TOWN AND COUNTRY PLANNING ACT 1990 (AS AMENDED)

Appeal by T A Fisher & Sons Limited against a refusal by West Berkshire District Council of planning permission for:

Erection of 32 dwellings including affordable housing, parking, and landscaping. Access via Regis Manor Road

Land to the rear of The Hollies Nursing Home, Reading Road, Burghfield Common

11 MAY 2023

PROOF OF EVIDENCE

Safety including nuclear safety, REPPIR 2019 and continuity of AWE B's operations

Prepared by:

Person AW

LPA Ref: 22/00244/FULEXT

Appeal Ref:

APP/W0340/W/22/3312261

1. QUALIFICATIONS AND RELEVANT EXPERIENCE

1.1 I hold a Bachelor of Engineering Degree in Engineering and German and a Master of Science Degree in Safety and Loss Prevention. I also hold a National Examination Board in Occupational Safety and Health (NEBOSH) Certificate.

1.2 I have 30 years' experience in the production of safety cases for high hazard industries, ranging from Oil and Gas, Explosives, Nuclear, and Nuclear-Explosives.

1.3 I spent 12 years in consultancy initially with AEA Technology (Safety and Reliability Directorate) and then WS Atkins until 2006 when I joined AWE plc (AWE) as a full-time employee. During my time in consultancy, I was responsible for the production and peer review of safety cases for the following clients: UKAEA Dounreay; UKAEA Harwell; HMNB Devonport; Shoeburyness; AWE plc. and Defence Ordnance Safety Group.

1.4 The safety case work included COMAH safety cases and nuclear safety cases for new builds, operational facilities and facilities in decommissioning. I also provided training courses on safety case production process and peer review and have lectured on the Shrivenham Explosive, Ordnance Engineering MSc covering Hazard Identification and Risk Assessment Techniques.

1.5 At AWE, I was Head of Environment Safety and Health for Directorate Major Projects (DMP) and Capital Projects (now known as Infrastructure Projects Directorate); during that time, I was responsible for the production of safety cases and safety assessments for all new build projects. Following my work for DMP I became the Head of Nuclear Safety overseeing AWE's compliance with all Nuclear Licence Conditions. However, due to my technical knowledge and experience, AWE determined that my skill set would be best utilised in providing strategic and technical direction for safety case production across the Company.

1.6 I spent a number of years at AWE Burghfield providing technical leadership in production of Facility Safety Justifications for the extant processing facility and the replacement new build facility. Within this role I was responsible for the facility Hazard Analyses determining the fault sequence frequencies and the dose estimates at the site fence which were used as the reference accidents for the previous Hazard Identification and Risk Evaluation (HIRE) (under Radiation (Emergency Preparedness and Public

Information) Regulations 2001 (REPPIR 2001) and the 2019 Hazard Evaluation and Consequence Assessment (HECA) (under Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR 2019). During that time, I was also one of the Burghfield Emergency Managers.

1.7 I am currently the Technical Authority in Design Basis Accident Analysis, Probabilistic Safety Assessment and Nuclear Explosive Hazard Analysis. I also provide training in regulatory framework and Licence Condition / Authorisation Condition compliance.

1.8 At present I am the Facility Safety Case and Integration Lead for a major programme and ensure integration between the design engineers and the Lifecycle Phase safety cases across the Nuclear Weapon Enterprise, providing technical advice on the safety production process and influencing the safety of the design.

1.9 I understand my duty to provide independent evidence to the Inquiry and appointed Inspector and have sought to comply with this duty in preparing my evidence and will continue to comply with this duty as required. To ensure that my evidence is independent, I have approached my analysis and conclusions with objectivity and impartiality, and I have not been influenced by any party or interested person.

2. SCOPE OF EVIDENCE

2.1 My evidence is concerned with the safety, including nuclear safety, and the continuity of operations case for AWE Burghfield (AWE B).

2.2 I will first introduce the nuclear licenced sites. I will then set out the requirements of the REPPIR 2019 and explain the difference between REPPIR 2019 and the predecessor regulations - focusing specifically on the application of REPPIR 2019 to AWE.

2.3 I then consider other regulatory and safety regimes which apply to AWE B, in the context of its existing and future operations.

2.4 Against this context, I make points of clarification or correction to aspects of the evidence by Dr Keith Pearce. (Where I refer to this evidence, I am referring specifically to Appendix Q of the Appellant's Statement of Case, titled Statement of Dr Keith Pearce [**CD 5.23**]).

2.5 Finally, I provide evidence to support the public safety grounds set out in the AWE and MOD joint Statement of Case (Ground 2) as well as providing further explanation of how an increased local population has the potential to adversely affect AWE's operations (Ground 3). I conclude by explaining why the Appellant's proposals do not address these issues.

3. AWE

3.1 AWE B and AWE Aldermaston (AWE A) are both designated sites under the Atomic Weapons Establishment Act 1991[1]. This means they are sites which form part of the undertaking carried on by the Secretary of State and known as the Atomic Weapons Establishment[2]. AWE is the Secretary of State's contractor with responsibility at these designated sites for carrying out the designated activities under the Act, which are any activities connected with the development, production, or maintenance of nuclear devices or with research into such devices or their effects.

3.2 AWE B operates under a Nuclear Site Licence, an Authorisation Certificate, an Explosives Licence and various environmental permits. AWE B is the only site in the UK which can undertake the authorised activities associated with assembly, disassembly, handling and storage of nuclear warheads. These activities are essential in the support of Continuous At Sea Deterrent (CASD).

3.3 AWE B and AWE A are separate nuclear licenced sites under the Nuclear Installations Act (NIA) 1965. There is a difference between the licensed activities at AWE A and AWE B as described in Schedule 1 of Aldermaston and Burghfield's nuclear site licences.

