



Office for
Nuclear Regulation

**Determination of the Off-Site Emergency Planning and Public
Information Areas for the AWE Plc Nuclear Licensed site of
Burghfield**

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

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EXECUTIVE SUMMARY

Determination of the Off-site Emergency Planning and Public Information Areas for the AWE Plc Nuclear Licensed site of Burghfield: Radiation (Emergency Preparedness and Public Information) Regulations 2001

The Office for Nuclear Regulation (ONR) is responsible for regulating GB nuclear sites in order to protect the health and safety of employees and the public against risks of harm arising from ionising radiations. ONR's responsibilities include a legal duty, where it is concluded that there is a potential for a reasonably foreseeable radiation emergency (as defined in the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPiR)), to determine an off-site emergency planning area¹ (i.e. the area within which, in ONR's opinion, any member of the public is likely to be affected by such an emergency). In these cases, there is also a legal duty, under the same Regulations, for ONR to determine an area² within which prior information is to be distributed to the public. A radiation emergency is defined in REPPiR as a reasonably foreseeable event where a person off-site is likely to receive a radiation dose in excess of the thresholds in REPPiR (typically an effective dose in excess of 5 milliSieverts (mSv)) in the 12 months following. It therefore constitutes an important component of the UK's overall emergency response framework.

This ONR Project Assessment Report describes and explains the basis for the redetermination, in accordance with REPPiR, of the off-site emergency planning area and the area within which prior information is to be distributed to persons around the Atomic Weapons Establishment (AWE) Plc nuclear licensed site of Burghfield.

In relation to the off-site emergency planning area, the responsible local authority, in this case West Berkshire District Council (WBDC), is required to prepare an off-site emergency plan with the purpose of minimising, so far as is reasonably practicable, radiation exposures to those likely to be affected by such an emergency. This plan will reflect the potential need to implement appropriate countermeasures such as sheltering and evacuation in order to reduce radiation doses to members of the public within all or parts of this area.

REPPiR requires operators who carry out work involving quantities of radioactive materials at or beyond those specified by REPPiR, in this case AWE Plc, to undertake a Hazard Identification and Risk Evaluation (HIRE) in relation to their work with ionising radiations. The HIRE must identify all hazards on the site with the potential to cause a radiation accident, and evaluate the nature and magnitude of the risks to employees and other persons (e.g. those who live or work nearby) arising from those hazards. REPPiR also requires operators to assess their HIRE and to submit a Report of Assessment (RoA) to ONR either prior to commencement of the work with ionising radiation, following any relevant material change in this work, or within three years of the last assessment, whichever is the shorter.

From 2002-2018, the off-site local authority emergency planning and prior information areas have been represented by a circular area of radius 1.5 km around the Burghfield site.

The re-determination of this area has been undertaken in response to the submission of a RoA to ONR by AWE Plc. A modification to the emergency plan is required by REPPiR as a result a review of AWE Plc's assessment and the application of ONR's principles for the determination of such areas.

ONR's re-determination of the REPPiR off-site emergency planning area and the REPPiR prior information area for the AWE Plc nuclear licensed site located in Burghfield, West Berkshire, has been undertaken in accordance with ONR's regulatory processes, guidance

¹ ONR has historically used the term detailed emergency planning zone (DEPZ) to refer to the area it defined under REPPiR regulation 9 as requiring an off-site emergency plan. (The term is still used this way in some ONR guidance.) As the term is not used within REPPiR itself (although referred to in the related guidance), and to ensure legal clarity and avoid misunderstanding amongst stakeholders, this report refers to the 'REPPiR off-site emergency planning area' under regulation 9 rather than to 'detailed emergency planning zone' or 'DEPZ'.

² This is sometimes, and has historically been, referred to as the Public Information Zone (PIZ) under regulation 16, but for the same reasons as given above is not used in this report. This report refers to the 'REPPiR prior information area'.

associated with REPPiR itself, and the relevant ONR Technical Assessment Guide (TAG). In particular, the TAG includes ONR's determination principles published in 2014 and associated guidance for the determination of such areas. These principles recognise the learning that has emerged from global events such as occurred at Fukushima and the need to review the scope of off-site emergency planning. They also reflect ONR's commitment to high standards of nuclear safety at nuclear installations, and its continual efforts to seek improvements to measures to secure public safety and to the consistency and transparency of its decision-making.

ONR's determination process requires that:

- (i) Technical assessment be undertaken, by ONR, of AWE Plc's Hazard Identification and Risk Evaluation (HIRE) and Report of Assessment (RoA).
- (ii) In accordance with the relevant ONR TAG, ONR also gives appropriate consideration to practical and strategic factors relating to the planning and potential implementation of a credible off-site emergency plan, and other pragmatic factors appropriate to secure confidence as regards protection of the public. This aspect of the process includes dialogue with the relevant local authorities, in this case WBDC (as the organisation responsible under REPPiR regarding the offsite plan) and considers, amongst other factors, local population (including vulnerable groups), geographical considerations and existing good practice where the local authority emergency plan already extends beyond the minimum required distance. This informs ONR's determination so as to define more practical emergency planning and prior public information areas than would be the case from purely technical considerations.

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

The outcome of ONR's review, taking into account the latest review of hazards on the site and relevant practical and strategic considerations relating specifically to Burghfield is that both the REPPiR off-site emergency planning area and the REPPiR prior information area for the sites have been re-defined and are shown in Appendix D, Map 3. It may generally be described as a land area that varies from 1.3 km to 2.1 km from the centre of the Burghfield nuclear licensed site, which is defined by roads, a railway line, footpaths and fields. The area includes Poundgreen Farm, James's Farm and St. Mary's Church and Parish Hall, Burghfield.

Changes to the shape of the off-site emergency planning area from a circle to the shape indicated with Appendix D reflect factors which ONR judges to be relevant in securing confidence as regards protection of the public during a reasonably foreseeable radiation emergency, the learning that has emerged from global events such as occurred at Fukushima, and the need to review the scope of off-site emergency planning.

The recommendations of this report are that ONR write to:

1. WBDC and AWE Plc to advise that the REPPiR off-site emergency planning area has been redetermined as the area within the red line shown on Map 3 within Appendix D.
2. WBDC confirming the need to update, as required, its detailed emergency plan to adequately cover the area defined in the first recommendation.
3. AWE Plc confirming the requirement to ensure the appropriate provision of prior information to the public within the area referred to in the first recommendation. This information should also be copied to WBDC.
4. Ministry of Defence (MOD), Environment Agency (EA), Food Standards Agency (FSA) and Department of Business, Energy and Industrial Strategy (BEIS), to advise it of the revised REPPiR off-site emergency planning and information areas.

GLOSSARY

| | |
|---------|--|
| AWE ML | Atomic Weapons Establishment Management Limited |
| AWE Plc | Atomic Weapons Establishment Public Limited Company |
| CCA | Civil Contingencies Act (2004) |
| DEPZ | Detailed Emergency Planning Zone (Ref: REPPiR regulation 9(1)) |
| EURATOM | European Atomic Energy Committee |
| FEPA | Food and Environment Protection Act 1985 |
| FSA | Food Standards Agency |
| GB | Great Britain |
| HIRE | Hazard Identification and Risk Evaluation |
| IAEA | The International Atomic Energy Agency |
| MOD | Ministry of Defence |
| 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 | (ONR) Safety Assessment Principles |
| TAG | (ONR) Technical Assessment Guide |
| UPZ | Urgent (protective action) Planning Zone (IAEA terminology) |
| WBDC | West Berkshire District Council |

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1 REGULATORY CONTEXT

The UK Energy Act (reference 1) requires the Office for Nuclear Regulation (ONR) to do whatever it considers appropriate for the purposes of protecting persons against risks of harm arising from ionising radiations from GB nuclear sites, including through:

- a. securing the health, safety and welfare of persons at work on GB nuclear sites; and
- b. protecting persons, other than persons at work on GB nuclear sites, against risks to health or safety arising out of or in connection with the activities of persons at work on GB nuclear sites.

ONR does this by providing efficient and effective regulation of the nuclear industry, holding it to account on behalf of the public, and, in particular, ensuring that appropriate arrangements are put in place to deal with a nuclear emergency.

ONR's responsibilities include a legal duty, where it is concluded that there is a potential for a reasonably foreseeable radiation emergency (as defined in the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPPIR)), to determine an off-site emergency planning area. This is the area within which, in ONR's opinion, any member of the public is likely to be affected by such an emergency³. In these cases, there is also a legal duty under the same regulations, for ONR to determine an area within which prior information is to be distributed to the public⁴. A radiation emergency is defined in REPPPIR as a reasonably foreseeable event where a person off-site is likely to receive a radiation dose in excess of the thresholds in REPPPIR (typically an effective dose in excess of 5 milliSieverts (mSv)) in the 12 months following. It therefore constitutes an important component of the UK's overall emergency response framework.

This report sets out the outcome and justification for the determination of the revised off-site emergency planning and prior information areas for the Atomic Weapons Establishment (AWE) Plc nuclear licensed site of Burghfield, in accordance with the requirements of REPPPIR regulations 9(1) and 16(1) respectively (reference 2).

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 'REPPPIR off-site emergency planning area' is used in this report, it should be assumed to refer equally to the off-site emergency planning and prior information areas.

2 BACKGROUND

The UK nuclear regulatory system requires that every licensee (i.e. nuclear site license holder) demonstrate to the regulator that it fully understands the hazards and risks associated with its operations and controls them appropriately. The regulator (in this case ONR) assesses the safety and security of the design and operation of nuclear plant to ensure that licensees' provisions are robust, and that any risks are reduced so far as is reasonably practicable.

AWE Plc is the company which provides and maintains nuclear warheads for the UK's continuous at sea deterrent, Trident.

AWE Plc works under contract to the Ministry of Defence (MOD) through a government owned, contractor operated arrangement. In 2000, AWE Management Limited (AWE ML) was awarded the contract to operate the site safely and securely as well as deliver a safe, effective

³ ONR has historically used the term detailed emergency planning zone (DEPZ) to refer to the area it defined under REPPPIR regulation 9 as requiring an off-site emergency plan. (The term is still used this way in some ONR guidance.) As the term is not used within REPPPIR itself (although referred to in the related guidance), and to ensure legal clarity and avoid misunderstanding amongst stakeholders, this report refers to the 'REPPPIR off-site emergency planning area' under regulation 9 rather than to 'detailed emergency planning zone' or 'DEPZ'.

⁴ This is sometimes, and has historically been, referred to as the Public Information Zone (PIZ) under regulation 16, but for the same reason as given above is not used in this report. This report refers to the 'REPPPIR prior information area'.

and efficient nuclear warhead programme. The MOD owns the Burghfield site and facilities. The day-to-day management, operations and the maintenance of the site are the responsibility of AWE ML's wholly owned subsidiary, AWE Plc. AWE Plc employs the workforce and maintains the nuclear site licence.

The licensed site is located at Burghfield in West Berkshire. Burghfield operated as an ordnance factory until it entered the Atomic Weapons Programme in 1954. Today, AWE Plc's operations include the entire life cycle of warheads from concept and design, manufacturing, assembly, servicing, as well as decommissioning and disposal.

REPPiR came into force in 2001, and the REPPiR off-site emergency planning area around Burghfield was determined to be a circle of radius 1.5 km from the centre of the nuclear licensed site.

In relation to emergency planning, REPPiR requires operators, in this case AWE Plc, to undertake a Hazard Identification and Risk Evaluation (HIRE) of hazards arising from their work with the potential to cause a radiation accident on their site. These assessments must be sufficient to demonstrate that all such hazards have been identified and the nature and magnitude of the radiation risks to employees and other persons arising from those hazards have been evaluated. Where the assessment shows that a risk exists from an identifiable radiation accident, the operator shall take all reasonably practical steps to prevent any such accident and limit the consequences of any such accident which does occur. REPPiR also requires that operators submit a Report of the Assessment (RoA) of their HIRE to the ONR prior to commencement of the work, following any material change, and at least every three years, whichever is the shorter.

Where it is reasonably foreseeable that a radiation emergency (as defined in REPPiR) could arise, REPPiR requires ONR to determine areas within which, in its opinion, persons (including any member of the public) are likely to be affected by such emergencies. This then defines the area for which local authorities are required to prepare an adequate off-site emergency plan (regulation 9(1)) and for which operators are required to provide specified prior information (regulation 16(1)) to members of the public without them having to request it and also make that information publicly available.

The off-site emergency plan, in cases where one is required, should include countermeasures in order to reduce radiation doses to members of the public, such as sheltering, evacuation, administering stable iodine tablets (in the case of operating nuclear reactors), and other protection measures that are relevant, reasonably practicable, and proportionate to the radiological risk.

Following ONR's determination, the local authority, in this case West Berkshire District Council (WBDC), 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 operator, 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, revised where necessary, and tested at least every three years.

From 2002-2018, there was a circular REPPiR off-site emergency planning areas around Burghfield. ONR defined a radius of 1.5 km around the centre of the Burghfield licensed site (grid reference SU 684 680). This area is shown in Map 1: Map of Burghfield 2002-2018 REPPiR off-site emergency planning area. The corresponding WBDC emergency plan for this area is entitled "Atomic Weapons Establishments Off-site Emergency Response Plan" (reference 3), and public actions are summarised in the "REPPiR: What to do in the event of an Emergency at AWE" (reference 4).

This report sets out the main considerations that ONR has given to redetermining a revised REPPiR off-site emergency planning area for Burghfield. It takes due account of the findings of the RoA, HIRE, and of ONR's principles and guidance for making such determinations.

3 SCOPE

The assessment described in this report sets out the basis for, and conclusions of, the redetermination of the REPPIR off-site emergency planning and prior information area relating to Burghfield. It has been undertaken in accordance with the guidance on REPPIR (reference 5) and the relevant ONR supporting Technical Assessment Guide (TAG) (reference 6), which incorporates ONR's principles for determination of REPPIR areas and related guidance.

ONR's principles recognise the learning that has emerged from global events such as occurred at Fukushima, and the subsequent need to review the scope of off-site emergency planning. They also reflect ONR's commitment to high standards of nuclear safety at nuclear installations, and its continual efforts to seek improvements to standards and to the consistency and transparency of its decision-making.

Provisions for the implementation of food restrictions are not relevant to the process of determining the REPPIR off-site emergency planning area on the basis that they are provided separately (Food and Environment Protection Act 1985 (FEPA)) and are under the legal jurisdiction of the Food Standards Agency (FSA). These provisions are therefore addressed by separate legislation other than REPPIR, may be exercised in a broader range of circumstances (i.e. not restricted to a radiological event), and are subject to existing planned implementation arrangements made by the FSA. They are therefore out with the scope of this report.

4 METHODOLOGY

4.1 ONR's process for determining a REPPIR off-site emergency planning area

This process requires that ONR:

- A. Conduct an initial independent technical assessment of the information provided by the licensee in their HIRE and RoA seeking and using additional information as appropriate; and
- B. Where the potential for a REPPIR defined reasonably foreseeable radiation emergency exists, establish and consider any other relevant practical and strategic factors relating to the planning and practical implementation of measures to restrict public exposure so far as reasonably practicable (e.g. urgent countermeasures) for those persons who are likely to be affected by a radiation emergency.

Step A requires ONR to assess the operator's identification and characterisation of the likelihood, nature and magnitude of the radiation related risks that may result for a radiation accident. ONR also assess the operator's assessment of whether there is the potential for a radiation emergency to occur that is reasonably foreseeable. If this potential exists ONR will then consider the likely extent of any area within which the dose criteria contained within Schedule 1 of REPPIR may be met or exceeded. This indicates the minimum distance for further consideration in Step B, and is usually presented in the operator's assessment reports as a circle with a specified radius centred at the source of the potential accident.

Step B applies additional pragmatic, population (including vulnerable groups), geographic and practical factors to the ONR determination and requires dialogue with the relevant local authority. The nature of these factors is set out in detail in the relevant ONR TAG (reference 6). Whilst the determined REPPIR off-site emergency planning area, as a result of considering these additional factors, need not be circular, it cannot be smaller than that arising from the technical assessment under Step A.

ONR's principles relating to practical and strategic considerations (reference 6) emphasise that, in the undertaking of the determination, it is important to ensure that a balance is achieved between the assessment of the technical submissions provided by the licensee, and such additional practical and strategic considerations that, in ONR's opinion, are judged necessary in the interests of confidence in public safety. As a consequence, the extent of the

REPPIR off-site emergency planning area represents a regulatory judgement of the significance of all of these factors, and is made on a case-by-case basis.

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

- local geographic, population and practical implementation factors;
- avoidance of bisection of local communities where sensible to do so;
- inclusion of immediately adjacent groups of vulnerable people;
- the need for the REPPIR off-site emergency planning area to provide for a credible emergency plan, for the purposes of public protection, in which the public will be confident;
- consideration of the implications of the extent of the REPPIR off-site emergency planning area in the context of an effective emergency response (e.g. dilution of resources (i.e. police, fire and ambulance) and potential dis-benefits associated with immediate/urgent countermeasures);
- relevant international good practices; and
- other relevant site specific factors of which ONR are aware.

The starting point for the off-site emergency planning area is based on the most significant reasonably foreseeable event (referred to in ONR's Technical Assessment Guide (TAG) reference 6 as the 'reference accident', and described in guidance as an event which is less than likely but realistically possible). Such an accident could be caused, for example, by possible plant and equipment failures, breakdown of administrative arrangements, and potential unauthorised behaviour of employees or the public.

For radiation emergencies that are judged not to be reasonably foreseeable (e.g. have an extremely low likelihood but which potentially have a greater range of affect than the off-site emergency planning area), the guidance associated with REPPIR recommends, as a good practice, that local authorities should be capable of extending their emergency response beyond the REPPIR off-site emergency planning area should it be necessary to do so.

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

In determining a REPPIR off-site emergency planning area, ONR acknowledges that the implementation of urgent countermeasures, for example rapid evacuation, can in some circumstances, convey a risk of harm to individuals to whom they are applied. For example, 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 7). Within the REPPIR off-site emergency planning area determined by ONR, the local authority may expect some countermeasures to be applied immediately or urgently across at least a part of the area (normally the closest to the potential source of radiation). It is important that the area within which they may be applied, in the event of an emergency, is targeted and proportionate in order to ensure that overall risks to those affected are reduced so far as is reasonably practicable.

4.2 Basis of assessment

The REPPIR off-site emergency planning area must, as a minimum, include all of the area around the site within which any person could receive an effective dose in excess of 5 mSv in the year following a reasonably foreseeable radiation emergency (or other dose criteria defined in REPPIR Schedule 1). When assessing the extent of exposure, REPPIR requires that operators assess the potential doses to members of the public from all exposure routes and, for this purpose, must disregard any health protection countermeasures that may be implemented by the local authority, emergency services or the exposed persons themselves, during the first 24 hours immediately following the event.

AWE Plc has completed its HIRE assessment and prepared its RoA, which form the basis of 'Step A' (see section 4.1) of the assessment and determination described in this report.

4.3 Standards and Criteria

4.3.1 Acts, regulations and guidance

The relevant standards and criteria considered within this assessment are those contained within the REPIIR (reference 2) and its associated guidance (reference 5). REPIIR are regulations created under the Health and Safety at Work Act 1974 and implements the articles on intervention in cases of radiation emergencies contained in the European Council Directive 96/29/EURATOM (European Atomic Energy Committee (EURATOM)) - Basic Safety Standards for the Protection of the Health of Workers and Members of the Public against the Dangers from Ionising Radiation (reference 8).

4.3.2 Safety Assessment Principles

ONR's Safety Assessment Principles (SAPs) provide inspectors with a guiding framework for making consistent regulatory judgements on nuclear safety cases. Although the SAPs are not directly relevant to the assessment of REPIIR submissions, the guidance within SAP: AM.1 - Accident management and emergency preparedness (reference 9) has been taken into account.

4.3.3 Technical Assessment Guides

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

- The technical assessment of REPIIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 3 2016 (reference 6). This TAG incorporates ONR's principles for determination of REPIIR off-site emergency planning areas.

4.3.4 National and International Standards and Guidance

The following national guidance has also been considered and, where appropriate, has informed the conduct of this assessment:

- A guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (reference 5).

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

- The International Atomic Energy Agency (IAEA) Safety Standard Series – Preparedness and Response for a Nuclear or Radiological Emergency No GSR Part 7 (reference 10).
- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GS-G-2.1 (reference 11).

