Determination of the requirement for Off-site Emergency Planning and Prior Information Areas for the Rolls Royce Marine Power Operations Limited Neptune Reactor and Nuclear Fuel Production Plant Nuclear Licensed Sites, Derby

Radiation (Emergency Preparedness and Public Information) Regulations 2001
EXECUTIVE SUMMARY


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 (REPPIR) 2001), to determine an off-site emergency planning area\(^1\) (i.e. the area within which, in ONR’s opinion, any member of the public is likely to be affected by such an emergency). In these cases, there is also a legal duty, under the same Regulations, for ONR to determine an area\(^2\) 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 determination, in accordance with REPPIR, of the off-site emergency planning area and the area within which prior information is to be distributed to persons around the Rolls Marine Power Operations Limited (RRMPOL) Neptune Reactor and Nuclear Fuel Production Plant Nuclear licensed sites at Raynesway, Derby.

In relation to the off-site emergency planning area, the responsible local authority, in this case Derby City Council (DCC), 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 RRMPOL, 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.

The determination of this area has been undertaken in response to a REPPIR submission to ONR by RRMPOL.

ONR’s determination of the REPPIR off-site emergency planning area and the REPPIR prior information area for the RRMPOL nuclear licensed sites located at Raynesway, Derby, has been undertaken in accordance with ONR’s regulatory processes, guidance 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

\(^1\) 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’
the determination of such areas. These principles recognise the learning that has emerged from global events such as occurred at Fukushima Japan in 2011 and the need to review the scope of off-site emergency planning. They also reflect ONR’s commitment to seek 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 RRMPOL’s submission of 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 DCC (as the organisation responsible under REPPiR regarding the off-site plan) and considers, amongst other factors, local population (including vulnerable groups), geographical considerations and existing good practice where the local authority emergency plan already extends beyond the minimum required distance. This informs ONR’s determination so as to define more practical emergency planning and prior 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 the hazards on the site and the relevant practical and strategic considerations relating specifically to Raynesway, is that both the REPPiR off-site emergency planning area and the REPPiR prior information area for the Raynesway site have been defined and are shown in Appendix E, Map 4. The area defined by this map may be generally described as an area based on a radial distance of 500 m from the centre of the Nuclear Fuel Production Plant, including the A5111 Raynesway dual carriageway to the east and Alvaston Park to the south.

The recommendations of this report are that ONR write to:

1. DCC and RRMPOL to advise that the REPPiR off-site emergency planning area has been determined as the area within the red line shown on Map 4 within Appendix E.
2. DCC confirming the need to prepare a detailed emergency plan to adequately cover the area defined in the first recommendation.
3. RRMPOL 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 DCC.
4. Ministry of Defence (MOD), Environment Agency (EA), Food Standards Agency (FSA) and Department for ‘Business, Energy & Industrial Strategy’ (BEIS), to inform them of the new REPPiR off-site emergency planning and information areas.
# Glossary

