropriate provision of prior information to the public within the area referred to in recommendation 1. This information should also be copied to Suffolk County Council.

## 7 REFERENCES

1	A guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001. L126. 2002. <a href="http://www.gov.uk/pubns/priced/l126.pdf">http://www.gov.uk/pubns/priced/l126.pdf</a> .
2	The technical assessment of REPIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 2 2013. <a href="http://www.onr.org.uk/depz-onr-principles">www.onr.org.uk/depz-onr-principles</a> .
3	Koichi Tanigawa et al. Loss of life after evacuation: lessons learned from the Fukushima accident: Lancet: Volume 379 Issue 9819 889-891, 10 March 2012. <a href="http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60384-5/fulltext">http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60384-5/fulltext</a>
4	Council Directive 96/29 Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation. Official Journal of the European Communities (1996) 39, No L159, 1-114 ISBN 0 11 915263 0
5	ONR Safety Assessment Principles for Nuclear Facilities, 2006 Edition, Revision 1. AM.1 Accident management and emergency preparedness.
6	IAEA Safety Standards Series (General Safety Requirements) No GS-R-2 dated November 2002. Preparedness and Response for a Nuclear or Radiological Emergency. ISBN 92-0-116702-4. <a href="http://www-pub.iaea.org/MTCD/publications/PDF/Pub1133_scr.pdf">http://www-pub.iaea.org/MTCD/publications/PDF/Pub1133_scr.pdf</a>
7	IAEA Safety Standards – Safety Guide No GS-G-2.1 2007. Arrangements for Preparedness for a Nuclear or Radiological Emergency. ISBN 92-0-109306 3. <a href="http://www-pub.iaea.org/mtcd/publications/pdf/pub1265_web.pdf">http://www-pub.iaea.org/mtcd/publications/pdf/pub1265_web.pdf</a>
8	TR/SE/221 Issue 2 Sizewell ‘A’: REPIR Regulation 6(4) Hazard Identification and Risk Evaluation Report of Assessment. September 2011.
9a	British Energy. REPIR Hazard Identification and Risk Evaluation Report for Sizewell B Power Station. SZB/50296/R. 12 February 2002.
9b	British Energy. REPIR Hazard Identification and Risk Evaluation Report for Sizewell B Power Station. SZB/TZR/015. 28 March 2011.
9c	EDF Energy Nuclear Generation Ltd. (NGL): The REPIR “Reference Accident” – Additional information for Sizewell B, March 2014. E/REP/BCEB/0032/SZB/13 Rev 1 Draft 3: The Sizewell B REPIR “Reference Accident” – A review of the safety case to provide additional information, March 2014. Additional information on Ingestion Dose Contributions and Equivalent Doses to the Lens of the Eye and Skin. Email to ONR dated: 31 March 2014.
10	ONR-CNRP-AR-12-130: ONR Assessment of Sizewell A REPIR HIRE RoA, Rev 1, August 2013.
11a	ONR Assessment: Sizewell B Nuclear Power Station: Assessment of Operator’s detailed emergency planning zone (DEPZ) submission. June 2002. Report No. 18. NUC/552/70/11/0/0/0-03.
11b	ONR-CNRP-AR-13-104: ONR Technical Assessment of the Sizewell B REPIR Report of Assessment, Rev 3, March 2014.
12	HSE. Arrangements for responding to nuclear emergencies. HSE Books. ISBN 0 7176 0828X. 1994.

13a	SCC letter to ONR confirming request to use postcodes and list of vulnerable groups. 30 July 2013.
13b	ONR written information request to Suffolk County Council. 18 February 2014. SCC response to ONR confirming in principle its ability to implement an off-site emergency plan within the proposed area identified in this report, the request to use postcode boundaries, and the demographic and vulnerable group data contained in appendix A. A Osman, Suffolk County Council, Suffolk Joint Emergency Planning Unit, 7 March 2014.
14	Written correspondence between ONR and Maritime Coastguard Agency (MCA): 19-24 February 2014.
15	SCC example mapping of a potential area defined by postcodes within 1 km of the centre of the sites. Email to ONR dated: 12 July 2013.
16	SCC example mapping of a potential area defined by postcodes within 1 km of any part of the sites boundaries. Email to ONR and operators dated: 18 July 2013.
17	PHE (formerly NRPB), NRPB advice (Volume 8. No.1. 1997, Intervention for Recovery After Accidents, para 35).
18	Civil Contingencies Act (2004): Chapter 36, 13 November 2004, Her Majesty's Stationery Office

## APPENDIX A

### Demographic data for the area around Sizewell

Data provided by Suffolk County Council (Reference 13b)

Description	1 km (approx)	2 km	2.4 km	Off-site emergency planning area determined by this report
	Based on geographical location of 6-figure postcode areas around the Sizewell sites (which lie all or in part within 1 km of the site boundaries).	A circular area of radius 2 km from the Sizewell sites.	The current circular area of radius 2.4 km from the Sizewell sites.	The area within the blue line on the map at appendix B.
Permanent Population	104	120	493	7,300
Transient population	400 – 500*	500 – 600*	700 – 800*	1,000
Total Private Properties	53	59	219	3,200
Total Commercial Properties	9	10	82	250
<b>Vulnerable Groups**</b>				
Schools (public and private)	0	0	0	3
Children Centres	0	0	0	1
Care Homes	0	0	1	5
Camping/Caravan Sites	3	3	3	3
Critical infrastructure	████████	████████	████████	████████

\* Nature reserve visitors – although the majority of the nature reserve is located outside this area. This includes up to 150 visitors with disabilities.

\*\* Suffolk County Council advice: “In completing this work, further child and adult care provision at individual homes was identified but a complete list of such provision has not been completed within the proposed area. Notwithstanding this, the Suffolk Resilience Forum has in place arrangements for the identification of vulnerable groups during any emergency that allows information held by various agencies on vulnerable individuals or groups to be validated at the time of any incident to ensure that up to date information is used when generating emergency response capability.”



## APPENDIX B

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

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

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

### Definitive Sizewell REPIR Off-site Emergency Planning Area:

