



ATOMIC WEAPONS ESTABLISHMENT

AWE BURGHFIELD

CONSEQUENCES REPORT

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Introduction

This document is the consequences report for the Burghfield Site, as required under Regulation 7(1) of The Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPPIR 2019).

The following information has been titled to relate specifically to the REPPPIR 2019 Schedule 4 items required to be included within this report.

Part 1 – Factual Information

1. Regulation 7(3) Schedule 4, paragraph 1(a) - Name and address of the operator:

AWE plc, Aldermaston, Reading, Berkshire, RG7 4PR.

2. Regulation 7(3) Schedule 4, paragraph 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:

AWE plc, Burghfield, Reading, Berkshire, RG7 2PQ.

3. Regulation 7(3) Schedule 4, paragraph 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 Burghfield Site has been occupied in support of the UK nuclear deterrent since 1950 and work with ionising radiation has been conducted on the site since that date.

Part 2 – Recommendations

1. Regulation 7(3) Schedule 4, paragraph 2(a) - The proposed minimum geographical extent from the premises to be covered by the local authority's off-site emergency plan:

- a. The proposed minimum geographical extent to be covered by the Local Authorities Off-Site Emergency plan is an area extending to a radial distance of 3160m from the Burghfield Site centre location.
This is illustrated on Map A in Appendix A.
- b. In addition to the minimum geographical extent recommended above, an Outline Planning Zone, extending to a radial distance of 12km around the Burghfield Site centre location, has been determined by the Secretary of State for Defence, in accordance with Regulation 9(1)(c).
This is illustrated on Map B in Appendix B.

2. Regulation 7(3) Schedule 4, paragraph 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 paragraph 3(a) – The recommended urgent protective actions to be taken within that zone, if any, together with timescales for the implementation of those actions.

- a. The following distance is recommended for the urgent protective action of sheltering. This is the largest distance determined by detailed consequence assessment of a range of source terms and includes consideration of a range of weather conditions and vulnerable groups within the population.
- b. The minimum distance to which urgent protective actions should be taken corresponds to an area with radial distance of 3160m.
- c. It is recommended that people are instructed, as soon as is practical, to immediately take-cover in a suitable building and to stay inside with the windows and doors all properly shut. This 'sheltering' action may be necessary for a period of up to two days, or at least until the initial contaminated plume has passed and monitoring of the ground contamination has been undertaken to determine the level of groundshine; and subsequent potential for further dose uptake, (e.g. from contaminated locally produced foodstuffs).
- d. It is recommended that the declaration of a Radiation Emergency, by the operator, to the Local Authority is the trigger for implementing the off-site emergency plan and initiating all the above recommended urgent protective actions.
- e. Category F weather conditions typically has an associated mean wind speed of 2ms^{-1} . From the event site, there will be an average of approximately 1500 seconds (25 minutes) from the initiation of the event until the leading edge of any plume travels to the minimum distance recommended for urgent action. Assuming no early warning of the onset of any incident, and that the Site Response Group could take up to an estimated 15 minutes to set-up and formally notify the Local Authority, there remains approximately 10 minutes to inform the public, and for the public to find suitable shelter, in order to realise any substantive benefit from the sheltering action.

3. Regulation 7(3) Schedule 4, paragraph 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 release of radioactivity from the Burghfield Site as a result of a fault condition has the potential to result in doses to the public through a range of exposure pathways, including:
 - i. First-pass inhalation of air in the plume of contamination;
 - ii. Short-term external irradiation during passage of the plume – Cloudshine;
 - iii. Long-term inhalation after resuspension, from ground contaminated by the initial plume;
 - iv. Long-term external irradiation from ground contamination by the initial plume – Groundshine;
 - v. Ingestion of food crops contaminated by the initial plume.
- b. The relative importance of the different exposure pathways is dependent on the type of accident and the potential radioactive isotopes which may be released.