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>BNG</td>
<td>British National Grid (referencing eastings and northings)</td>
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<tr>
<td>CCA</td>
<td>Civil Contingencies Act (2004)</td>
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<tr>
<td>DCC</td>
<td>Derby City Council</td>
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<tr>
<td>DEPZ</td>
<td>Detailed Emergency Planning Zone (Ref: REPPIR regulation 9(1))</td>
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<td>DNSR</td>
<td>Defence Nuclear Safety Regulator</td>
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<td>EURATOM</td>
<td>European Atomic Energy Committee</td>
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<td>FEPA</td>
<td>Food and Environment Protection Act 1985</td>
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<td>FSA</td>
<td>Food Standards Agency</td>
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<td>GB</td>
<td>Great Britain</td>
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<tr>
<td>HIRE</td>
<td>Hazard Identification and Risk Evaluation</td>
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<tr>
<td>IAEA</td>
<td>The International Atomic Energy Agency</td>
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<td>MOD</td>
<td>Ministry of Defence</td>
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<td>NFPF</td>
<td>Nuclear Fuel Production Plant</td>
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<td>ONR</td>
<td>Office for Nuclear Regulation</td>
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<td>PAR</td>
<td>Project Assessment Report</td>
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<td>PAZ</td>
<td>Precautionary Action Zone (IAEA terminology)</td>
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<td>PIZ</td>
<td>Public Information Zone (Ref: REPPIR regulation 16(1))</td>
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<td>PHE</td>
<td>Public Health England</td>
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<td>REPPIR</td>
<td>Radiation (Emergency Preparedness and Public Information) Regulations 2001</td>
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<td>RoA</td>
<td>Report of Assessment</td>
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<td>RRMPOL</td>
<td>Rolls Royce Marine Power Operations Limited</td>
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<td>SAPs</td>
<td>(ONR) Safety Assessment Principles</td>
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<td>TAG</td>
<td>(ONR) Technical Assessment Guide</td>
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<td>UPZ</td>
<td>Urgent (protective action) Planning Zone (IAEA terminology)</td>
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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 (REPPIR) 2001) (reference 2), to determine an off-site emergency planning area. This is the area within which, in ONR’s opinion, any member of the public is likely to be affected by such an emergency\(^3\). In these cases, there is also a legal duty under the same regulations, for ONR to determine an area within which prior information is to be distributed to the public\(^4\). A radiation emergency is defined in REPPIR as any 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 report sets out the outcome and justification for ONR’s determination of the off-site emergency planning and prior information areas for the Rolls-Royce Marine Power Operations Limited (RRMPOL) Neptune Reactor and Nuclear Fuel Production Plant (NFPP) nuclear licensed sites at Raynesway, Derby, in accordance with the requirements of REPPIR regulations 9(1) and 16(1) respectively.

ONR is of the opinion that the extent of areas for local authority detailed 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.

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.

RRMPOL is the company responsible for operations at the Neptune Reactor and NFPP nuclear licensed sites at Raynesway.

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\(^3\) ONR has historically used the term detailed emergency planning zone (DEPZ) to refer to the area it defined under REPPIR regulation 9 as requiring an off-site emergency plan. (The term is still used this way in some ONR guidance.) As the term is not used within REPPIR itself (although referred to in the related guidance), 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’.

\(^4\) 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 ‘REPPIR prior information area’.
The Neptune Reactor and NFPP licensed sites are both situated within the boundary of the RRMPOL Raynesway site which is approximately 3 kilometres south-east of Derby city centre. The Neptune Reactor was licensed in 1961 and commenced operation in 1963. The NFPP was largely built in 1950s and 1960s and is involved in the manufacture and trial assembly of submarine nuclear reactor components. The NFPP site is currently undergoing a period of regeneration and new facilities are under design and construction in the north-east area of the site.

REPPIR came into force in 2001, and at the time ONR accepted RRMPOL’s conclusion that there were no reasonably foreseeable hazards on either licensed site which could give rise to a radiation emergency and hence there was no formal requirement for an off-site emergency plan. Prior to this, as a resilience measure following a criticality incident at Tokai Mura in Japan in 1999, Derby City Council drew up a contingency plan (reference 20) for dealing with emergencies arising at Raynesway and this is shown in Appendix A, map 1.

In relation to emergency planning, REPPIR requires operators, in this case RRMPOL, to undertake an assessment (Hazard Identification and Risk Evaluation (HIRE)) of their work with ionising radiation which is sufficient to demonstrate that all hazards arising from their work with the potential to cause a radiation accident 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 practicable steps to prevent any such accident and limit the consequences of any such accident which does occur. REPPIR regulation 6 requires that operators submit a Report of the Assessment (RoA) of their HIRE to ONR and resubmit following any material change and, at least every three years of the last assessment, make a further assessment or, if there has been no change of circumstance which would affect the last RoA, sign a declaration to that effect and send it to ONR.

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 plan shall be prepared in respect of such area as in the opinion of ONR any member of the public is likely to be affected by such radiation emergencies.

The off-site emergency plan, in cases where one is required, should include urgent countermeasures in order to reduce radiation doses to members of the public, such as sheltering, evacuation and other protection measures that are relevant, reasonably practicable, and proportionate to the radiological risk.