5 ASSESMENT OF TECHNICAL SUBMISSIONS

In accordance with REPIIR regulation 5, AWE Plc undertook a review of their HIRE assessment (reference 12) and identified and assessed the hazards on site with the potential to cause a radiation accident. An RoA was submitted to ONR to reflect this review (reference 13). By agreement with the ONR (reference 14), diagrams and descriptions of plant systems as well as specific details of the quantities of radioactive materials present on the site have not been included within the RoAs for reasons of national security. However, AWE Plc made the information available in order that ONR could undertake a comprehensive review of the assessments.

The ONR TAG (reference 6) sets an expectation that the primary source for much of the information used by the licensee to identify and characterise radiation related hazards will come from the existing safety cases. The safety assessment process is a systematic identification of those factors with a potential to cause a major release of radioactive material or an unacceptable reduction of safety margins used to control criticality hazards. This provides a comprehensive schedule of initiating events and the associated safeguards, mitigation and emergency response plans.

ONR has subjected AWE Plc's RoA (reference 13) and supporting documentation to expert technical assessment (reference 15) and the key findings are summarised in sections 5.1.

5.1 Burghfield Report of Assessment (RoA)

AWE Plc identifies the reference accident for the Burghfield site as a detonation within a cell. This could result in radioactive materials being dispersed into the air in a plume carried off-site by the speed and direction of the wind.

The dose assessments are based on inhaled dose of the passing plume. The contributions of external irradiation from the passing plume or from deposited uranium/plutonium, and ingestion dose have been assessed as negligible due to the nature of these materials. Inhaled dose as a result of resuspension of deposited uranium/plutonium material has also been assessed as negligible.

The RoA concludes from the reference accident that the area in which a member of the public might potentially receive a radiation dose of up to 5 mSv as a result of a reasonably foreseeable radiation emergency is bounded by a distance of 1.252 km (reference 13). This distance is a reduction from the distance of 1.5 km that the off-site emergency planning area has previously been based on. The assessment for Burghfield is more precise and pessimisms in the calculations refined, hence the reduction to an area of 1.252 km from the centre of the nuclear licensed site.

5.2 ONR Technical Assessment

REPPIR and ONR guidance (references 5 and 6) specify that best-estimate analysis should be used by operators to calculate off-site dose consequences and that "evidence should be presented that unwarranted conservatism is not being used". Some conservatism may be used in the calculation of off-site dose figures, for example to simplify analysis, but unwarranted conservatism can give rise to a disproportionately extensive emergency plan. Therefore, ONR has considered whether analysis undertaken by AWE Plc is appropriate to support the conclusions of the RoA.

ONR's technical assessment (reference 15) considered the adequacy of the licensee's submissions against the issues listed below. Based on these, ONR's specialist inspectors recommend a minimum size for the off-site emergency planning area. This is based on a dose contour within which the radiation dose to a member of the public from a reasonably foreseeable event could exceed 5 mSv.

ONR's assessment addressed the following issues, with a view to commenting on the adequacy of different aspects of AWE Plc's submission:

- Whether the radionuclide inventory exceeds the REPPIR Schedule 2 or 3 threshold values for REPPIR to apply;
- The definition and selection of appropriate reference accidents;
- The adequacy of the RoA in determining the magnitude of off-site radiological releases resulting from the reference accident; and
- The distance of the 5 mSv dose contour to be used to inform the setting of the REPPIR off-site emergency planning area.

For Burghfield, an RoA was published (reference 16) which considered there were no reasonably foreseeable events that could lead to a radiation emergency at Burghfield. This position was challenged by the ONR and a revised assessment concluded that a reasonably

foreseeable radiation emergency did exist (reference 17). This assessment concluded that the reference accident was a seismic event leading to a building collapse and consequential inadvertent detonations of conventional explosives causing loss of containment. ONR sought clarification regarding some inconsistencies in this assessment. In the meantime, a number of operational restrictions were introduced and the fault is no longer considered reasonably foreseeable. In the most recent submission, the reference accident is as a result of a detonation within a cell.

The off-site dispersion for Burghfield has been modelled using the Hazard Prediction Assessment Capability (HPAC) code. This code was developed by the United States Defence Threat Reduction Agency and has been assessed against trials indicating that the code produces accurate results (reference 15).

The assessment uses weather conditions based on Pasquill Category D (i.e. average UK daytime weather which is consistent with the requirements of REPPiR).

All accidents that could lead to a reasonably foreseeable radiation emergency result in the release of uranium and/or plutonium compounds. These materials emit alpha and weak gamma radiations. The dose assessment includes internal contributions from plume inhalation over the year following the release. External irradiation from the passing plume or from deposited uranium/plutonium material has been assessed as negligible due to the nature of these materials. The dose associated with the inhalation of re-suspended radioactive material has also been assessed as being less than 1% of the dose uptake (reference 18).

The exclusion of ingestion dose is not accepted by ONR as the definition of a radiation emergency according to REPPiR requires that the dose averted by urgent early health protection countermeasures initiated during the first 24 hours (such as food bans) are disregarded when projecting the dose that members of the public are likely to receive (reference 2). However, assessment undertaken by the ONR found that contribution to public dose from ingestion was negligible (i.e. approximately 1% compared to the total dose) compared to inhalation (reference 19). This is because ingested uranium and/or plutonium compounds pass through the body quickly in contrast to inhaled material which remains in the lungs. Therefore ONR concludes that ingestion dose would not be significant.

High consequence, low frequency external events such as aircraft impacts are considered in the safety case and no faults are identified that give rise to a significant off-site release of radiation. The inadvertent detonation of a warhead is judged to be well beyond a reasonably foreseeable occurrence. A security review has also been undertaken by AWE Plc. This has been assessed separately by the Defence Nuclear Safety Regulator and it is judged that it is not reasonably foreseeable for any security related event to lead to public dose consequences beyond the reference accident (reference 15).

5.3 Conclusions of Technical Assessments

ONR's technical assessment (reference 15) concludes that AWE Plc's submissions adequately meet the requirements of REPPiR with respect to the representation of a reasonably foreseeable radiation emergency.

The assessment also concludes that the radiation emergency dose contour distance (5 mSv) is appropriately established at 1.252 km from the centre of the Burghfield site. ONR agrees that this distance bounds all reasonably foreseeable radiation emergencies with 5 mSv contours and is supported by appropriate technical analysis. However, the distance is informed solely by the technical assessment and does not consider the application of strategic and practical factors (as described in section 6 below).

For the purposes of applying these strategic and practical factors, the distances determined in the technical assessment have been rounded up to 1.3 km for Burghfield.

Conclusion 1: ONR is satisfied that the technical submissions made by AWE Plc demonstrate that members of the public would not be likely (the legal test provided by REPPiR) to be exposed to effective doses in excess of 5 mSv (or other dose criteria defined in REPPiR Schedule 1), in the year following a reasonably foreseeable radiation emergency, beyond a radial distance of 1.3 km from the centre of the Burghfield nuclear licensed site.

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

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

In accordance with ONR's TAG (reference 6) and the principles incorporated within it, ONR must also give consideration to the practicality (in an emergency planning sense) of the REPPiR off-site emergency planning area, by considering a number of pragmatic factors considered to be relevant to securing its confidence regarding the effectiveness and credibility of the plans to deliver protection of the public.