- c. The most likely predicted accidents would spread material by explosive distribution, these are non-fission incidents, where the material that would dominate in this type of release will be plutonium (which is an Alpha emitting actinide) in an inhalable particulate form.
- d. For potentially more energetic events, a range of fission products would be produced meaning that both internal (inhalation) as well as external exposure (irradiation) would dominate.
- e. For the majority of fault sequences, the material released would be in the form of fine particulates of plutonium oxide and the predominant exposure pathway to individuals outside the Burghfield Site during the passage of the plume would be by inhalation. As the plume travels downwind, deposition mechanisms would deplete the plume and leave radioactive material on the ground. Most forms of plutonium are removed from biological pathways by being fixed in the soil and only small amounts are concentrated by biological processes into the food chain, primarily through grazing animals. However, the material can be resuspended by the action of the weather, or by farming practices, or any other disturbance processes, resulting in a potential for longer term inhalation doses.
- f. Doses to the public resulting from this consequence may include contributions from cloudshine, first-pass inhalation, long-term inhalation following resuspension, and groundshine.
- g. Overall, the primary concern for early response decision-making to radiation emergencies involving possible accidents at the Burghfield Site only merits consideration of the first-pass inhalation dose and therefore sheltering is the recommended urgent protective action.

Part 3 - Rationale

1. ***Regulation 7(3) Schedule 4, paragraph 4 – The rationale supporting each recommendation made:***

- a. The release of radioactive particles small enough to be respirable have the potential to result in radiological doses to the public from a range of exposure routes, most notably:
 - First-pass inhalation of air from the plume of contamination;
 - Long-term inhalation after resuspension of ground contamination by the initial plume;
 - Ingestion of food crops contaminated by the initial plume;
 - Long-term external irradiation from ground contamination by the initial plume.
- b. It has been assessed that the first-pass inhalation dose is the most significant by far, for initial emergency response purposes, which has resulted in the recommendation to shelter as the most appropriate urgent protective action. This should be coupled with a restriction on the consumption of all locally produced food, until the direction of the plume and the extent of the contamination has been

fully investigated, examined and understood. Appropriate local instructions should then be made available to the public based on the prevailing conditions.

- c. The recommendation for the minimum emergency action distance at the Burghfield Site originates from the Consequence Assessment carried out under REPIR 2019. The guidance set out in the Approved Code of Practice is to use the largest candidate distances recommended for the urgent protective actions identified against the lower Emergency Reference Level. This 3160m distance is selected as the minimum geographical extent of the Detailed Emergency Planning Zone (see appendix C for definition) about the Burghfield Site Centre Location.
- d. This distance has increased from the REPIR 2001 ONR determination. The REPIR 2001 determination was based on a 5mSv dose contour using 55% Cat D weather conditions. Under REPIR 2019, the minimum distance for urgent protective actions is based on a 7.5mSv dose contour. However, in accordance with the new requirements of REPIR 2019, the 'reasonable foreseeability' argument is no longer allowed, and several different requirements have had to be taken into consideration, these being that the assessment must:
 - Consider age, and other characteristics which would render specific members of the public especially vulnerable;
 - Include all relevant pathways;
 - Consider a representative range of source terms;
 - Consider a range of weather conditions to account for consequences that are less likely, but which have greater consequences.
- e. A further consideration is the geographical area around the site and the potentially significant period that these adverse weather conditions could be experienced.
- f. AWE has analysed the dose from a range of weather conditions and has decided to base its proposal on a weather category that is less likely, but which could provide significantly greater doses. Consideration of less likely weather categories, which occur around 12% of the time in the local geographical area, increases the 7.5mSv dose contour to 3160m around the site centre location.

