Rolls-Royce

Rolls-Royce Submarines Limited

Neptune Licensed Site and Nuclear Fuel Production Plant – Consequences Report

Radiation (Emergency Preparedness & Public Information) Regulations 2019, Regulation 7

Record of Change

Date	Version Number	Reason for Change
September 2019	1.0	Initial Issue
September 2022	2.0	Update following three year regulatory review. Incorporating data from the latest modelling studies and information from the new safety case for the Neptune Reactor facility.

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1 Introduction

1.1 Purpose of the Report

1.1.1 This Consequences Report is the submission made by Rolls-Royce Submarines Limited (RRSL) in accordance with the Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR) 2019.

1.1.2 This report is provided to the Local Authority for RRSL's two Nuclear Licensed Sites at Raynesway, as required under Regulation 7 of REPPIR 2019.

1.1.3 Regulation 4 of REPPIR requires a Hazards Evaluation to be undertaken for any premises holding more than specified quantities of radioactive materials. The quantity of radiological material held on each of the RRSL operated Nuclear Licensed Sites at Raynesway is sufficiently high to require a Hazard Evaluation to be undertaken.

1.1.4 Where the Hazard Evaluation identifies that a radiation emergency[1] can occur, a Consequence Assessment is required by Regulation 5 to establish the long and short-term impacts from those identified events.

1.1.5 The output from these assessments determines whether formal off-site emergency plans are required by the Local Authority and what those plans should include in terms of protective actions for the public. That output is presented in this Consequences Report.

1.1.6 Local Authorities are required under REPPIR 2019 to determine the Detailed Emergency Planning Zone (DEPZ) for the site based on the recommendations in this report and to produce an off-site emergency plan to restrict radiation doses to the public and secure their health and safety in the unlikely event of a radiation emergency.

1.1.7 This report and the underpinning assessments have been produced in accordance with the REPPIR 2019 Approved Code of Practice and Guidance. The assessments have been through RRSL due process and governance and have been submitted to the Office for Nuclear Regulations (ONR) as the lead regulator for REPPIR 2019 on Nuclear Licensed Sites.

1.2 Background

1.2.1 There are two RRSL operated Nuclear Licensed Sites on the Raynesway estate, the Neptune Site and the Nuclear Fuel Production Plant (NFPP). Both have operated safely for over 50 years with no emergencies causing any significant off-site doses.

1.2.2 The REPPIR 2019 regulations came into force in 2019, prompting RRSL's initial submission of this Consequences Report to the Local Authority. In accordance with Regulation 6(2), the site operator is required to undertake a review of the

[1] A 'radiation emergency' is defined as a non-routine situation or event arising from work with ionising radiation that necessitates prompt action to mitigate serious consequences: (a) of a hazard resulting from that situation or event, (b) of a perceived risk arising from such a hazard, or (c) to human life, health and safety, quality of life, property and the environment. Further guidance on 'serious consequences' recommends the use of a dose threshold of one milli-sievert (mSv) received by a member of the public in the year following the emergency.

Hazard Evaluation and Consequence Assessment at least every three years. This report presents the findings of the latest review conducted in 2022.

1.2.3 There have been no significant changes to the level of risk on site. However, the assessments have been updated to take into account the latest modelling data and to incorporate the latest assessments for the Neptune Reactor facility, which is due to go into operation within the next three years. The 'representative range of radiation emergencies' has been updated accordingly.

1.3 The Raynesway Site

1.3.1 The Rolls-Royce Raynesway site is located on the outskirts of Derby, to the south-east, as shown at Figure 1. The whole site is surrounded by a security fence and access is controlled via a manned gatehouse. Further security fences surround the two Nuclear Licensed Sites situated on the premises.

2 Items for Inclusion in Consequences Report (Schedule 4, REPPIR)

2.1 Part 1 – Factual Information

Clause 1(a) - Name and address of the operator:

Rolls-Royce Submarines Limited (Registered Office),
Atlantic House Raynesway,
Derby,
Derbyshire,
DE21 7BE.