3.4 AWE B's nuclear installations are for:

3.4.1 the incorporation of enriched uranium, plutonium and any alloy, chemical compound, mixture or combination containing the same, in any device designed to form part of a nuclear assembly; and

3.4.2 the storage of radioactive matter.

3.5 The different operations undertaken on the sites result in a difference between the fault types, release mechanisms and dispersion. Therefore, the two sites cannot be directly compared for the purpose of this appeal. AWE B cannot be compared to other licensed sites in the UK due to the unique nature of operations which is only permitted at AWE B.

3.6 AWE has a number of regulators, including the Office for Nuclear Regulation (ONR), the Defence Nuclear Safety Regulator (DNSR), and Chief Inspector of Explosives (reporting

[1] Atomic Weapons Establishment Act 1991 (legislation.gov.uk) [**CD 13.25**]
[2] The Atomic Weapons Establishment (Designation and Appointed Day) Order 1992 (legislation.gov.uk) [**CD 13.26**]

to ONR on nuclear licensed sites). Both ONR and DNSR are independent Regulators for AWE whose purpose is to ensure that AWE as an operator continues to demonstrate its Duty of Care that risks from its activities have been reduced As Low As Reasonably Practicable (ALARP).

3.7 AWE's operations are subject to a significant number of legislative requirements. In the context of this appeal and my witness statement the key safety legislation is:

3.7.1 REPPIR 2019;

3.7.2 Control of Major Accident Hazards Regulations 2015 (COMAH) – although AWE B at present is not currently a registered COMAH site, future operations may require it to be so; and

3.7.3 Explosives Regulations 2014.

3.8 All of these Regulations require periodic reviews of the status of the site and comparison with expected practice. Amendments to arrangements are required if changes (operational or regulatory) have occurred between review periods. As a case in point, the change in the assessment methodology introduced by REPPIR 2019 led to AWE recommending the urgent protection action (UPA) radial distance from AWE B be increased from 1.52 km to 3.16 km.

3.9 It should be noted that the UPA distance will not remain static and has the potential to increase or decrease as changes to the operations at AWE or in the legislation, guidance and/or national or international best practice are realised. For example, a change in the International Commission on Radiological Protection (ICRP) recommendations for public dose coefficients is due to be issued in the near future and may require a recalculation of the UPA distance.

4. CHANGES AS A RESULT OF REPPIR 2019

4.1 The changes between REPPIR 2001 and 2019 are significant from a technical assessment perspective and had a material impact on the setting of AWE B's UPA. They can broadly be summarised as:

4.1.1 modification to the definition of radiation emergency and removal of reference to ‘radiation accidents’;

4.1.2 removal of the requirement to assess only reasonably foreseeable hazards and introduction of a new requirement to assess all hazards;

4.1.3 introduction of a risk assessment framework matrix and ‘Consequence Assessment’ methodology;

4.1.4 removal of the Hazard Identification and Risk Evaluation (HIRE) and replacing it with a Hazard Evaluation [Regulation 4] and Consequence Assessment [Regulation 5] (HECA) [**CD 13.7**]; and

4.1.5 Changes to or additional granularity on the factors to be considered within the Consequence Assessment as stated in paragraph 189 REPPIR 2019 ACoP [**CD 13.8A**], these being:

(a) The range of potential source terms and weather conditions;

(b) The different persons that may be exposed;

(c) The effective and equivalent doses they are likely to receive;

(d) The pathways for exposure; and

(e) The distances in which urgent protective action may be warranted for the different source terms when assessed against the relevant emergency reference level (ERL).

5. AWE’S DUTY UNDER REPPIR 2019

5.1 AWE’s duty under REPPIR 2019 is to identify and assess all hazards which have the potential to result in a radiation emergency. This is achieved through the Hazard Evaluation and Consequence Assessment (HECA). The principal output from the HECA is the determination of the UPA distance which AWE must provide to West Berkshire District Council (WBDC) via a Consequences Report. This enables WBDC to set the Detailed Emergency Planning Zone (DEPZ) (Regulation 8) [**CD 13.7**] around AWE B and produce an off-site emergency plan.

5.2 The assessment process under REPPIR 2019 therefore means that the work undertaken under REPPIR 2019 for the HECA provides a systematic and thorough evidence trail from hazard identification and evaluation through to the assessment of consequences resulting in the determination of the UPA distance around AWE B.

Regulation 4 – Hazard Evaluation

5.3 Hazard Evaluation under Regulation 4 [**CD 13.7**] requires the identification of all hazards which may result in a radiation emergency (where an annual effective dose could exceed 1 mSv off-site), determining:

5.3.1 the potential consequences of each radiation emergency in terms of the effective dose; and

5.3.2 likelihood of the consequences occurring.

5.4 The REPPIR 2019 Approved Code of Practice (ACoP) and Guidance Paragraph 127 advises "*Operators should consider the possibilities for radiation emergencies with extremely low likelihoods but with significant or catastrophic consequences*". Therefore, low likelihood of a fault should not be used as a reason for discounting the hazard from having the potential to cause a radiation emergency.

5.5 Paragraph 162 REPPIR 2019 ACOP [**CD 13.8A**] states that "*Best-estimate methods should be used as far as possible for determining the likelihood of the initiating events*". Paragraph 142 REPPIR ACOP states "*The assessment should be performed on a suitably conservative and consistent basis*". The AWE B Hazard Evaluation utilised the predicted consequences at the site fence (considered to be suitably conservative due to the severity of the consequences) and best estimate frequency from all relevant faults within the Probabilistic Safety Assessment (PSA) supporting the Burghfield Facility Safety Justification (also known as the safety case) permissioned by both ONR and DNSR in August 2019. PSA is based on best-estimate and avoids unwarranted conservatism and is in line with REPPIR 2019 guidance.