For nuclear sites where ONR determines the need for and extent of an off-site emergency plan, the local authority is required to prepare an adequate off-site emergency plan. In so doing, the local authority has a legal obligation under REPPIR regulation 9(12) 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.

3 SCOPE

This report sets out ONR’s assessment and regulatory decision for the requirement for off-site emergency planning and prior information areas for the RRMPOL nuclear licensed sites, in accordance with the requirements of REPPIR regulations 9(1) and 16(1) respectively, and the main considerations that ONR has given to determining the extent of these areas. It takes due account of the findings of the RoA and has been undertaken in accordance with the guidance on REPPIR (reference 3) and the relevant ONR supporting Technical Assessment Guide
(TAG) (reference 4), which incorporates ONR’s principles for determination of REPPIR areas and related guidance as published in 2014.

ONR’s principles recognise the learning that has emerged from global events such as occurred at Fukushima Japan in 2011, and the subsequent need to review the scope of off-site emergency planning. They also reflect ONR’s commitment to seek 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 planning area

This process requires that ONR:

A. Conduct an initial independent technical assessment of the information provided by the operator in their HIRE and RoA seeking and using additional information as appropriate; and

B. Where the potential for a 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 4). Whilst the determined REPPIR off-site emergency planning area, as a result of considering these additional factors, need not be circular, it cannot be smaller than that arising from the technical assessment under Step A.

ONR’s principles relating to practical and strategic considerations (reference 4) emphasise that, in the undertaking of the determination, it is important to ensure that a balance is achieved between the assessment of the technical submissions provided by the operator, and such additional practical and strategic considerations that, in ONR’s opinion, are judged necessary in the interests of providing 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 (reference 4) indicate should be considered are summarised as follows:
- local geographic, population and practical implementation;
- inclusion of immediately adjacent groups of vulnerable people;
- avoidance of bisection of local communities where sensible to do so;
- the need for the REPPiR off-site emergency planning area to provide for an adequate and credible emergency plan, for the purposes of public protection;
- relevant international good practices;
- 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); 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 4 as the ‘reference accident’, and described in guidance as an event which is less than likely but realistically possible). Such an accident could be caused, for example, by possible plant and equipment failures, breakdown of administrative arrangements, and potential unauthorised behaviours of employees or the public.

For radiation emergencies that are judged not to be reasonably foreseeable (e.g. the likelihood of which is so remote that detailed emergency planning against their consequences is not justified), the guidance associated with REPPiR recommends, as a good practice, that local authorities should be capable of extending their emergency response beyond the REPPiR off-site emergency planning area should it be necessary to do so. However, extendibility arrangements are not considered further in this determination.

Although the local authority off-site emergency plans include many protection measures to reduce radiation doses to members of the public, the most commonly referenced off-site urgent countermeasures available in the early stages of a nuclear emergency are sheltering, evacuation and, in the case of operating nuclear power reactors, the administration of 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 evacuation (reference 5). Within the REPPiR off-site emergency planning area determined by ONR, the local authority may plan for some countermeasures to be applied immediately or urgently across at least a part of the area (normally the closet 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. These decisions are a matter for the local authority in statutory consultation (REPPiR regulation 9(12)) with relevant organisations and persons.

4.2 Basis of assessment

The REPPiR off site emergency planning area must, as a minimum, include all of the area around the site within which a person (including members of the public) is likely to 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 have been taken by the local authority, emergency services or the exposed persons themselves, during the first 24 hours immediately following the event.

RRMPOL has completed its HIRE assessments for the Neptune Reactor (reference 6) and NFPP (reference 7) licensed sites and prepared a single RoA (reference 8) for the Raynesway site, 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 REPPIR (reference 2) and its associated guidance (reference 3). REPPIR 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 9).

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 REPPIR submissions, the guidance within SAP: AM.1 - Accident management and emergency preparedness (reference 10) 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 REPPIR submissions and the determination of detailed emergency planning zones, ONR NS-TAST-GD-082 Revision 2 2013 (reference 4). This TAG incorporates ONR’s principles for determination of REPPIR 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:


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

- IAEA Safety Standards – Arrangements for Preparedness for a Nuclear or Radiological Emergency GSR Part 7 (reference 11).