Clause 1(b) - Postal address of the premises where the radioactive substance will be processed, manufactured, used or stored, or where the facilities for processing, manufacture, use of storage exist:

Rolls-Royce Submarines Limited,
Raynesway,
PO Box 2000,
Derby,
DE21 7XX.

NOTE: The site address is the same for both Nuclear Licensed Sites.

Clause 1(c) - The date on which it is anticipated that the work with ionising radiation will commence or, if it has already commenced, a statement to that effect:

The company has been involved in work with ionising radiation at the site, in the form of radioactive materials, since 1961.

2.2 Part 2 – Recommendations

Clause 2(a) - The proposed minimum geographical extent from the premises to be covered by the local authority's off-site emergency plan:

a. Due to the location and nature of emergencies that could occur at Raynesway, the minimum geographical extent of the Detailed Emergency Planning Zone (DEPZ) has been selected as a combination of radial distances as shown at Figure 2. This is based on the recommendations for protective actions shown in Figure 3. The largest of these radial distances extends 398 m from facilities on the south-west side of the NFPP site, this being the bounding case in terms of potential dose to the public.

b. In addition to the DEPZ recommended above, an Outline Planning Zone (OPZ) of 1 km has been determined for the Rolls-Royce Raynesway site by the Secretary of State for Defence in accordance with Regulation 9(1)(c). This area is shown at Figure 4.

Clause 2(b) – The minimum distances to which urgent protective actions may need to be taken, marking against each distance the timescale for implementation of the relevant action; and Clause 3(a) – The recommended urgent protective actions to be taken within that zone, if any, together with timescales for the implementation of those actions:

There are two urgent protective actions recommended within the DEPZ:

a. **Evacuation** – the recommended evacuation zone is provided as a combination of radial distances as indicated by the blue circles in Figure 3. The bounding case relates to facilities located on the south-west side of the NFPP site which require evacuation to a distance of 219 m from the source of the incident. The only areas accessible to the public within this zone are along the riverbank, certain areas of Alvaston Park and a small area to the north of the railway line in the Derby Triangle development. The evacuation distance for the Neptune Reactor site does not extend beyond the boundary fence. Evacuation should take place as soon as possible following activation of the off-site emergency plan.

b. **Sheltering** – The recommended shelter zone is depicted by a combination of radial distances as indicated by the red circles in Figure 3. As above, the bounding case relates to facilities located on the south-west side of the NFPP site which require sheltering out to a distance of 398 m from the source. Within this area, personnel should be advised to shelter indoors as soon as possible following activation of the off-site emergency plan. The area includes a number of local businesses plus a section of Alvaston Park and the Derby Triangle development.

The declaration of an Off-Site Nuclear Emergency by the operator to the Local Authority will provide the trigger for implementing the off-site emergency plan and initiating the urgent protective actions recommended above.

Clause 3(b) – Details of the environmental pathways at risk in order to support the determination of food and water restrictions in the event of a radiation emergency:

a. The representative range of radiation emergencies selected for detailed emergency planning do not involve the release of radioactive materials.

b. However, it is possible that very low probability events could lead to an airborne release of short-lived radioactive material which will be dispersed downwind. A proportion of this material will fall to the ground but will only be at detectable levels within close proximity to the site. The quantity of material released is small and its radioactivity is very short lived – less than 24 hours. Uptake into the terrestrial food chain is therefore likely to be negligible and there are no concerns for ingestion of contaminated foodstuffs or extracted water from surface or groundwater. Therefore, no food or water restrictions are required in the event of a radiation emergency.