5.6 In line with Paragraph 142 and 162 REPPIR 2019 ACOP, the frequency and consequence (dose at site fence) of all qualifying faults were then plotted on the REPPIR risk framework as Shown in Figure 1.

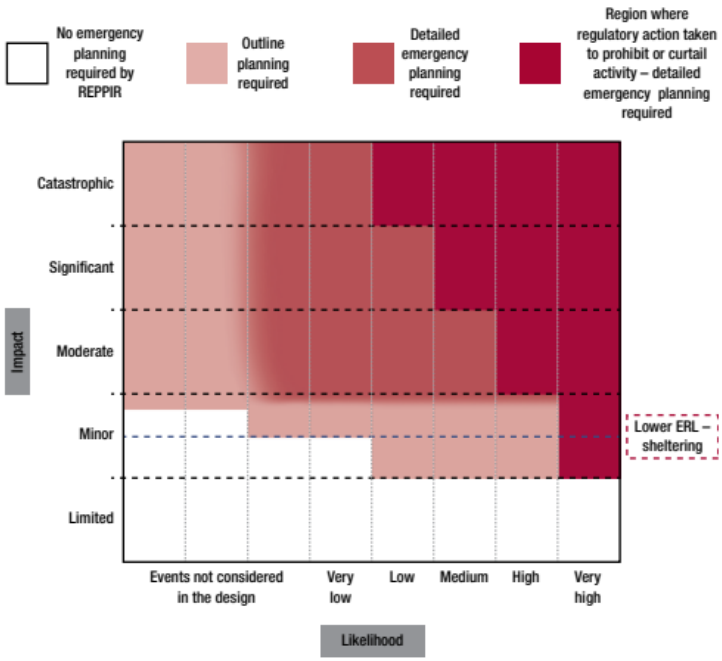

Figure 1: Risk Framework (REPPIR 2019 ACoP)

5.7 This established that detailed emergency planning was required for AWE B and AWE A to determine the UPA under Regulation 5 (consequence assessment) [**CD 13.7**] and advise WBDC of the same in the Consequences Report.

5.8 The details associated with frequencies and consequences associated with AWE B are classified and as such cannot be published in the public domain. The Hazard Evaluation and Consequence Assessment and the rationale for the data used were subject to significant scrutiny in 2019 both through AWE internal governance and external assessment by regulators. Further discussion is provided in the Review, Governance and Security section 6.

Regulation 5 – Consequence Assessment

5.9 The Consequence Assessment was undertaken by Suitably Qualified and Experienced Persons in line with Licence Condition 12. The Consequence Assessment followed the methodology provided in Schedule 3 of the REPPIR 2019 ACoP [**CD 13.7**] and was supplemented with additional guidance from UKHSA (formerly Public Health England),

such as *'REPPIR 2019 Consequence Assessment Methodology'*[3] and *'Public Health Protection in Radiation Emergencies'*[4].

5.10 The Consequence Assessment modelled the dispersion from the source to a 1 mSv contour using a modern computational model specifically developed to assess energetic release events[5]. This model has been internally validated and verified through empirical data.

5.11 As stated previously, there are a number of changes between REPPIR 2001 and REPPIR 2019. REPPIR 2019 has provided additional granularity in factors for consideration when undertaking the Consequence Assessment compared with the REPPIR 2001 HIRE.

5.12 There are minimal changes between the REPPIR 2001 HIRE and the REPPIR 2019 HECA for the person exposed and the exposure pathways due to the release being the same. One of the most significant changes for the AWE B UPA distance between REPPIR 2001 and REPPIR 2019 is the guidance on the use of weather conditions for atmospheric dispersal, where a range of weather conditions must be considered. ACoP Schedule 3 (3(3) -3(6)) [**CD 13.8**] states:

> *The calculations undertaken in order to reach the assessment must consider a range of weather conditions (if weather conditions are capable of affecting the extent of the radiation emergency) to account for—*
>
> *(a) The likely consequences of such conditions*
>
> *(b) Consequences which are less likely, but with greater impact*

5.13 UKHSA guidance[6] provides further clarification regarding this by stating "The consequence methodology should take account of consequences due to unfavourable

[3] PHE-CRCE-50 "REPPIR 2019 Consequence Assessment Methodology" [**CD 13.27**]
[4] PHE "Public Health Protection in Radiation Emergencies" [**CD 13.28**]
[5] Energetic release events – events where radiological material has been released following high explosive detonation
[6] See footnote 3 [**CD 13.27**]

weather conditions via the use of the ninety-fifth percentile of consequences based on weather variability". This means that the worst-case weather category needs to be used if the percentage time it can occur is 5% or greater.

5.14 A review of the weather conditions at AWE B concluded that stable weather conditions are more likely with the likelihood of Pasquil Stability Category F weather[7] exceeding the 5% threshold with Category F weather occurring at AWE B circa 10-12% of the time. On behalf of the Appellant, Dr Pearce states (paragraph 51-52 of Appendix Q) that Category F weather conditions typically only occur on a cold winter night[8] (then further stating in paragraph 55 that it only occurs at night) and cites the 2011 Stress Test Report which set out that operations at AWE B take place during standard daytime hours. The statement on Category F conditions is correct but the Stress Test Report is no longer valid and does not reflect current operations. At the present time, AWE B's operations involve working shift patterns meaning that Category F weather conditions will overlap with AWE operations at Burghfield. REPPIR 2019 therefore requires AWE to include calculations using Category F weather to support the assessments in the 2019 HECA. Previous HIREs only used an average Category D weather in line with the requirements of REPPIR 2001.

5.15 The change in weather category and the use of a more accurate computational dispersion model have led to a significant increase in the UPA distance (7.5 mSv contour based on the short-term exposure) extending it from 1.52 km to 3.16 km from the site centre coordinates.