5 ASSESSMENT OF TECHNICAL SUBMISSIONS

In accordance with REPPPIR regulation 5, RRMPOL undertook a review of their HIRE assessments (reference 6, 7) which identified and assessed all hazards on site with the potential to cause a radiation accident. An RoA was submitted to ONR to reflect this review (reference 8). By agreement with the ONR, 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 RoA for reasons of national security. However, RRMPOL made the information available in order that ONR could undertake a comprehensive review of the assessments.

The ONR TAG (reference 4) 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 facilities’ 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 RRMPOL’s RoA (reference 8) and supporting documentation to expert technical assessment. This is reported in reference 13 and key findings are summarised in section 5.1.

5.1 Raynesway Report of Assessment (RoA)

There are two nuclear licensed sites operated by RRMPOL at the Raynesway site. The Neptune Reactor site is a research reactor facility used for prototype testing and confirmation of design methods used in the development of reactor cores for naval submarine pressurised water reactors. The NFPP is involved in the manufacture and trial assembly of submarine nuclear reactor components.

In considering the potential for radiation emergencies following accidents associated with the Raynesway site, RRMPOL subjected the hazard assessment information produced in support of the site safety cases to a systematic review to identify those hazards that are considered to be credible, and which could give rise to a potentially significant radiation dose to a member of the public.

RRMPOL have evaluated a range of possible accidents, including those associated with malicious acts, that have the potential to cause a radiation emergency (as defined in REPPIR) and concluded that, based on experience from international accidents on nuclear sites undertaking similar activities with radioactive materials, that, although extremely unlikely to occur, a radiation emergency is reasonably foreseeable and that off-site emergency planning under REPPIR is required.

RRMPOL’s assessment for the Neptune Reactor site shows that it is not reasonably foreseeable that a radiation emergency could arise at the facility. The NFPP HIRE identified a number of accident scenarios in which an unintended criticality (a self-sustaining nuclear chain reaction) event could theoretically occur and result in a reasonably foreseeable radiation emergency. These reasonably foreseeable scenarios are bounded by a reference accident, which is based upon the accumulation of sufficient fissile material within a non-geometrically favourable vessel. Details regarding specific plant, processes and accident consequences have been excluded from this report for security reasons.

RRMPOL has identified that a solution based criticality is easier to achieve, more likely to have higher off-site radiological consequences and has the potential for multiple pulses (re-occurring criticality) over a period of time. As a result RRMPOL consider that a solution based criticality should be used as the basis for emergency planning. RRMPOL have stated that they have judged that the risks from malicious acts to be in line with those from other sources and are bounded by this criticality accident.

The magnitude of a criticality accident is extremely difficult to predict. RRMPOL used data from a review of a number of historic global criticality accidents to determine the potential scale of an event on the site. The size of the criticality assumed by RRMPOL encompasses 85 - 90% of the historic events for which data is available. This type of event would generate very high local radiation levels which fall rapidly with distance.

RRMPOL’s dose assessments include the major contributions from external radiation arising directly from the criticality; external radiation emitted from released fission products (cloud shine); and inhalation doses from fission products breathed into the body. RRMPOL consider that doses from radionuclides deposited on surfaces (ground shine) and transferred to individual foodstuffs (ingestion) are not significant when compared with that of ‘direct and cloud’ shine and their longer term effects would be 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 310 m from the hazardous areas of the site.

5.2 ONR Technical Assessment

REPPIR and ONR guidance (references 2, 4) 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 RRMPOL is appropriate to support the conclusions of the RoA.

ONR's technical assessment (reference 13) considered the adequacy of the licensee’s submission against the issues listed below. Based on these, ONR’s specialist inspectors consider whether there is the potential for a reasonably foreseeable radiation emergency and, where there is, recommend a minimum size for the off-site emergency planning area. For each site 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 RRMPOL’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.

ONR is satisfied that RRMPOL has presented an adequate assessment of the hazards associated with the Raynesway site. In ONR’s opinion the reference accident selected by RRMPOL may be regarded as a good generalised representation of the type of criticality accident which could occur at the site.

ONR agrees with RRMPOL’s judgement that the risks from malicious acts are in line with those from other sources and their radiological consequences will be bounded by the reference accident scenario.