2.3 Part 3 - Rationale

Clause 4 – The rationale supporting each recommendation made:

a. Evacuation of the area shown in Figure 3 is to protect against the direct neutron and gamma radiation hazards from the incident, in accordance with the Lower Emergency Reference Level (ERL) for evacuation of 30 mSv.

b. Sheltering of the area shown in Figure 3 is to protect against the direct neutron and gamma radiation hazards from the incident, in accordance with the Lower ERL for sheltering of 3 mSv.

c. There are no possible contamination release scenarios which would require the administration of Stable Iodine Tablets (SITs) in accordance with the Lower ERL for SITs of 30 mSv.

d. The minimum geographical extent of the DEPZ (as shown at Figure 2) has been recommended to align with the Lower ERL for shelter based on the most recent consequence assessments for the site, produced in accordance the methodology given in Schedule 3 of REPPIR 2019. Figure 5 provides a comparison of this area against the current DEPZ.

e. The Secretary of State for Defence has determined an OPZ distance of 1 km. This distance is considered proportionate when compared to the findings of the Hazard Evaluation and Consequence Assessments and is considered sufficient to provide outline planning for very low probability events which may have more severe consequences.

Clause 5(a) – The rationale for its recommendation on the minimum distances for which urgent protective action may need to be taken:

a. The minimum distances recommended are based on the full range of possible consequences of the representative range of radiation emergencies evaluated in the Consequence Assessment. This includes site-specific postulated initiating events, as identified within the Nuclear Site Safety Cases. These consequences were subsequently compared with the ERLs recommended by the National Radiological Protection Board (now UK Health Security Agency).

Clause 5(b) – Where the operator and local authority have agreed that no off-site planning is required and therefore no emergency planning is recommended, the rationale for that agreement.

a. This clause does not apply to RRSL Raynesway.

3 Conclusion

3.1.1 This Consequences Report has been produced for RRSL's two Nuclear Licensed Sites at Raynesway, as required by Regulation 7 of REPPIR 2019. It is provided to the Local Authority to assist with the development of their off-site emergency plan.

3.1.2 A Hazard Evaluation and Consequence Assessment has been carried out to determine the potential extent of a radiation emergency on the Raynesway site and the impact on the public. These assessments provide the basis for the recommendations in this report, as summarised below:

a. The proposed minimum geographical extent of the DEPZ is the area shown in Figure 2 which is a combination of radial distances with a maximum of 398 m from the facilities on the south-west side of the NFPP.
b. The proposed area for sheltering in the event of an emergency is equivalent to the area discussed above, as shown at Figure 3.
c. The proposed area for evacuation in the event of emergency is the area shown at Figure 3 which is a combination of radial distances with a maximum of 219 m from the facilities on the south-west side of the NFPP.
d. The OPZ is determined by the Secretary of State for Defence and extends to a distance of 1 km from the site as shown in Figure 4.

3.1.3 As shown at Figure 5, these recommendations fall within the current DEPZ for the Raynesway site as determined by the Local Authority and therefore no changes to the off-site planning zones are recommended.