5.16 The Consequence Assessment as per ACoP Schedule 3(7)-(8) [**CD 13.8**] assessed the total annual effective dose as a result of exposure from all intake pathways:

5.16.1 The short term (at least two days following the start of the release); and

5.16.2 The long term (in the 12 months following the start of the release).

5.17 There is a difference in the sources of intake pathway for short term vs. long term releases. Following assessment, the dominant intake pathway over the short term (up to

[7] Pasquill weather categories are weather types as referenced in NRPB-R91 which are used to determine dispersion of material.

[8] Category F weather is a stable weather condition

2 days) was the inhalation of the plume as it passes over (termed first pass inhalation) with only minor contribution from other pathways such as inhalation from resuspended particulate deposited from the plume and direct radiation. For the long term (up to 1 year) the intake pathways are the inhalation of resuspended deposited material on the ground and direct radiation exposure from settled particulates.

5.18 Dr Pearce states (Appendix Q paragraph 33) [**CD 5.23**] "*the table below shows the arrival time of the plume in minutes after the explosion for a range of windspeeds (the columns) and a range of downwind distance (the rows). Because it is an explosive distribution, we can assume air concentrations at a point downwind will reduce rapidly after the plume arrival*". What Dr Pearce does not consider is that an initial energetic release will be followed by a longer passive release phase (material will continue to be dispersed for a period of time after the initial event). This has been modelled in the Consequence Assessment for the short-term exposure (up to 2 days).

5.19 The Consequence Assessment estimated the averted dose in order to determine what urgent protective action would be following a radiation emergency.

7.5 mSv x (1-0.6) = 3 mSv

5.20 This aligns with the lower emergency reference level (ERL) for sheltering (i.e., the distance which has the potential to deliver a 3mSv dose saving when adopting the urgent protective action of sheltering). Paragraph 695 of the REPPIR ACOP [**CD 13.8**] states "for premises where inhalation is the dominant exposure the outdoor effective dose of 7.5 mSv can be used as surrogate for identifying the initial candidate minimum distance for the urgent protective action of sheltering." Therefore, AWE recommended the most suitable urgent protective action to be sheltering for up to 48 hours in line with the assessment above. However, this does not preclude the potential for further actions such as evacuation after the initial emergency response.

5.21 Dr Pearce states (paragraph 34), "*The general advice is that people should thoroughly ventilate their house as soon as the release has stopped and contamination levels in the outside air have fallen (NRPB [1990]). This will occur in less than an hour for the whole Urgent Protection Area in any weather condition. It should be possible to advise people that they can break shelter and return to normal life within an hour or two of the alarm*".

5.22 Dr Pearce's argument stating that members of the public can break shelter and return to normal life "*within an hour or two of the alarm*" is incorrect. It has been assessed that the public will be exposed for 2 days (initial release and longer passive release) and not for an hour or two. Dr Pearce's opinions do not reflect the recommendations in the AWE Consequences Report or the measures in WBDC's Off-Site Emergency Plan. These documents were developed by suitably qualified and experienced personnel following the requirements of REPPIR 2019 and the relevant guidance in the ACOP.

6. REVIEW, GOVERNANCE AND SECURITY

6.1 The 2019 AWE B Hazard Evaluation and Consequence Assessment, as stated previously (Paragraph 5.5) has utilised both the likelihood of the event and the potential impact from the PSA supporting the safety case. However, the assessments are internal documents containing highly classified information (not in the public domain) which are completed by competent individuals and subject to a high degree of independent scrutiny. The AWE assessments have undergone verification and independent peer review and been submitted to the Nuclear Safety Committee for advice and Site Governance Meeting for approval. Following AWE due governance, the reports were submitted to the ONR and DNSR on a Need to Know basis. ONR completed its assessment of the Consequence Assessment and concluded that 2019 HECA was suitable and sufficient and the determination of the UPA distance by AWE was reasonable.

6.2 Public Health England (now UKHSA) in an advisory role to WBDC in 2019/2020, assessed the rationale for use of Category F weather within the AWE B Consequence Report. On 10 January 2020, UKHSA issued a statement to WBDC concluding the Council should consider implementing the minimum distance of 3160m (3.16 km) radially for AWE B.

6.3 The AWE B HECA was subject to significant scrutiny both internally and externally, which was examined in the judicial review (JR) *Crest Nicholson Operations Ltd v West Berkshire DC* [2021] EWHC 289 (Admin) [**CD 13.3**].

7. REGULAR REVIEW OF THE HECA

7.1 Regulation 6(2) requires a 3 yearly review of the HECA. AWE completed this review in 2022. The evidence gathered by the review process concluded that there was no change in circumstances or material change which would affect the conclusions of the previous HECA. The output of this review was a 'Declaration of No Change' which was provided to WBDC confirming that the extant Consequences Report continues to provide the necessary information for the local authority to prepare an off-site emergency plan.

8. REGULATION 7 – CONSEQUENCES REPORT

8.1 The HECA was issued November 2019 and in line with Regulation 7 AWE produced the required Consequences Report and issued it to WBDC in November 2019.

8.2 The 2019 Consequences Report set out a 3.16 km UPA radial distance as determined from the Consequence Assessment with Category F weather. Dr Pearce (Paragraph 49) makes a statement that the reader may expect to see two distances provided in the Consequences Report: one for the likely weather conditions and the distance to the same contour under conditions that are "*less likely, but with greater impact*" and finally states that "*REPPIR guidance is quiet on whether the average or upper bound result should be used to determine the minimum size of the DEPZ*". This statement by Dr Pearce does not align with the requirements of REPPIR 2019. Schedule 3(7)-(8) makes it very clear to the operator that "*the largest of the distances…should be selected as the recommended distance for the minimum geographical extent of the Detailed Emergency Planning Zone*". AWE followed the requirement in Schedule 3 and made the recommendation for the UPA to be set at 3.16 km, shown in Figure 2.