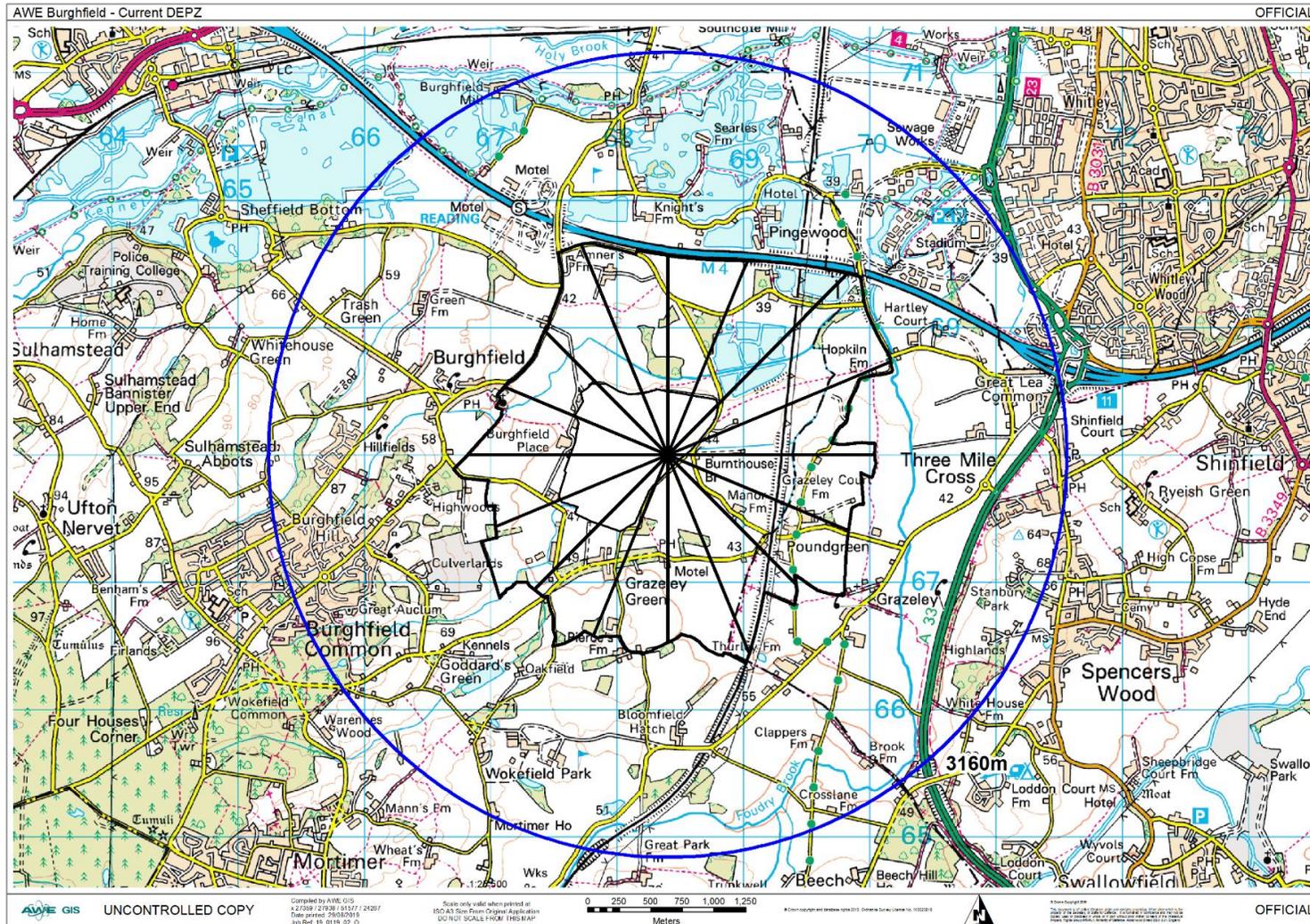
2. *Regulation 7(3) Schedule 4, paragraph 5(a) – The rationale for its recommendation on the minimum distances for which urgent protective action may need to be taken:*

- a. The minimum distance is established from the guidance provided in support of the Regulations, for the appropriate source terms, and is based on the requirement to identify a distance that has the potential to deliver a 3mSv dose saving, when adopting the recommended urgent protective action; which in this case is sheltering.