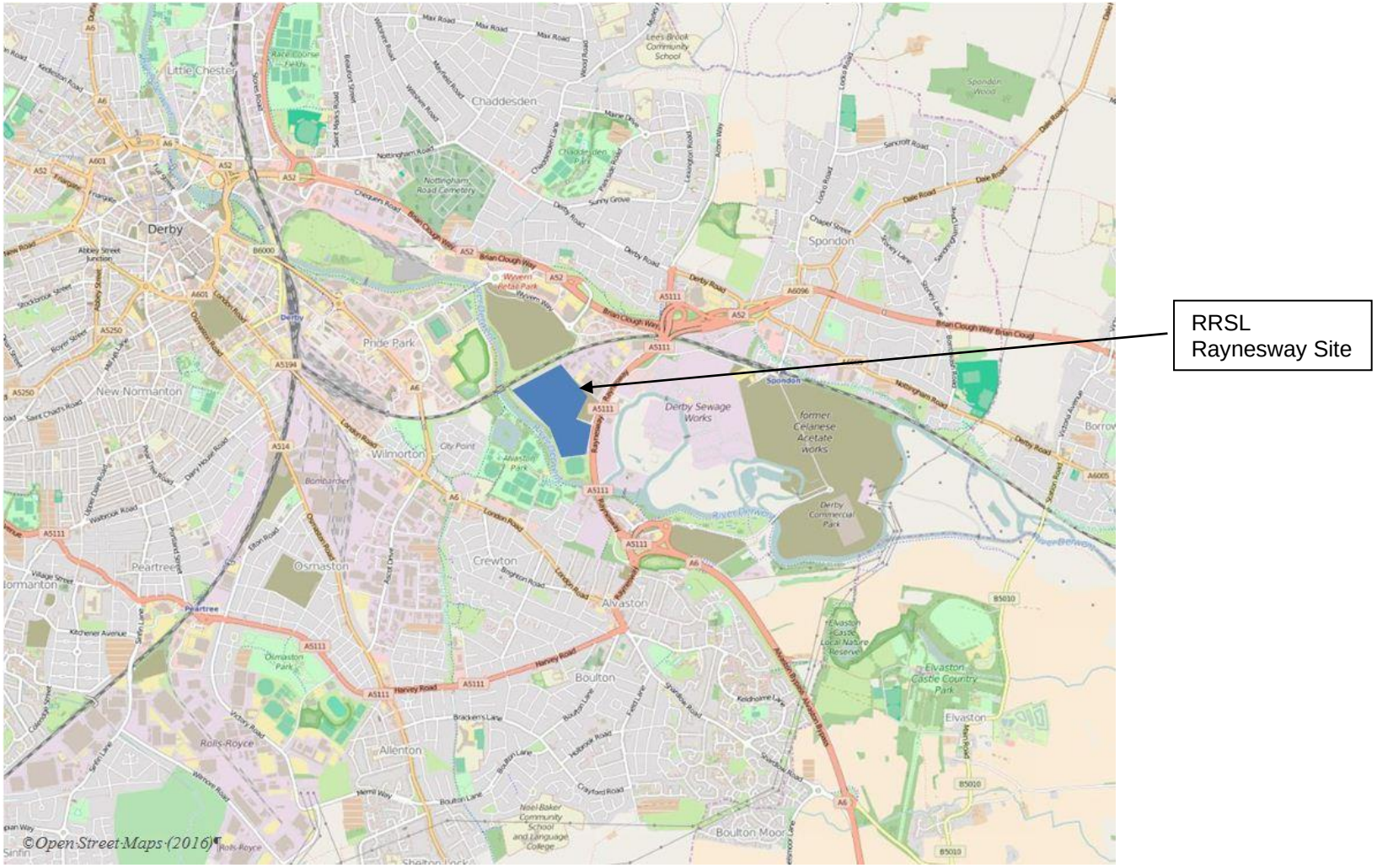

Figure 1. Location of the RRSL Raynesway Site.