ONR supports RRMPOL’s approach to estimating the magnitude of a criticality arising on the site and accepts that the size of the event selected by RRMPOL is appropriate. However, ONR recognises the uncertainties in analysis of criticality hazards and their consequences (reference 14), and notes that although unlikely, and not considered reasonably foreseeable, a larger event could occur.

5.3 Conclusions of Technical Assessments

ONR’s technical assessment (reference 13) concludes that RRMPOL’s submission in 2016 for Raynesway adequately meets 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 310 m from the hazardous areas of the 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).

**Conclusion 1:** ONR is satisfied that RRMPOL has presented an adequate assessment, recognising the uncertainties in analysis of this particular hazard and its consequences. ONR accepts that the technical assessment made by RRMPOL demonstrates that members of the public are not 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 distance of 310 m from the hazardous areas on the Raynesway site.

## 6 ASSESSMENT OF PRACTICAL AND STRATEGIC CONSIDERATIONS

The purpose of the REPPIR off-site emergency planning area is to define the area for which the local authority must prepare an adequate off-site emergency plan to secure, 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 radiation emergency.

In accordance with ONR’s TAG (reference 4) 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 DCC (reference 15) (as the duty-holder under REPPIR for preparation of the off-site emergency plan for the Raynesway site). Consideration has also been made of data in the RoA and consultation with RRMPOL (reference 16) (as the duty-holder under REPPIR for the provision of prior information to the public).

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 4) 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 Raynesway site, which encompasses the Neptune Reactor and NFPP nuclear licensed sites, is located 3.25 kilometres south-east of Derby city centre. The site is closely bounded by the river Derwent to the south and west, the Derby to London mainline railway to the north, and the A5111 Raynesway dual carriageway to the east. The immediate vicinity is made up of industrial and commercial premises, recreational grounds, and recent residential developments at Alvaston Park and the former Wilmorton College site. Within one kilometre of the site are the residential areas of Chaddesden, Alvaston and Cherry Tree Hill. Other significant nearby local features include the Wyvern Retail Park, Pride Park Velodrome, Derby County Football Stadium, and the proposed Derby Triangle extension to Pride Park.

ONR has consulted DCC on a number of local geographic, demographic and practical implementation factors which are taken into account throughout this report. The use of practical geographic features was identified as beneficial for ease of implementing the emergency plan. Therefore, as far as is sensible, the REPPIR planning area for the Raynesway site should be defined using physical features such as roads, rivers or footpaths.
Conclusion 2: 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.

ONR is of the opinion that the off-site emergency plan should include adequate provision to effectively and efficiently control the access of road traffic during a radiation emergency. The A5111 Raynesway dual carriageway forms part of the Derby ring road linking the A38 to the A52, is subject to heavy traffic flow, and provides primary access for emergency services to the site. It is ONR’s opinion that the A5111 should be included within the off-site emergency planning area.

To the south of the site, the southern border of Alvaston Park provides a clearly defined boundary to the adjacent residential areas of Wilmorton and Crewton. The western edge of Pride Park similarly forms a clearly defined boundary to the west of the site adjacent to the Derby Triangle. To the north-west of the site (Derby Triangle extension) there are no defining features other than roadways bounding the area and the Wyvern Retail Park.

Conclusion 3: Around the Raynesway site there are a number of clear physical features that should be considered as specific boundaries for the off-site emergency planning area. These are:

- A5111 Raynesway dual carriageway;
- Southern edge of Alvaston Park;
- Wilmorton housing estate;
- Derby to London mainline railway;
- Western edge of Pride Park; and
- Roadways bounding the Derby Triangle and Wyvern Retail Park (Derwent Parade, Wyvern Way).

6.2 Inclusion of Immediately Adjacent Vulnerable Groups

ONR TAG (reference 4) 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 DCC (reference 17). 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 authority’s 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 18) 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.

Information provided by DCC relating to vulnerable communities in the area around the Raynesway site identifies schools, childcare, caravan sites and recreational facilities within 1 km of Raynesway and is summarised in Appendices B and C. All of these groups are over 700 m from the hazardous areas of the site.