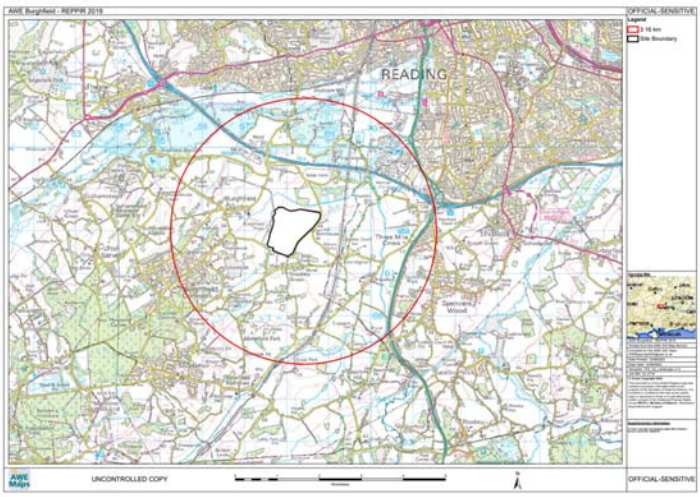

Figure 2: AWE(B) UPA

8.3 The 2019 Consequences Report also identifies the Outline Planning Zone (OPZ) for AWE B at a distance of 12 km. The OPZ is a zone which extends beyond the DEPZ and is specific in REPPIR 2019 to assist local authorities in planning for extremely unlikely but more severe events. This distance is provided to AWE by the Secretary of State for Defence (Regulation 9 – Schedule 5). The OPZ is shown in Figure 3.

Figure 3: AWE(B) OPZ

8.4 The 2019 Consequences Report issued to WBDC in November 2019 provided information in accordance with REPPIR 2019 and the guidance in the ACoP on which WBDC could base their DEPZ determination. It included:

8.4.1 Factual information – name and address of operator, the postal address of the premises where the radioactive substance will be processes, manufactured, used or stored, or where the facilities for processing, manufacture, use or storage exist; and statement that work with ionising radiation;

8.4.2 Recommendations

(a) The proposed minimum geographical extent to be covered by the Local Authority's Off-Site emergency plan – stated to be an area with radial distance of 3.16 km. In addition, an Outline Planning Zone – stated to be an area with radial distance of 12 km;

(b) Minimum distance to which urgent protective action should be taken – an area with radial distance of 3.16 km

(c) People to be instructed, as soon as practical, to immediately take cover in a suitable building with windows and all doors properly shut. The report stated that this sheltering action may be necessary for a period of up to 2 days or at least until the initial contaminated plume has passed (the description of "initial plume" in the report is intended to encompass the immediate release followed by a longer passive release).

(d) Details of environmental pathways at risk. The potential exposure pathways to the public:

(i) first pass inhalation (up to 2 days exposure);

(ii) short term external radiation during passage of the plume – cloudshine;

(iii) long term inhalation after resuspension from ground contaminated by the initial plume;

(iv) long term external radiation form ground contamination by the initial plume – groundshine;

(v) ingestion of food crops contaminated by the initial plume.

(e) The dominant pathway for short term is inhalation so sheltering is recommended.

8.4.3 Rationale

(a) The recommended UPA with a radial distance of 3.16 km was based on:

(i) The requirement in REPPIR 2019 to consider all events including those which are less likely but more severe (not just reasonably foreseeable events as required under REPPIR 2001);

(ii) Consideration of less likely weather category which could provide significantly greater doses – this involved a change of weather category from Category D to Category F since it was assessed that AWE B will experience Category F weather 12% of the time and sits within the 95 percentile as recommended by UKHSA.

8.5 The 2019 Consequences Report enabled WBDC to set the Detailed Emergency Planning Zone (DEPZ). The DEPZ needs to fully encompass the UPA radial distance[9].

9. HISTORIC COMPARISONS

9.1 Dr Pearce in paragraphs 39 to 46 of his evidence [**CD 5.23**] refers to ONR's 2018 determination of the DEPZ for AWE B under REPPIR 2001 [**CD 13.40**] and the guidance which applied to REPPIR 2001. However, the inputs and guidance leading to the 2018 determination cannot be directly compared to the assessment carried out under REPPIR 2019. Given the scale of changes in the assessment approach and methodology in REPPIR 2019 which I have explained above. The hazardous event assessed from 2019 Safety Case is still a detonation leading to release of radiological material resulting in an inhalation dose to members of the public. The likelihood of the event is such that a consequence assessment is required to be undertaken in line with REPPIR 2019.

[9] See Regulation 8(1) REPPIR **[CD 13.7]** and paragraph 231 of the ACOP **[CD 13.8]**

9.2 The ONR 2018 determination followed a different legislative regime and different assessment expectations. The change in the requirements of REPPIR 2019 (as summarised in paragraph 4.1 above) are as a result of important lessons learned from the Fukushima Daiichi incident as well as updates in the standards issued by the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP). The assessments in the HECA were also based on improvements in assessment techniques and enhancement in dispersion modelling capability based on empirical data.

9.3 Comparison against superseded documentation is not appropriate here, particularly when considering the following factors:

9.3.1 AWE Safety Case Updates (issued in August 2019) and Periodic Review of Safety (PRS) – where the safety cases are assessed against modern standards ensuring the most up to date and Relevant Good Practice (RGP) in assessment techniques are deployed;

9.3.2 changes to international standards that pose significant changes (for example REPPIR 01 vs REPPIR 2019);

9.3.3 improvements in assessment techniques; and

9.3.4 enhancement in dispersion modelling capability based on empirical data.