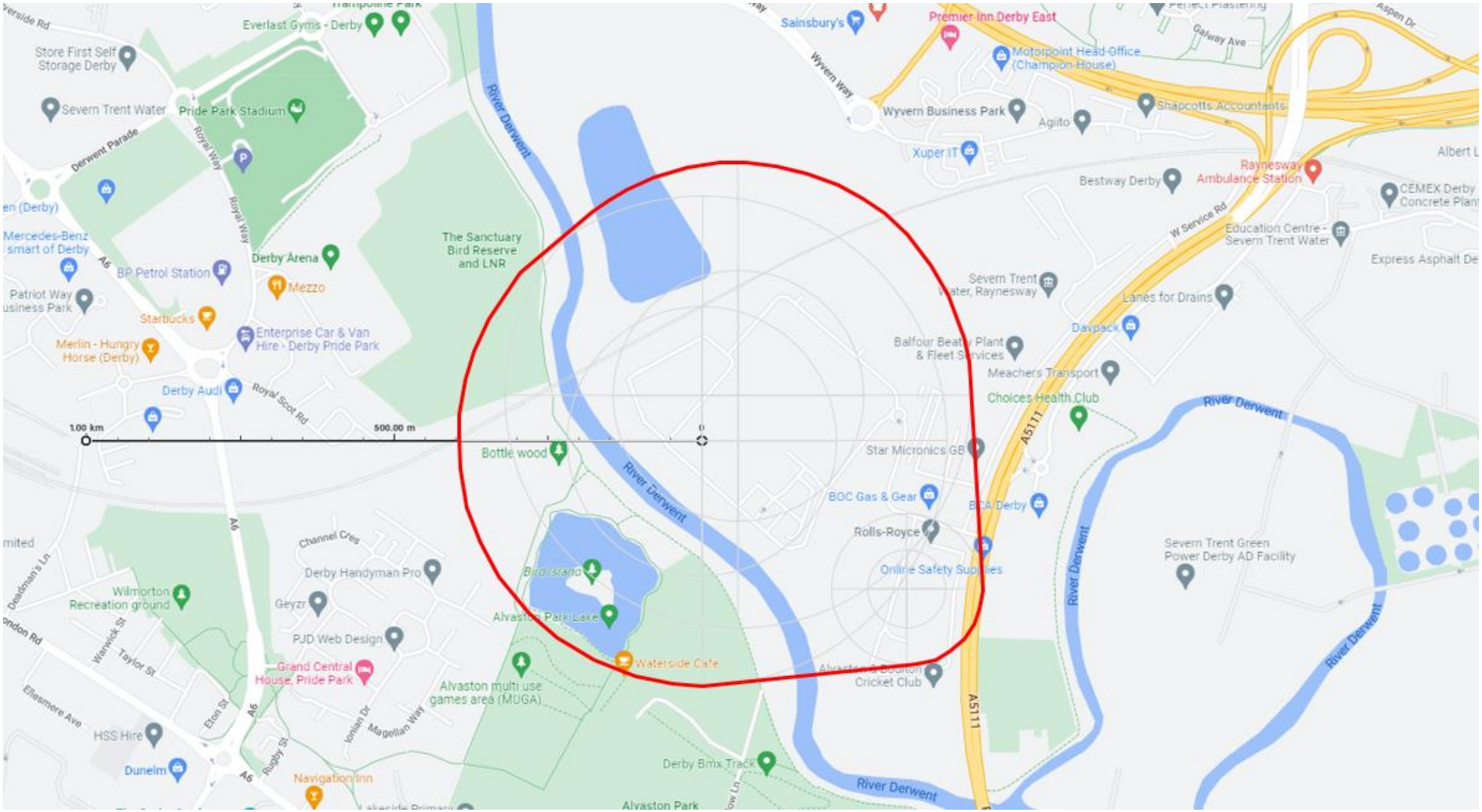

Figure 2. Proposed minimum geographical extent of the Detailed Emergency Planning Zone (DEPZ) (marked in red).
(Map data © 2022 Google Maps).