In the course of considering these factors, ONR has consulted with WBDC (as the organisation responsible under REPPiR for preparation of the off-site emergency plans for AWE Plc). Consideration has also been made of data in the RoA (references 13) and data from the Health and Safety Executive National Population Database (reference 20).

The application of these practical and strategic factors is discussed in sections 6.1 to 6.7 below.

6.1 Local Geographic, Population and Practical Implementation Factors

ONR TAG (reference 6) states that:

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

The Burghfield site covers 1.05 km² and contains assembly, servicing, maintenance, office buildings, amenities and decommissioning facilities. There are also on-going construction activities on the site.

The site is in a rural location. The prevailing wind direction on the site is from the south-west. Numerous watercourses pass through this flood plain area; Burghfield brook passes through the eastern part of the site and Millbank pond is 1 km to the south of the site.

Population distribution information is derived from the HSE National Population Database (reference 20) and is illustrated in Map 2: Populations around Burghfield. Further details are tabulated below.

Table 1: Burghfield population distribution information

| Conurbation | Approximate Population | Distance from Site | Direction from Site |
|-----------------|------------------------|--------------------|---------------------|
| Burghfield | 230 | 1.5 km | North West |
| Grazeley | 60 | 2 km | South East |
| Burghfield Hill | 550 | 2.5 km | South West |

| Conurbation | Approximate Population | Distance from Site | Direction from Site |
|-------------------|------------------------|--------------------|---------------------|
| Burghfield Common | 6,000 | 3 km | South West |
| Wokefield Park | 30 | 3 km | South West |
| Three Mile Cross | 1,400 | 3 km | East |
| Mortimer | 6,000 | 4 km | South West |
| Spencers Wood | 3,000 | 4 km | South East |
| Reading | 156,000 | 5 km | North |
| Basingstoke | 85,000 | 12 km | South West |
| Thatcham | 25,000 | 22 km | West |
| Newbury | 31,000 | 25 km | West |

WBDC has been consulted on a number of local geographic, demographic and practical implementation factors which are taken into account throughout this report. Appendix B provides further details of local factors. WBDC has advised that in this locality, there is no apparent benefit for using parish or postcode boundaries in defining the boundary of off-site emergency planning areas. However, the use of practical geographic features were identified as beneficial for ease of implementing the emergency plan. Therefore, as far as is sensible, the REPPiR planning area for the Burghfield site should be defined using physical features such as roads, rivers or footpaths.

Conclusion 2: To assist WBDC in the preparation and implementation of the off-site emergency plan, the REPPiR off-site emergency planning area boundary should be defined, so far as is sensible, using physical features such as roads, rivers, footpaths or other established boundaries.

6.2 Credibility and Confidence in the Extent of the REPPiR Off-site Emergency Planning Area

ONR TAG (reference 6) states that:

“Although REPPiR places the duty on the independent regulator to make an objective and unbiased regulatory determination of the extent of the REPPiR off-site emergency planning area (formerly Detailed Emergency Planning Zone (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 ONR’s technical assessment of the RoAs submitted by AWE Plc confirms that the limit of the extent to which members of the public are likely to be exposed to 5 mSv in the year following a reasonably foreseeable radiation emergency’ is a distance within 1.3 km from the centre of the Burghfield nuclear licensed site.

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 based on a contour equating to the limit of the extent of public exposures of ‘5 mSv over the year after such an emergency’ must also

provide a sufficient off-site planning area for the purposes of satisfying this broader REPIR dose restriction intention, noting the proximity of any significant conurbations to the site.

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

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

As a consequence, ONR's principles recognise that an off-site emergency planning area, which demands very little by way of an emergency plan in practice (e.g. it contains a very small population), 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.

To examine the extent of the area necessary to provide for such off-site planning, the populations adjacent to the sites were considered. As a starting point consideration has been given to the off-site emergency planning challenge presented by the areas within 1.3 km of Burghfield. The following describes the populations within this area as well as the area with a radius of an additional 1 km beyond it.

The night time residential population within 1.3 km of the site is approximately 200 and the night time residential population between 1.3-2.3 km is approximately 700 (reference 20). The nearest major population beyond those distances is Reading which is 5 km away. The population of Reading is approximately 156,000.

The Off-Site Emergency Response Plan which is prepared by WBDC (reference 3), is prepared for the Burghfield and Aldermaston sites. Aldermaston is a nuclear licensed site operated by AWE Plc located approximately 8 km away from Burghfield. Within the off-site planning area for Aldermaston, there are more than 16,000 residents. Due to the fact that both AWE Plc sites are protected by one off-site plan, I would consider that such a plan would provide sufficient flexibility to take all reasonably practicable measures to restrict exposure, in the highly unlikely event that the effects of reasonably foreseeable radiation emergencies had been underestimated for Burghfield, or that any assumptions and judgements in the licensee submissions were challenged in practice.

Conclusion 3: Noting the populations within the 1.3 km radial area of the Burghfield site, the additional populations immediately outside these areas, and that WBDC have an emergency plan to cover both the Aldermaston and Burghfield site, I consider that the 1.3 km radial areas from the centre of the Burghfield nuclear licensed site would provide for a credible and effective plan to secure the protection of the public and restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency.

6.3 Avoidance of Bisection of Local Communities

ONR TAG (reference 6) states that:

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

Bisection or division of communities has the effect that neighbours may find themselves inside and outside of the area respectively. ONR is aware that this may result in expressions of concern from members of the community, may confuse the community, and may result in practical differences in the levels of emergency planning provided to immediate neighbours.

These practical differences in levels of planned protection could also present practical challenges for the local authority and emergency services.

Clearly, whilst the avoidance of the bisection of these communities presents the benefits described, these need to be weighed against potential drawbacks in terms of the size of the protection challenge and impact on the effectiveness of the off-site emergency plan. For example, the risks presented to the additional population associated with implementation of protection countermeasures (e.g. stress, traffic accidents etc) should not be overlooked. This is considered further in section 6.6.

An area with a radius of 1.3 km from the centre of the Burghfield nuclear licensed site, bisects the village of Poundgreen.

ONR is of the opinion, 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 REPPiR off-site emergency planning area and prior information area to bisect the village of Poundgreen.

It is also considered that the avoidance of bisection of Poundgreen would limit confusion as regards to the action to be taken in the event of a reasonably foreseeable radiation emergency.

In addition, the associated dis-benefits of including the entirety of this village would not be grossly disproportionate to the benefits in this particular case.

Considering all of these arguments, all of the village of Poundgreen should be included within the revised REPPiR off-site emergency planning area.

In this specific case, ONR is of the opinion that, it is sensible, justifiable, and appropriate, from the perspective of assuring the effectiveness of the emergency plan, for the REPPiR off-site emergency planning area and prior information area, to include the whole of the community of Poundgreen. It is ONR's opinion that the associated costs and drawbacks of including the entirety of it would be outweighed by the benefits.

Conclusion 4: It would be appropriate and reasonably practicable to include the entirety of the village of Poundgreen within the determination of a revised REPPiR off-site emergency planning area for Burghfield.