10. THE APPELLANT'S EVIDENCE ON RISK

10.1 The Appellant has provided evidence which seeks to challenge AWE's approach to hazards and risk assessment. My understanding is that the Appellant, through the evidence of Dr Pearce, seeks to make the point that the risk to the population from a radiation emergency is low. I have explained above where I disagree with Dr Pearce's evidence and the reasons why. I do not repeat the detail of those points here but to assist the Inspector they are summarised below:

10.1.1 Hazard Evaluation – I have clarified that the likelihood and consequences of a radiation emergency were considered on a best estimate basis but due to security reasons are not publicly available;

10.1.2 Consequence Assessment – I have explained why AWE used Category F weather in its calculations and why this was appropriate in light of the requirements of REPPIR 2019 and the guidance in the ACoP.

10.1.3 I do not agree with Dr Pearce that the public should be able to break shelter within an hour of the event. The use of latest available validated models and the consideration of intake pathways both in the short and long term and wind speed justify a recommended period of sheltering of up to 2 days. After this period, there remains a risk to the public from other (long-term) intake pathways, although I accept that the main intake pathway is through inhalation while the plume passes over and during the longer period when there is passive release.

10.1.4 Historic comparisons – I have explained why it is not appropriate to compare the current assessments under REPPIR 2019 with the previous regulations (REPPIR 2001) and guidance.

10.2 In this section, I also respond to the Appellant's argument that the potential impact to human health from incidents at AWE B is low (see paragraph 22 of Appendix Q) [**CD 5.23**]. In my opinion, this risk-based approach to the issue is flawed and does not reflect the requirement to keep risks ALARP or reflect industry best practice.

10.3 Dr Pearce explains that AWE B does not pose a significant risk to those living or working in the area of the proposed development (paragraph 73-74 and 107). Dr Pearce presents a risk estimation for a member of the public using assumptions and extrapolations which results in an optimistic presentation of risk:

10.3.1 Consequence - Dr Pearce (paragraph 62) extrapolates the dose at the location of the proposed development using an approximation based on non-linear methodology to determine the dose at the development site for Category F weather (based on the 7.5 mSv dose contour within the 2019 Consequence Report) and the dose at the development site for Category D weather (based HIRE report circa 2017). Since the dose estimations are based on an approximation there is uncertainty within the dose values presented and therefore, I do not consider it a sound basis for the risk assessment.

10.3.2 Likelihood of event – Dr Pearce estimated the initial probability of the accident in $1x10^{-5}$ yr^{-1} based upon the comparison of the 'reasonable foreseeability' of the event defined in the 2017 HIRE to the 2019 HECA. Dr Pearce has assumed that the initiating event for 2019 HECA is the same as the 2017 HIRE. Whilst both the faults lead to an energetic release, there is no basis for assuming that the initiating event is the same. It cannot be assumed that the frequencies are comparable. Secondly, the individual risk to a member of the public from AWE B is not based on one single event but upon the total frequency of events resulting in consequences to a member of the public. Therefore, Dr Pearce's estimation of risk to a member of the public is a significant under estimation.

10.3.3 Probability of wind – the probability of the wind blowing towards the development is taken as 0.03 using wind rose data for RAF Benson and can be used in risk assessments. However, UKHSA guidance covers the use of wind direction specifically for emergency planning. Whilst there may be a prevailing wind direction for the site, the use of it in determining emergency planning zone shapes is too uncertain for reliance or emphasis to be placed on it.

10.3.4 Risk Factor – The risk factor of 5.7x10-5 mSv-1 is a correct assumption and supported by literature.

10.4 The multiplication of these factors ($1x10^{-5}$ * 0.03 * 11.3 * $5.7x10^{-5}$) results in a risk given of $2x10^{-10}$ per year[10]. As stated above, this approximation presents an inaccurate representation of individual risk from AWE B as a whole. A true reflection of risk to an individual must be based upon the summated frequencies of all fault sequences. Dr Pearce's assessment represents an under estimation and therefore, in my opinion it is not a sound basis for the low risk argument since it is not a true reflection of public risk.

10.5 I can confirm that AWE has met their duty in demonstrating that risks from their operations are tolerable and ALARP. The argument that the ultimate risk is low does not address the principal requirement of REPPIR which is to develop a suitable off-site emergency plan given a UPA distance has been determined and a DEPZ established. The development of the off-site emergency plan assumes the accident has already

[10] Dividing 1 by 2x1010 yr-1 gives the value of 1 in 5,000 million years quoted by Dr Pearce

happened irrespective of the risk value. Increasing the population within the DEPZ will increase the burden on the off-site emergency plan potentially rendering it unsuitable.

10.6 Ensuring that a suitable emergency plan is in place is part of the defence-in-depth approach to nuclear safety to mitigate the radiological consequences of a release of radioactive material into the environment (guidance from International Nuclear Safety Advisory Guidance (INSAG) 10 Section 2.2 – see Figure 4) [**CD 13.40F**].

10.7 Arguing that defence-in-depth (suitable off-site emergency response) can be challenged (increase in population within DEPZ) based on a low individual risk to a member of the public is inconsistent with the defence-in-depth principle which supports the ultimate argument for ensuring risks are kept ALARP. Therefore, basis and intent of the Appellant's argument for low risk does not reflect the expectations of REPPIR and its role in nuclear safety and the delivery of defence-in-depth.

Levels of defence in depth	Objective	Essential means
Level 1	Prevention of abnormal operation and failures	Conservative design and high quality in construction and operation
Level 2	Control of abnormal operation and detection of failures	Control, limiting and protection systems and other surveillance features
Level 3	Control of accidents within the design basis	Engineered safety features and accident procedures
Level 4	Control of severe plant conditions, including prevention of accident progression and mitigation of the consequences of severe accidents	Complementary measures and accident management
Level 5	Mitigation of radiological consequences of significant releases of radioactive materials	Off-site emergency response

Figure 4 – Levels of Defence in Depth from INSAG 10

Radiation Dose in the Event of an Accident

10.8 The Appellant's evidence (paragraph 68) uses assumptions to argue that any potential radiation dose is low in the region where the proposed development is located.