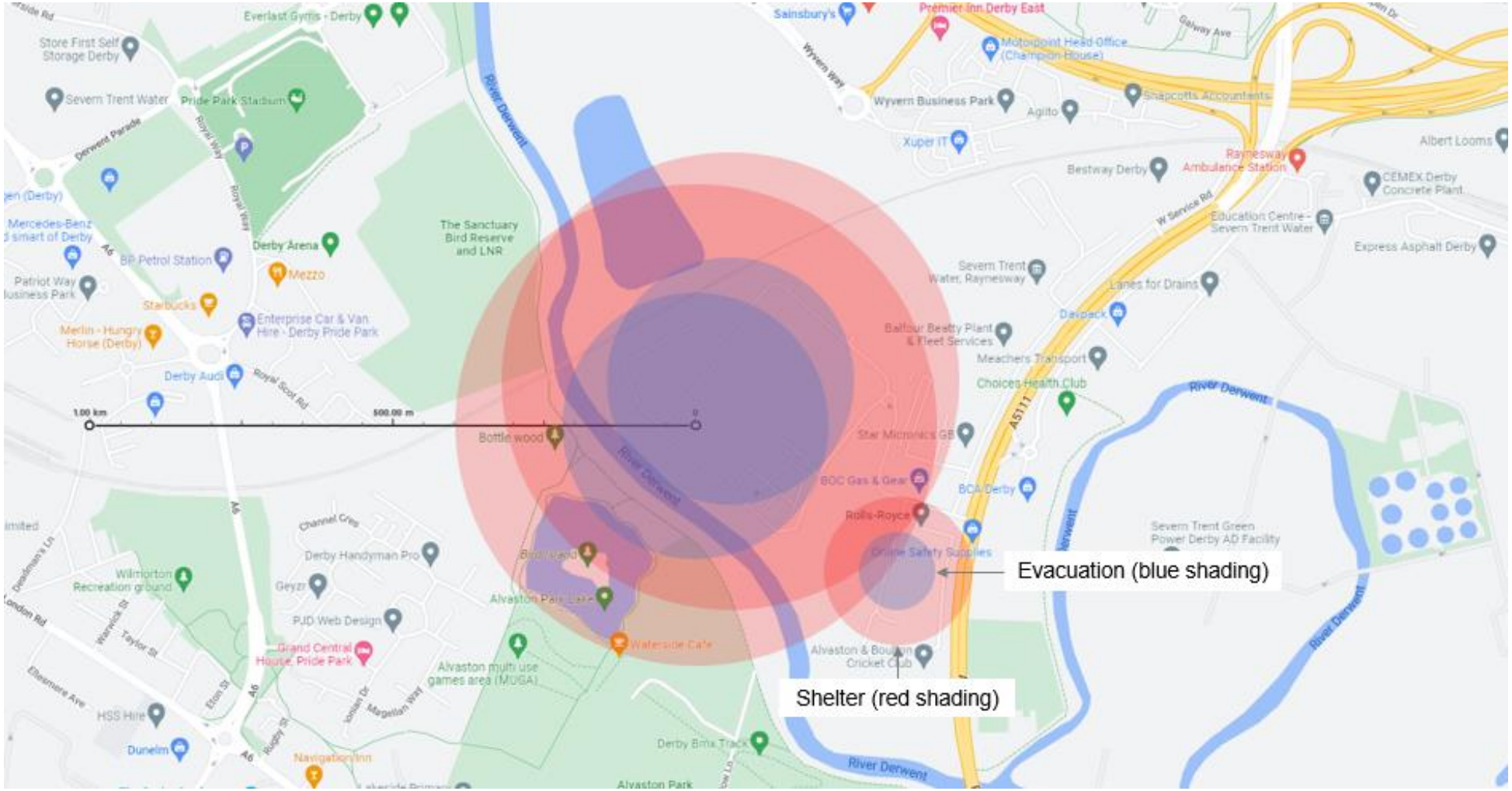

Figure 3. Recommended areas for evacuation and sheltering based on Lower Emergency Reference Levels.
(Map data © 2022 Google Maps)