The RRMPOLO reference accident is a criticality event which leads to mostly external radiation doses and with little release of radioactive materials beyond the site boundary. This means that the majority of the radiation dose falls away rapidly with distance and the uncertainty in the distances at which doses may be received is not significantly affected by weather conditions such as wind and rain. The inclusion of these vulnerable groups is therefore judged not to be necessary as a result of their significant distance from the site compared to the 5 mSv dose contour distance.
For consistency with other determinations ONR has also considered the inclusion of additional 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.

Alvaston Park is adjacent to the Raynesway site, and the 5 mSv dose contour extends into the Park. ONR therefore considers it to be appropriate to include Alvaston Park in the off-site emergency planning area.

Conclusion 4: Due to the unique nature of the radiation criticality hazard presented by the reference accident and the distance of vulnerable groups from the RMMPOL site, ONR concludes that the adoption of a REPPIR off-site emergency planning area that includes Alvaston Park would not need further modification to incorporate additional adjacent vulnerable groups.

6.3 Avoidance of Bisection of Local Communities

ONR TAG (reference 4) states that:

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

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.

The commercial/industrial premises adjacent to the site’s northern boundary, bounded by the A5111 Raynesway dual carriageway and Derby to London railway line could be considered as communities for the purposes of emergency planning. However, in ONR’s judgement, it would be disproportionate to include the whole of this area in the off-site emergency planning area. In ONR’s opinion it is appropriate for the area to extend from the Raynesway site up to the defined boundary between Severn Trent Water and the adjacent business units. In ONR’s view this is an appropriate balance in the interests of securing confidence in public safety and requiring the local authority to consider all reasonably practicable planning measures to restrict exposures in the event of a reasonably foreseeable radiation emergency at Raynesway.

Conclusion 5: It would be proportionate and practicable to include the commercial/industrial premises adjacent to Raynesway, up to but excluding Severn Trent Water, within the determination of the REPPIR off-site emergency planning area.

6.4 Credibility and Confidence in the Extent of the REPPIR Off-site Emergency Planning Area

ONR TAG (reference 4) 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...”
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 RoA submitted by RRMPOL 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 of approximately 310 m from the hazardous areas of the site.

REPPIR states that the safety objective of the planning undertaken by local authorities for the REPPIR off-site emergency planning area is to ‘secure, 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 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 REPPIR dose restriction and safety 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.

ONR has accepted the estimation of the overall risk from the site given in the REPPIR submission made by RRMPOL. However, given the uncertainty associated with determining the risk posed by a criticality event, ONR is of the opinion that it is appropriate, where public safety is at stake, that it acts with reasonable conservatism in its own right, in the interests of confidence in securing the public safety objective of REPPIR.

ONR’s principles recognise that should an off-site emergency planning area demand very little by way of an emergency plan in practice (e.g. it contains a very small population), it 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.

ONR notes that there are no households or residential populations within the 5 mSv dose contour, and that the closest residential population is the Wilmorton estate which at its closest approach is over 350 m from the NFPP site boundary, and even further from the hazardous areas of the site.

In ONR’s opinion, in this case the exclusion of any residential population will not limit the credibility or effectiveness of the off-site emergency plan to secure protection of the public in the event of a reasonably foreseeable radiation emergency at Raynesway.

ONR therefore does not consider it to be sensible, justifiable or appropriate to extend the off-site emergency planning area to include any residential population.

Conclusion 6: Noting that there are no households or residential properties within the immediate vicinity (350 metres) of the site boundary, the REPPIR off-site emergency planning area for Raynesway does not need to be extended to 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.

6.5 International Good Practice

ONR TAG (reference 4) 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 11, 12). 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 is 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 9) and is broadly supported (of the same order of magnitude) by Public Health England (PHE) (reference), 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 Principles for Determination of the REPPIR off-site emergency planning area (and related guidance) 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 19), 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.

For the purpose of comparison, the IAEA guidance for a facility with a comparable threat category to the RRMPOL Raynesway site, recommends no Precautionary Action Zone and 0.5 – 1.0 km for the Urgent Protective Action Planning Zone.