6.4 Inclusion of Immediately Adjacent Vulnerable Groups

ONR TAG (reference 6) states that:

“ONR recognises that groups of vulnerable people (e.g. care homes, schools, camping and caravan sites, itinerant populations, etc) located close to the REPPiR off-site emergency planning area (formerly DEPZ) should be provided for in the same manner as those located within the zone.” (The definition of ‘vulnerable’ groups must be the definition adopted by the relevant local authority.)

To support the determination of the required emergency planning area, additional information on vulnerable groups was provided by WBDC (reference 3). When considering this factor, ONR's intent is to be consistent with other aspects of council arrangements for vulnerable groups, therefore, as a default, it will use the relevant local authorities' definition of what constitutes a vulnerable group when considering the extent of the planning area. It should be noted that there is Cabinet Office guidance (reference 21) on this subject with a general definition of “vulnerability” to mean; “those that are less able to help themselves in the circumstances of the emergency” and include people with mobility difficulties, mental health issues, children/elderly, hearing and visual impaired.

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

Information provided by WBDC (reference 3) relating to vulnerable communities in the area 1 km outside the Burghfield site 5 mSv contours (i.e. 1.3-2.3 km from the site) has been considered (Appendix C Vulnerable Groups). This information identifies potential care homes, schools, childcare and caravan sites that are within 2.3 km of Burghfield.

At a distance of 1.4 km from the centre of the Burghfield nuclear licensed site is a nursery based at St Mary's Church Parish Hall, Burghfield. Due to the proximity of this nursery to the Burghfield site and the fact that those within the nursery are considered vulnerable in that they are less able to help themselves in the circumstances of an emergency, it is in ONR's opinion that it should be included in emergency planning considerations.

Grazeley Parochial Church of England Primary School is located 2 km from the Burghfield nuclear licensed site. The school and the community of Grazeley are judged to be of sufficient distance from the site and sufficiently segregated from adjacent populations that inclusion within the REPPiR off-site emergency planning area is not warranted.

Conclusion 5: The vulnerable group of the nursery at St Mary's Parish Hall in Burghfield which is adjacent to but not within the minimum defined area for the Burghfield site should be included in the REPPiR off-site emergency planning area.

6.5 International Good Practice

ONR TAG (reference 6) states that:

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

Relevant international good practice relating to nuclear emergency planning, is contained in International Atomic Energy Agency (IAEA) publications GSR Part 7 and GS-G-2.1 (references 10 & 11). The guidance document (GS-G-2.1) is non-binding, and provides one of many potential benchmarks for comparison.

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

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

- a) IAEA guidance document (GS-G-2.1) provides generic indicative radial distances around different categories of nuclear installations, but also states that 'a different distance should be used when this is substantiated by a detailed safety analysis'. UK legislation, REPPiR, requires the off-site emergency planning area to be based on a robust site specific technical identification and evaluation of the hazards and risks presented by each individual site and, as such, these indicative generic distances are not applied in the UK (although they do provide a comparator, albeit of limited value).
- b) IAEA guidance is based on consideration of extreme accidents, whereas the UK legal framework, as set out in REPPiR, requires detailed planning areas to be based on reasonably foreseeable events (more frequent but less severe events).
- c) IAEA guidance is based on restricting severe deterministic doses (i.e. relatively high doses accrued over a shorter period), whereas REPPiR is based on restricting doses, so far as is reasonably practicable, to everyone who may be affected by a radiation emergency, where a radiation emergency is defined in the UK as an emergency with the potential for an accrued dose of 5 mSv or more in the year following the

emergency (or other relatively low dose criteria). This is a far lower dose threshold in the range of stochastic (random or chance) effects only.

- d) The '5 mSv in the year following the emergency' criteria, relating to the definition of a '...reasonably foreseeable radiation emergency' in UK legislation (REPPIR), is based on European EURATOM Basic Safety Standards (reference 8) and is broadly supported (of the same order of magnitude) by Public Health England (PHE) (reference 22), 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 the REPPIR off-site emergency planning area (and related guidance) (references 10 & 6) indicate that areas should take account of a range of factors (e.g. geographical factors and electoral 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 23), and the developing concept of extendibility (i.e. the concept of planning for emergencies beyond those that are reasonably foreseeable, with the possibility of outline planning to implement dose reduction measures beyond the REPPIR off-site emergency planning area in the highly improbable event of a more severe emergency). UK regulatory guidance states that off-site plans prepared under REPPIR should include a framework for such scalability.

Section 8, Part 4 of the existing WBDC Off-site Emergency Plan (reference 3) contains voluntary arrangements that are supplementary to the REPPIR off-site emergency planning areas, 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. ONR is not the enforcing authority for CCA.

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

6.6 Consideration of Benefits and Dis-benefits of Dose Reduction Measures (including Countermeasures)

ONR TAG (reference 6) states that:

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

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

Noting that REPPIR requires that the off-site emergency planning area must, as a minimum, include all of the area around the sites within which a person (including members of the public) could receive an effective dose in excess of 5 mSv in the year following a reasonably foreseeable radiation emergency (or other dose criteria defined in REPPIR Schedule 1):

- an area of the minimum size might be beneficial as emergency responders would be able to focus their efforts on delivering dose reduction measures (including urgent

countermeasures) in a concentrated manner across a smaller population and geographical area;

- a larger area (e.g. that, for instance, extended to avoid bisection of local communities or to include a vulnerable group) might be perceived as providing safety benefits to a larger population;
- however, a larger area would be judged to have the potential to compromise the effectiveness and timeliness of some of the emergency arrangements; and
- a larger area might be perceived as requiring the application of protection measures (e.g. sheltering, evacuation) across more people than may be necessary (with any risks that could be presented by such measures). This notwithstanding, REPPIR provides the local authority with the flexibility to determine (in consultation with others) exactly what protection measures and dose restriction measures should be planned for in a proportionate and targeted manner. REPPIR does not require that identical measures be applied to everyone within the REPPIR off-site emergency planning area, and allows the targeting of specific dose reduction measures to specific sub-populations within the area.

As described in section 6.2 and in Conclusion 3: Noting the populations within the 1.3 km radial area of the Burghfield site, the additional populations immediately outside these areas, and that WBDC have an emergency plan to cover both the Aldermaston and Burghfield site, I consider that the 1.3 km radial areas from the centre of the Burghfield nuclear licensed site would provide for a credible and effective plan to secure the protection of the public and restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency.

Whilst some may argue that an extension to the REPPIR off-site emergency planning area might have unwarranted cost implications, REPPIR provides sufficient flexibility such that a targeted and proportionate plan can be produced. Whilst ONR notes the potential for cost implications, this is not a material factor in determining off-site planning areas.

From the perspective of assuring confidence and credibility in the effectiveness of the emergency plan it would not be sensible, justifiable, nor appropriate, for the off-site planning area determined by ONR for the Burghfield licensed site to be extended to include Burghfield Village or parts of Reading.