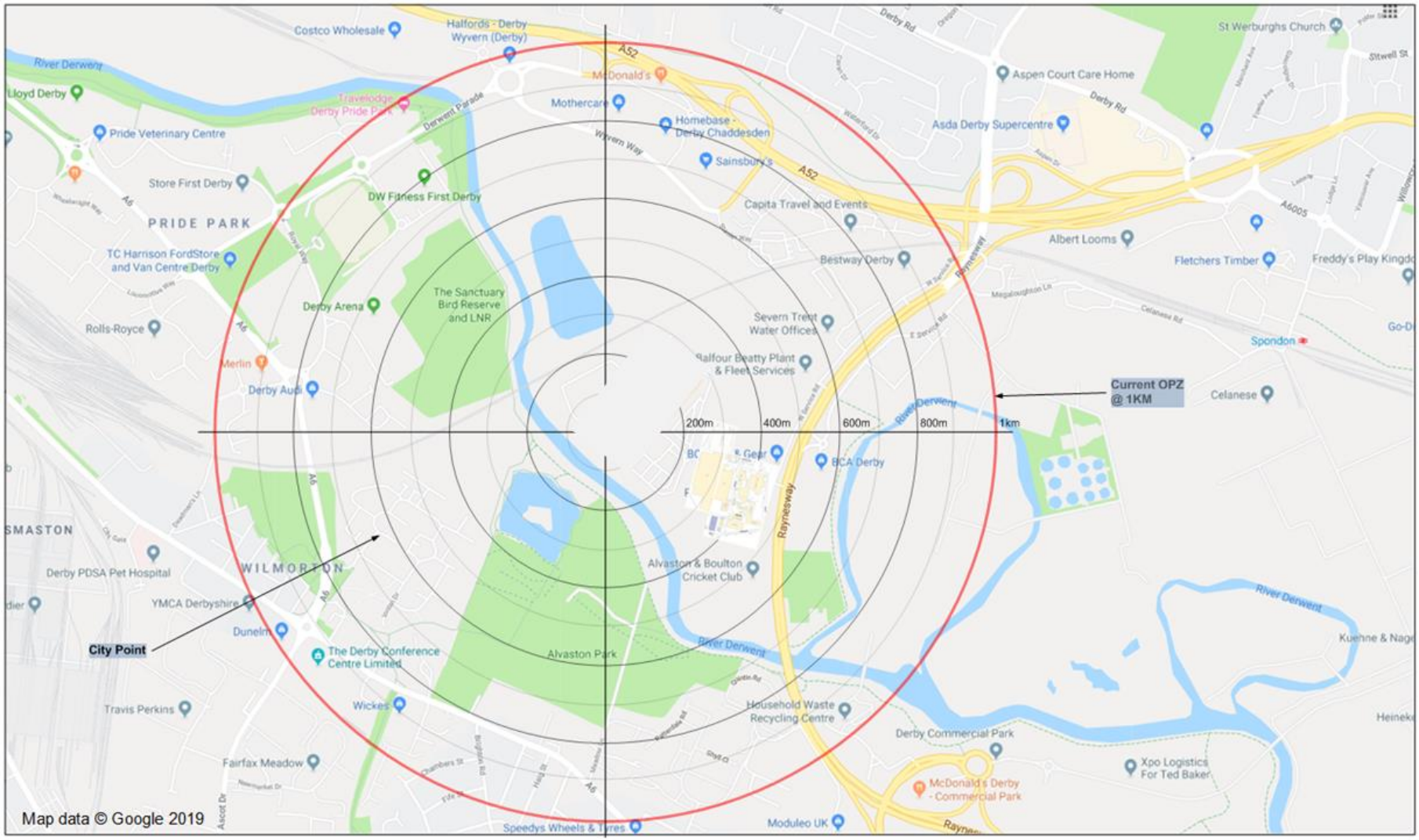

Figure 4. Proposed minimum distance for the Outline Planning Zone (OPZ) as determined by the Secretary of State for Defence.
(Map data © 2022 Google Maps).