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, the area determined within this report broadly reflects international good practice.

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

ONR TAG (reference 4) 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 site within which a person (including members of the public) is likely to 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 timely 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 might 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 6.1, the closest geographical boundaries to the north-west of the site are formed by the roadways bounding the Derby Triangle extension and the Wyvern Retail Park. This area extends to over 900 m from the NFPP site boundary, and even further from the hazardous areas of the site, as a result ONR does not consider it to be proportionate to include the whole of this area purely on the basis of using geographical features.

However, since the 5 mSv dose contour extends in to this area at least part of this area must be included in the off-site emergency planning area. On this occasion, ONR considers it to be
appropriate to define the off-site emergency planning area to the north-west of the Raynesway site by an appropriate distance from the site.

The 5 mSv dose contour is described by a radial distance of 310 m from the hazardous areas of the site, as a result, using this to define the off-site emergency planning area would essentially identify these hazardous areas. ONR does not believe this to be appropriate from a security perspective.

The area described by the arc of a circle with a 500 m radius centred on the NFPP would fully encompass the 5 mSv dose contour and obscure the location of the hazardous areas of the site. In addition, this is consistent with the distance to the closest residential properties, which were excluded in section 6.4. ONR consider that, in the interests of providing the Local Authority with the flexibility of considering protection measures for the restriction of exposure so far as is reasonably practicable in the event of a reasonably foreseeable radiation emergency, this area is adequate without being excessive or disproportionate.

As a consequence, it is ONR's judgement that the determination of the area in Map 4 Appendix E neither necessarily implies any detrimental dilution of the arrangements that DCC may put in place as regards the REPPIR off-site emergency planning area, nor the need to apply unnecessary (dis-beneficial) countermeasures.

**Conclusion 7:** Taking into account the benefits and dis-benefits of the application of emergency dose reduction measures it is judged that extension of the REPPIR off-site emergency planning area to include the area bounded by Roadways bounding the Derby Triangle and Wyvern Retail Park (Derwent Parade, Wyvern Way) is not appropriate in order to achieve an appropriate balance between public protection, the risks from the implementation of countermeasures, and implementation of an effective emergency planning area.

**Conclusion 8:** The REPPIR off-site emergency planning area boundary to the north-west of the site should be defined by the arc of a circle with a 500 m radius centred on the NFPP, between Wyvern Retail Park roadway to the north and the Derby to London mainline railway to the west.

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

ONR TAG (reference) 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 (regulation) requires that operators make a further HIRE assessment before the commencement of operation of any new work or where there is a material change in their 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.

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

ONR has not been advised by the Derbyshire County Council or RRPOL of any additional site specific factors that it considers relevant to the determination of the REPPIR off-site emergency planning area.

**Conclusion 9: There are no additional site specific factors of which ONR is aware that require consideration when determining the REPPIR off-site emergency planning area for the RRMPOL site.**

7 CONCLUSIONS

This report sets out the main considerations that ONR has given to determining the REPPIR off-site emergency planning and prior information area for the RRMPOL’s nuclear licensed sites at Raynesway. It takes due account of the findings of the RRMPOL RoA/HIRE, ONR’s detailed assessments of it, and ONR’s determination principles and guidance for undertaking such determinations.

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

ONR is satisfied that RRMPOL has presented an adequate assessment, recognising the uncertainties in analysis of this particular hazard and its consequences. ONR has factored those uncertainties into its independent review and considers its recommendations about the off-site emergency planning and prior information area to be proportionate, justifiable and comparable / consistent with international opinion relating to emergency planning for this type of nuclear operation.

In summary, the conclusions of this report are that:

**Conclusion 1:** ONR is satisfied that RRMPOL has presented an adequate assessment, recognising the uncertainties in analysis of this particular hazard and its consequences. ONR accepts that the technical assessment made by RRMPOL demonstrates that members of the public are not 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 distance of 310 m from the hazardous areas on the Raynesway site.

**Conclusion 2:** 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:** Around the Raynesway site there are a number of clear physical features that should be considered as specific boundaries for the off-site emergency planning area. These are:

- A5111 Raynesway dual carriageway;
- Southern edge of Alvaston Park;
- Wilmorton housing estate;
- Derby to London mainline railway;
- Western edge of Pride Park; and
- Roadways bounding the Derby Triangle and Wyvern retail park.