Inclusion of parts of Reading within the off-site planning area for Burghfield would introduce significant risks associated with implementation of protection measures to a large population centre. In addition to these considerations, at approximately 4 times further away than the 1.3 km minimum distance, it is sufficiently far enough away that inclusion is not justified.

Any safety benefits would, in my judgement, be outweighed by the risks of implementing effective protection measures to a much larger population, along with the potential compromise of the effectiveness of the emergency arrangements. Focus would also be diverted from providing protection measures to those groups most at risk.

Conclusion 6: Taking into account the benefits and dis-benefits of the application of emergency protection measures it is judged that a REPPIR off-site emergency planning area for the Burghfield site based on a minimum 1.3 km radius circle, without extension to include Burghfield Village or Reading, achieves an appropriate balance between public protection, the risks from the implementation of protection measures, and retention of an effective emergency planning area.

6.7 Other site specific factors of which ONR is aware

ONR TAG (reference 6) states that:

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

REPPIR requires operators to review their HIRE before the commencement of operation of any new work or relevant material change to existing work with ionising radiation. A material change could include, for example:

- a) use of different radioactive substances;
- b) use of different quantities of the same radioactive substances;
- c) changes in the physical form of the radioactive substances in use;
- d) use of new or different technologies;
- e) modifications to existing technologies; or
- f) changes in safety management or safety-critical administrative procedures.

Further to this, REPPIR places a legal duty on the operator to submit a RoA to ONR at least 12 months before the commencement of any such material changes to operations that could affect the validity of the off- site planning area, or new work with ionising radiation.

The radiological hazards and risks associated with any new work, or relevant material change to existing work, at the AWE Plc sites would need to be considered by ONR, and emergency planning arrangements put in place by WBDC to ensure adequate protection of the workforce and public as intended by REPPIR.

Construction to build replacement storage and processing facilities is currently underway at Burghfield. It is worth noting that the facility will be built to modern standards, including seismic qualification, and completion may result in a reduction in the consequences of the reference accident which could occur. Upon completion of the facility, AWE Plc will review their HIREs and, if appropriate, submit a revised RoA for ONR to consider.

Conclusion 7: 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 work or a relevant material change to existing work with ionising radiation on the AWE Plc site, it does not permit this to be taken into account at the time of this determination (i.e. speculatively). However, such material changes would require a review of the HIRE, potentially of the RoA, and subsequently potentially of the extent of the relevant off-site emergency planning area.

7 CONCLUSIONS

This report sets out the main considerations that ONR has given to determining revised REPPIR off-site emergency planning and prior information areas for the AWE Plc's nuclear licensed site of Burghfield. It takes due account of the findings of the RoA, HIRE, ONR's determination principles and guidance, international best practice and local geographic and population information.

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

In summary, the conclusions of this report are that:

Conclusion 1: ONR is satisfied that the technical submissions made by AWE Plc demonstrate that members of the public would not be likely (the legal test provided by REPPIR) to be exposed to effective doses in excess of 5 mSv (or other dose criteria defined in REPPIR Schedule 1), in the year following a reasonably foreseeable radiation emergency, beyond a radial distance of 1.3 km from the centre of the Burghfield nuclear licensed site.

Conclusion 2: To assist WBDC in the preparation and implementation of the off-site emergency plan, the REPPIR off-site emergency planning area boundary should be defined, so far as is sensible, using physical features such as roads, rivers, footpaths or other established boundaries.

Conclusion 3: Noting the populations within the 1.3 km radial area of the Burghfield site, the additional populations immediately outside these areas, and that WBDC have an emergency plan to cover both the Aldermaston and Burghfield site, I consider that the 1.3 km radial areas from the centre of the Burghfield nuclear licensed site would provide for a credible and

effective plan to secure the protection of the public and restriction of exposures so far as is reasonably practicable, in the event of a reasonably foreseeable radiation emergency

Conclusion 4: It would be appropriate and reasonably practicable to include the entirety of the village of Poundgreen within the determination of a revised REPPiR off-site emergency planning area for Burghfield..

Conclusion 5: The vulnerable group of the nursery at St Mary's Parish Hall in Burghfield which is adjacent to but not within the minimum defined area for the Burghfield site should be included in the REPPiR off-site emergency planning area

Conclusion 6: Taking into account the benefits and dis-benefits of the application of emergency protection measures it is judged that a REPPiR off-site emergency planning area for the Burghfield site based on a minimum 1.3 km radius circle, without extension to include Burghfield Village or Reading, achieves an appropriate balance between public protection, the risks from the implementation of protection measures, and retention of an effective emergency planning area.

Conclusion 7: 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 work or a relevant material change to existing work with ionising radiation on the AWE Plc site, it does not permit this to be taken into account at the time of this determination (i.e. speculatively). However, such material changes would require a review of the HIRE, potentially of the RoA, and subsequently potentially of the extent of the relevant off-site emergency planning area.

Consequently, for emergency planning purposes and in order to ensure appropriate conservatism as regards the protection of the public in the unlikely event of a reasonably foreseeable radiation emergency, the REPPiR off-site emergency planning area (and the area within which prior information must be distributed in accordance with REPPiR regulation 16(1)) is defined as the area around the nuclear licensed site bounded by the red line on Map 3: ONR determination of the REPPiR off-site emergency planning area and the REPPiR prior information area around the AWE Plc nuclear licensed site of Burghfield.

The area defined for the Burghfield site (Map 3) may generally be described as:

A land area that varies from 1.3 km to 2.1 km from the centre of the Burghfield nuclear licensed site (grid reference SU 684 680), which is defined by roads, a railway line, footpaths and field boundaries. The area includes Poundgreen, James's Farm and St. Mary's Church and Parish Hall, Burghfield.

This re-determination has been undertaken in response to REPPiR submissions to ONR by AWE Plc. In the submissions, AWE Plc estimates the maximum radiological hazard in the event of a reasonably foreseeable radiation emergency to be slightly small than previous estimates due to refinement of earlier pessimisms associated with calculations. ONR has considered this submission, applied its 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 and defined the areas shown in Appendix D, Map 3.

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

8 RECOMMENDATIONS

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

Recommendation 1: WBDC and AWE Plc to advise that the REPPiR off-site emergency planning area has been determined as the areas within the red line on Map 3 within Appendix .

- Recommendation 2: WBDC confirming the need to update, as required, its detailed emergency plan to adequately cover the area defined in the first recommendation.
- Recommendation 3: AWE Plc 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 WBDC.
- Recommendation 4: Ministry of Defence (MOD), Environment Agency (EA), Food Standards Agency (FSA) and Department of Business, Energy and Industrial Strategy (BEIS), to advise it of the revised REPPiR off-site emergency planning and information areas.