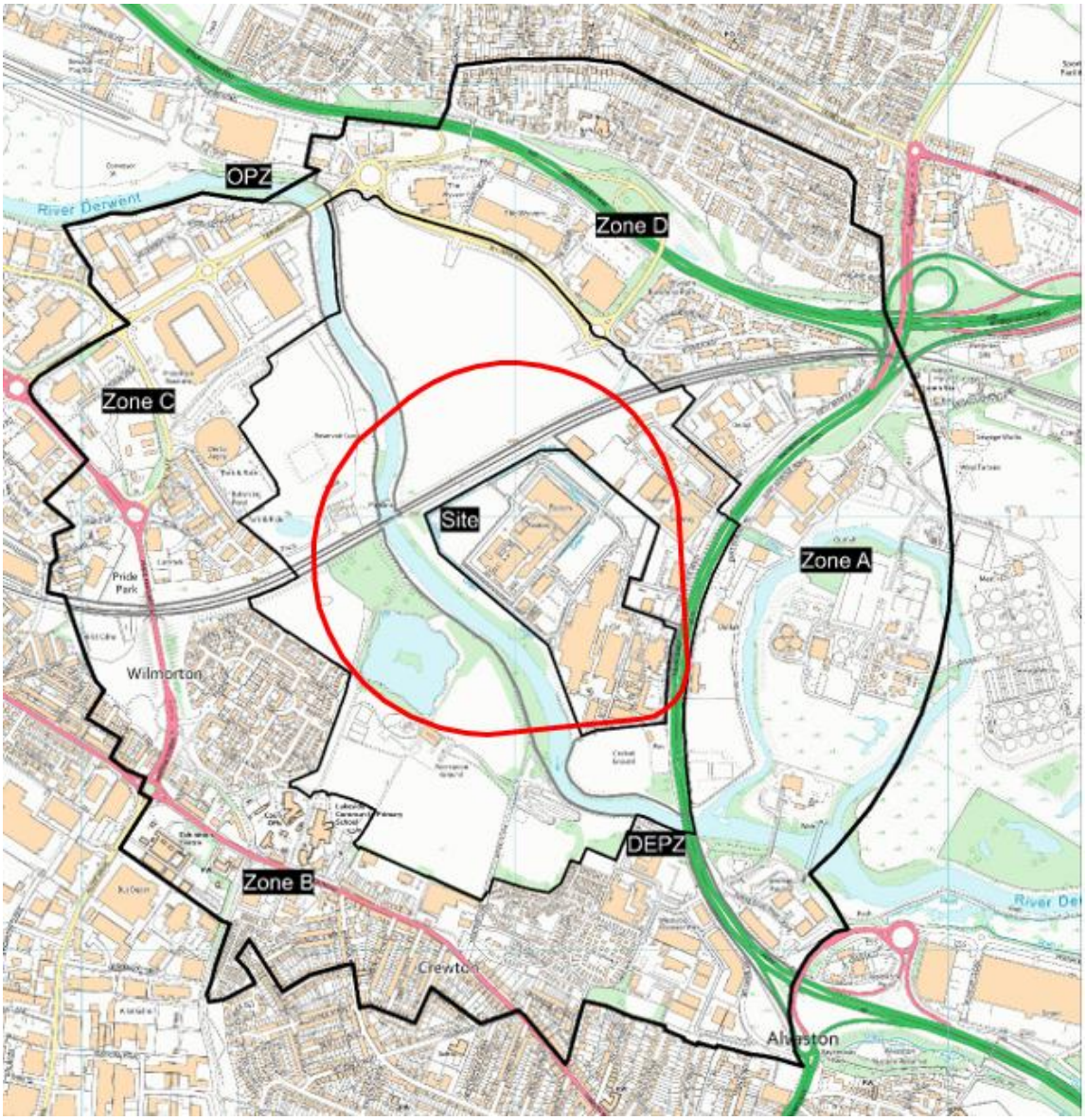

Figure 5. Comparison of proposed minimum geographical extent against current Detailed Emergency Planning Zone.
(Crown copyright and database rights, Ordnance Survey).

4 Acronyms and Abbreviations

ACoP	Approved Code of Practice
DEPZ	Detailed Emergency Planning Zone
ERL	Emergency Reference Level
mSv	Millisievert
NFPP	Nuclear Fuel Production Plant
ONR	Office of Nuclear Regulation
OPZ	Outline Planning Zone
REPPIR	Radiation Emergency Preparedness and Public Information Regulations
RRSL	Rolls-Royce Submarines Limited