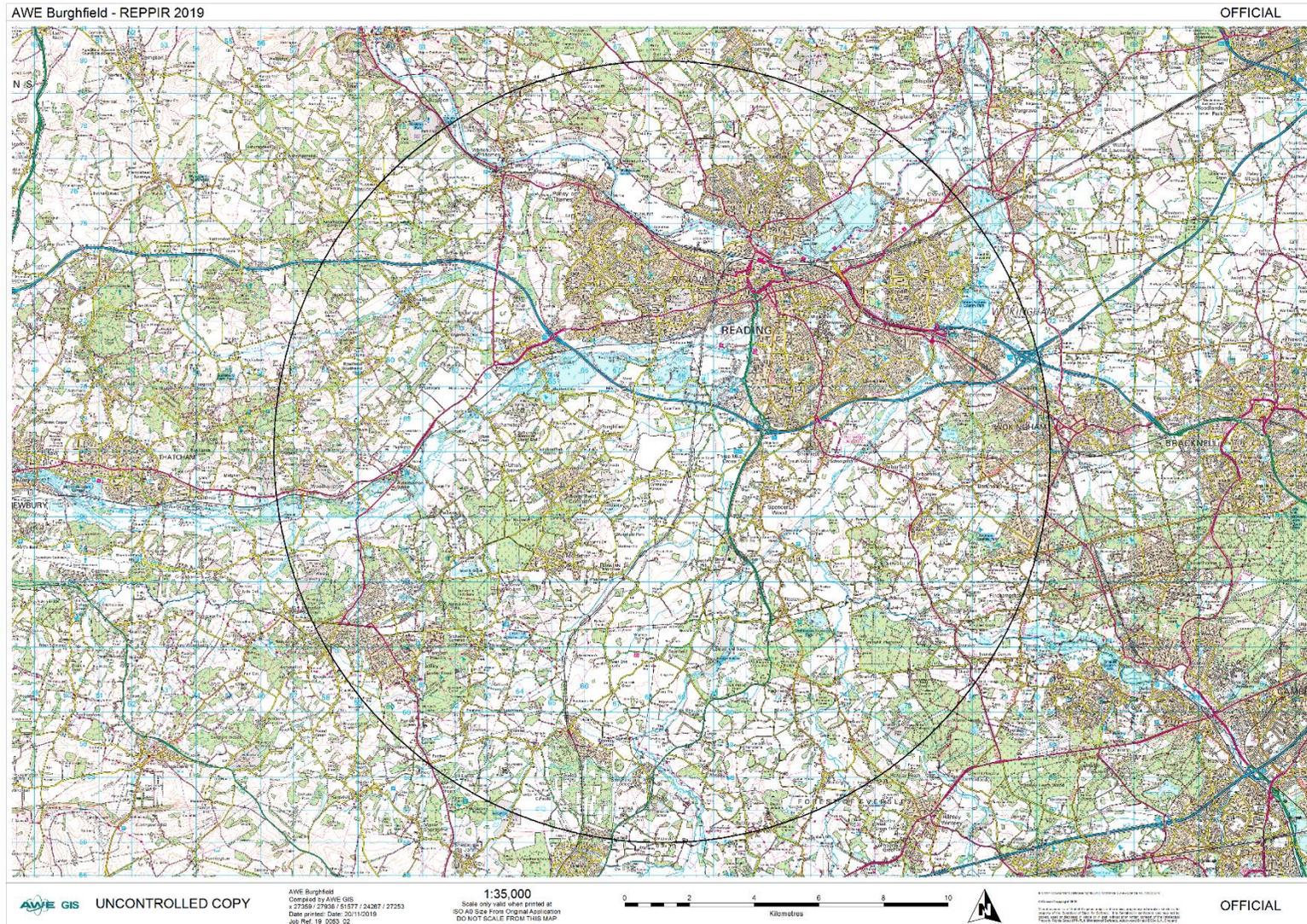
3. *Regulation 7(3) Schedule 4, paragraph 5(b) – The rationale for agreement that no off-site planning is required.*

- a. Given the content of this Consequences Report, this requirement does not apply to the Burghfield Site.

Appendix A: Map A – The ragged bold black sector is the current boundary of the Detailed Emergency Planning Zone. The Proposed Urgent Action Distance (blue circle) is set at 3160m for the Burghfield Site.



Appendix B: Map B – The Outline Planning Zone Boundary, set at 12Km for the Burghfield Site.



Appendix C: Definitions

Detailed Emergency Planning Zone (DEPZ)	A zone determined in accordance with Regulation 8 of the REPPIR 2019 Regulations. This is now covered by the Local Authority's off-site emergency plan
Outline Planning Zone (OPZ)	A zone determined in accordance with Regulation 9 of the REPPIR 2019 Regulations and covered by the Local Authority's off-site emergency plan.