10.9 Dr Pearce (paragraph 62) assesses the dose for Category D and Category F for the development site stating the dose to be 11.3 mSv for Category F weather and 1.9 m Sv for Category D weather.

10.10 Dr Pearce then states (paragraph 65 and 66) "*the REPPIR Risk Matrix describes doses in the range of 1-10 mSv as "minor"…*". "*The range 10-100 mSv also has no potential for deterministic effects*", implying that the doses are insignificant. However, Dr Pearce does not refer to ONR's 2014 Safety Assessment Principles (SAPs) (paragraph 618) where ONR considers that doses to members of the public above 0.01 mSv are significant requiring fault studies to be undertaken and subsequent management to prevent exposure and that REPPIR applies where annual off-site doses greater than 1 mSv.

10.11 Dr Pearce makes a comparison against natural exposures and medical exposures stating (paragraph 69) "*it does show that the radiation dose that could arise if a major accident occurred at the AWE Burghfield site are within the range commonly experienced by members of the public during their everyday life*." However, 11.3 mSv (Category F weather) or even 1.9 mSv (Category D weather) as determined by the Appellant's dose estimations are significantly above 0.01 mSv and 1mSv and so the regulatory requirements on AWE that I have identified above are engaged. AWE has no discretion to ignore the potential risks to the public on the basis that the dose from an emergency is "within the range commonly experienced by members of the public".

10.12 In addition, Dr Pearce does not consider that, unlike background natural radiation and medical radiation where the public accept the risk based on the benefits they perceive, the public does not accept exposure to radiation in the event of a radiation emergency from AWE B. The Appellant's arguments are at odds with the intent of REPPIR 2019 and ONR's expectations for public safety and also the public's expectations in the event of a radiation emergency (for example, relocation, medical surveillance, decontamination and clean-up and personal injury and property damage compensation).

Longer Term Consequences of Radiological Emergency

10.13 The Appellant's arguments about risk do not take into account the longer-term impacts of a radiation emergency; public perception of risk and the wider societal factors (these are examined in greater detail below).

10.14 The development site is located within the UPA distance, which means that the housing development will increase the contribution to societal risk. By this I mean the relationship between individual risk from an emergency and the number of people that can be exposed to that emergency i.e., the greater the number of people exposed the greater the societal risk. The off-site emergency plan deals with the first 2 days of the emergency and does not deal with the increased longer term recovery impacts as a result of more people being exposed to an emergency. The Appellant's attempt to present the potential radiological consequences from the immediate emergency as minor fails to note the other risk factors people may be subject to especially during recovery phase.

10.15 The larger the population in an impacted area, the increased potential for the following:

10.15.1 An adverse effect on the adequacy of the off-site emergency plan. Whilst the method of alerting will be insensitive to an increasing population, there may be additional time taken to deploy adequate protection measures around and within the area. This is due to an increased burden on emergency responders to safely manage the population e.g., access/egress, making sure emergency actions are followed and emergency provision of essential supplies (food and medication) to persons sheltering;

10.15.2 a larger range of health effects and physical injury arising from the undertaking of emergency actions for a larger population (including active and latent psychological and mental health issues as a result of being exposed to a radiation emergency). Research[11] into radiation emergencies has identified that one important driver of these types of health impacts is a higher than justified level of anxiety and concern among the public. This is exemplified by:

(a) People not at any significant risk from the emergency believing they or their loved ones have in fact been exposed to harmful radiation;

(b) Members of the public stigmatising people that they perceive to be in some way tainted, perhaps by exposure to radioactivity.

10.15.3 To minimise this type of health impact, plans need to prioritise the provision of timely and credible information and its delivery over a potentially wide area via

[11] NEPRG01 – Part 1 Preparedness [**CD 13.40C**]

routes and agencies likely to be trusted. It needs to be recognised that people in areas completely unaffected by any radiation release and at considerable distances from the site of the emergency may well be just as susceptible to this type of stress-related health impact as those in the vicinity of the site.

10.15.4 Experience reveals that another cause of these types of stress-related health impacts has been poorly conceived decisions or advice on radiation protection. This can lead to people suffering more harm from the actions taken to protect them than any benefit these actions deliver in terms of reduced radiation exposure;

10.15.5 a greater number of buildings to decontaminate;

10.15.6 extended disruptions to normal living as a result of restricted access to dwellings which could include impacts to health as a result of restrictions (e.g., access to medical support); and

10.15.7 a greater burden falling on local authorities to relocate impacted residents. Although sheltering is the primary UPA, the emergency plan does not preclude evacuation. A greater population in any potential affected areas which are part of the plan means that any evacuations either made in the short term or the longer term (e.g., for decontamination) means that local authorities will have to find additional suitable accommodation and access to required services for relocated people.

10.16 The response phase regulated by REPPIR 2019 is followed by a recovery phase which is regulated by the Civil Contingencies Act 2004 and other legislation. The recovery phase will have significant local and national resource implications as well as adverse economic impacts for AWE and MOD in terms of costs for remediation and compensation.

10.17 AWE, as the operator and holder of the nuclear site licence for AWE B, will be responsible for paying compensation to third parties for damages from a radiation emergency in accordance with the Nuclear Installations Act 1965 (NIA). By way of example, I am aware that a claim was brought by a property owner of land adjacent to AWE Aldermaston under the NIA for compensation arising from a flood event in July

1989 where an area of marshland was contaminated by flood water overflowing from AWE Aldermaston[12]. I did not work for AWE at the time but I understand the radioactivity was reported to not endanger health but remediation was nevertheless required. The court awarded damages to be paid by MOD (the operator at the time) to the property owner of over £6m (equivalent to £11m in 2023) plus MOD incurred remediation and disposal costs which are equivalent to over £1m in 2023.