**Conclusion 4:** Due to the unique nature of the radiation criticality hazard presented by the reference accident and the distance of vulnerable groups from the RRMPOL site, ONR concludes that the adoption of a REPPIR off-site emergency planning area that includes Alvaston Park would not need further modification to incorporate additional adjacent vulnerable groups.
Conclusion 5: It would be proportionate and practicable to include the commercial/industrial premises adjacent to Raynesway, up to but excluding Severn Trent Water, within the determination of the REPPIR off site emergency planning area.

Conclusion 6: Noting that there are no households or residential properties within the immediate vicinity (350 metres) of the site boundary, the REPPIR off-site emergency planning area for Raynesway does not need to be extended to 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 7: Taking into account the benefits and dis-benefits of the application of emergency dose reduction measures it is judged that extension of the REPPIR off-site emergency planning area to include the area bounded by Roadways bounding the Derby Triangle and Wyvern Retail Park (Derwent Parade, Wyvern Way) is not appropriate in order to achieve an appropriate balance between public protection, the risks from the implementation of countermeasures, and implementation of an effective emergency planning area.

Conclusion 8: The REPPIR off-site emergency planning area boundary to the north-west of the site should be defined by the arc of a circle with a 500 m radius centred on the NFPP, between Wyvern Retail Park roadway to the north and the Derby to London mainline railway to the west.

Conclusion 9: There are no additional site specific factors of which ONR is aware that require consideration when determining the REPPIR off-site emergency planning area for the RRMPOL site.

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 sites bounded by the red line on Map 4 in Appendix E.

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

**An area based on a radial distance of 500 m from the centre of the Nuclear Fuel Production Plant, including the A5111 Raynesway dual carriageway to the east and Alvaston Park to the south.**

This determination has been undertaken in response to REPPIR submissions to ONR by RRMPOL. 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.

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: DCC and RRMPOL to advise that the REPPIR off-site emergency planning area has been determined as the area within the red line on Map 4 within Appendix E.
Recommendation 2: DCC confirming the need to prepare a detailed emergency plan to adequately cover the area defined in the first recommendation.

Recommendation 3: RRMPOL 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 DCC.

Recommendation 4: The Defence Nuclear Safety Regulator, Ministry of Defence (MOD), Environment Agency (EA), Food Standards Agency (FSA) and Department of Energy & Climate Change (BEIS), to inform them of the new REPPIR off-site emergency planning and information areas.
9 REFERENCES


14. Email, RRMPOL REPPIR Assessment - views on fission yield, RRMPOL, 2016.


APPENDIX A

Map 1: Derby City Council Contingency Plan for Raynesway 2014 (reference 20)
APPENDIX B

Map 2: Map of significant geographical features around Raynesway site
APPENDIX C

Map 3: Map of populations adjacent to Raynesway

<table>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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APPENDIX D

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 require consideration of vulnerable groups, identifiable premises providing facilities for vulnerable people e.g. schools, sheltered accommodation etc.

DCC have provided the information below on these vulnerable groups (reference 17).

Zone E
Alvaston Children’s Centre (Lakeside Childrens Centre) 875 London Road
Lakeside Community Primary School 877 London Road (626 registered pupils as of 2013 Ofsted report)

Zone F
Incredible Kids Day Nursery (91 child places as of 2015 Ofsted report)

Tourists:
Zone C
Premier Inn

Zone G
Derby County Football Club (stadium capacity 33,000) – also likely to have a number of mobility impaired spectators
Derby Arena (Derby City Council) - (arena capacity 5,000)
APPENDIX E

Map 4: ONR determination of the REPPIR off-site emergency planning area and the REPPIR prior information area around the RRMPOL Neptune Reactor and Nuclear Fuel Production Plant nuclear licensed sites at Raynesway, Derby.

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

An area based on a radial distance of 500 m from the centre of the Nuclear Fuel Production Plant, including the A5111 Raynesway dual carriageway to the east and Alvaston Park to the south.