9 REFERENCES

- 1 Energy Act 2013, Chapter 32. Part 3, Chapter 4, 'Function of the ONR', paragraph 78, 'Principal function'. Part 3, Chapter 1, 'The ONR purposes', paragraph 68(1). The Stationery Office. December 2013. IBN 978-0-10-543213-5
- 2 Radiation (Emergency Preparedness and Public Information) Regulations 2001.
- 3 Atomic Weapons Establishment Off-Site Emergency Response Plan. West Berkshire Council, October 2013.
- 4 West Berkshire Council Emergency information leaflet. "*REPPIR: What to do in the event of an emergency at AWE*" May 2013.
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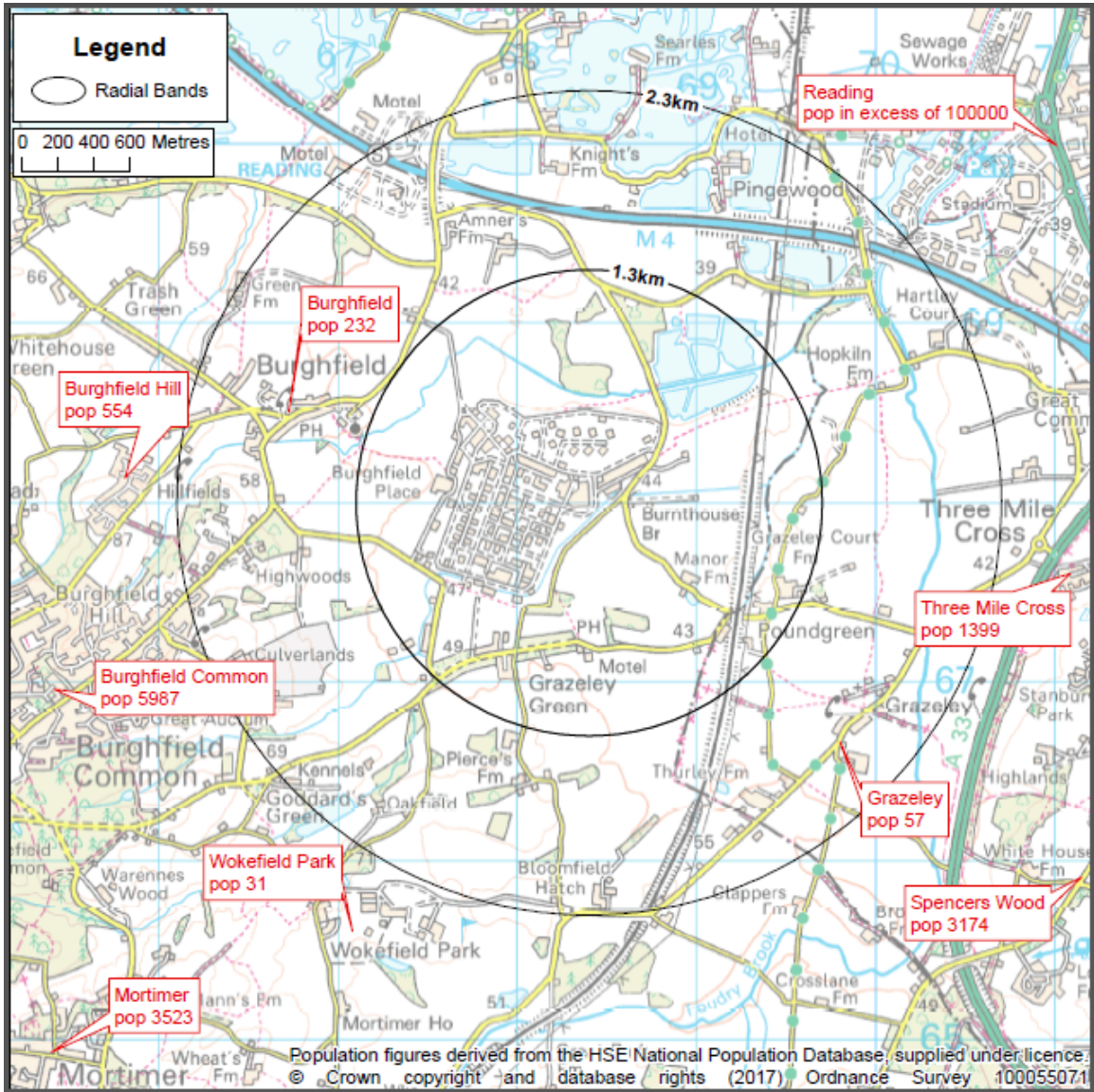
10 APPENDICES

APPENDIX A

Map 1: Map of Burghfield 2002-2018 REPIR off-site emergency planning area



Map 2: Populations around Burghfield site



APPENDIX B

Significant Infrastructure

The basic definition of national infrastructure means “those facilities, systems, sites and networks necessary for the functioning of the country and the delivery of the essential services upon which daily life in the UK depends”.

In terms of critical national infrastructure this definition is developed (or restricted) to those “critical” elements of infrastructure, the loss or compromise of which would have a major detrimental impact on the availability or integrity of essential services, leading to severe economic or social consequences or to loss of life.

WBDC have advised ONR that there are no critical or national infrastructure assets within 0-10km of the Burghfield site. (It should be noted that information relating to critical national infrastructure is marked official sensitive).

However, there are a number of local infrastructure assets e.g. relating to the provision of utilities within the 0-10km zone for each site. These include reservoirs, pumping stations and water treatment works and a few of private water supplies. There are electricity substations throughout the 0-10 km zones.

Transport issues

- Roads:
Around Burghfield, there are no A or B roads however the M4 passes 1.5 km from the site.
- The Rail line between Reading and Basingstoke passes within 1 km the Burghfield site.
- A number of footpaths and other rights of ways exist within the immediate area of the site.

Hospital

The Royal Berkshire Hospital located in Reading is the hospital designated to accept irradiated or contaminated casualties and to advise on, and to assist, with the decontamination of personnel. The hospital is within 10 km of Burghfield.

Strategic Control Centres

There are strategic control centres located at Kidlington, Oxfordshire and Netley, Hampshire.

APPENDIX C VULNERABLE GROUPS

In relation to “vulnerable groups” it should be noted that there is Cabinet Office guidance on this subject with a general definition of “vulnerability” to mean; “those that are less able to help themselves in the circumstances of the emergency” and include people with mobility difficulties, mental health issues, children/elderly, hearing and visual impaired.

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

ONR’s principles for determinations (reference 6) require consideration of vulnerable groups, identifiable premises providing facilities for vulnerable people e.g. schools, sheltered accommodation etc.

WBDC have provided the information below on these vulnerable groups:

Burghfield site

St. Marys Parish Hall, Burghfield which hosts a kindergarten is located less than 1.5 km from the centre of the Burghfield nuclear licensed site.

Grazeley Parochial Church of England Primary School is located 2 km from the Burghfield nuclear licensed site.

APPENDIX D

Map 3: ONR determination of the REPPIR off-site emergency planning area and the REPPIR prior information area around the AWE Plc nuclear licensed site of Burghfield

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

A land area that varies from 1.3 km to 2.1 km from the centre of the Burghfield nuclear licensed site (grid reference SU 684 680), which is defined by roads, a railway line, footpaths and field boundaries. The area includes Poundgreen Farm, James's Farm and St. Mary's Church and Parish Hall, Burghfield.