10.18 National and local guidance[13] outlines the wide range of recovery activities which would be required to facilitate the long process to recover an area which has been impacted by a radiation emergency. The complicated nature of recovery includes case by case requirements which by default cannot be predicted.

10.19 The post stabilisation recovery activities will be subject to significant activity which may proceed for a protracted time span to complete. Some specific recovery impacts of note include:

10.19.1 Long term quality of life effects as a result of disruption during decontamination and the extended clean-up;

10.19.2 Re-location of people to areas of lower hazard and the associated impact of disruption to their way of life, employment, education, care and any additional factors relevant to each individual;

10.19.3 Potential destruction of property and waste storage issues and the financial burden to undertake these activities for any assets which cannot be decontaminated;

10.19.4 Depreciation in the value of physical assets and difficulty to sell property/land.

10.20 The Appellant's low risk argument (paragraph 70) focuses purely on individual risk. Exposing additional people to the radiation emergency increases the societal risk as described above.

[12] *Blue Circle Industries plc v Ministry of Defence* [1998] 3 All ER 385 [**CD 13.40D**]

[13] Emergency Response and Recovery – Non statutory guidance accompanying the Civil Contingencies Act 2004, Revised October 2013 [**CD 13.29**]

11. INCREASED POPULATION WITHIN DEPZ AND EFFECT ON AWE'S OPERATIONS

11.1 HM Chief Inspector ONR Report 2011 "Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry" [**CD 13.40E**] discusses population density and the effectiveness of off-site emergency plans.

> *"The practicability of implementing off-site countermeasures is inextricably linked to the density and distribution of people around the nuclear site. A site that was acceptable for emergency planning purposes when it was first established may not continue to be acceptable unless planning controls limit population growth in the site's locality, or action can be taken to ensure the off-site emergency countermeasures can cope with the changed demographic*".

11.2 As set out in paragraph 3.1 above, AWE B is the only site in the UK that can provide the capabilities for the assembly, disassembly, handling and storage of nuclear warheads for the nation's nuclear deterrent. AWE B needs flexibility to be able to develop, expand and/or change its activities in response to MOD requirements for supporting CASD. Increasing the population within the DEPZ can affect this support to CASD in 3 ways:

11.2.1 Increasing the risk of adversely affecting current licensable activities. A population increase carries a significant risk that regulatory permissions would be subject to future restrictions which may limit AWE's operations. In particular, if further residential development meant that WDBC could not demonstrate to ONR that it had an adequate off-site emergency plan, then under Regulation 10(4) of REPPIR 2019 [**CD 13.7**] AWE would be unable to continue to carry out work with ionising radiation, preventing AWE's ability to meet MOD's requirements in support of CASD.

11.2.2 AWE being refused planning permission and/or other operating consents resulting in a limitation to its future operations. In order for AWE to meet MOD's future requirements it is likely there will be a need to amend, expand and develop operations at AWE B. There is a risk that future operational changes could be deemed to be unacceptable given a larger population in the vicinity of AWE B and required permissions, licence amendments and other consents refused. Given AWE B is the only site in the UK permitted to assemble, disassemble, handle and store nuclear warheads, preventing AWE's ability to

obtain future operational permissions and consents would threaten the delivery of CASD.

11.2.3 An increase to the risk of public challenge or complaints against AWE's operations.

12. SUMMARY AND CONCLUSIONS

12.1 I can confirm that the 2019 HECA adequately reflects the frequency and consequence data from the PSA within the Burghfield Facility Safety Justification.

12.2 All assessments have satisfied regulatory scrutiny and third party challenge[14] on:

12.2.1 appropriateness of the consequence and frequency values within the Burghfield Facility Safety Justification;

12.2.2 the rationale for the use of Category F weather;

12.2.3 rationale for the setting of the UPA distance.

12.3 The point of setting the UPA is to ensure that a suitable off-site emergency plan is in place as part of the defence-in-depth approach to nuclear safety to mitigate the radiological consequences of a release of radioactive material into the environment. Arguing that such defence-in-depth is not required based on low individual risk to a member of the public is not consistent with the requirements of REPPIR 2019 or the expectations of defence-in-depth (suitable emergency off-site plan) which supports the ultimate argument for ensuring risks are kept ALARP.

12.4 REPPIR 2019 is not just focussed on public safety during the immediate emergency but also focuses on the longer-term impacts to the public and the transition to the recovery phase (covered by the Civil Contingencies Act 2004).

12.5 The UPA distance has been determined and the DEPZ established. In my opinion, arguments that the risk to individuals is "low" are not relevant to the question of whether this development should be permitted because these arguments are not consistent with well-established principles of nuclear safety and the underlying regulatory regime. The

[14] *Crest Nicholson Operations Ltd v West Berkshire DC* [2021] EWHC 289 (Admin) [**CD 13.3**]

key focus is on the demonstration that the off-site emergency plan is adequate. Increasing the number of people within the DEPZ has the potential to adversely affect the adequacy of the plan and will increase the number of people exposed to radiation emergency and all the associated longer-term impacts.

12.6 Increasing the population within the DEPZ can have a potential adverse effect on the future operations of AWE. In particular if ONR deemed the off-site emergency plan inadequate then AWE may not be able to continue to work with ionising radiation in line with Regulation 10(4) REPPIR 2019.

13. DECLARATION

The evidence which I have prepared and provide for this planning appeal in this proof of evidence is true and has been prepared and is given in accordance with the guidance of my professional institution and I confirm that the opinions expressed are my true and professional opinions.

Dated: 11 May 2023

Person AW

Person AW