# TOWN AND COUNTRY PLANNING ACT 1990 (AS AMENDED)

# APPEAL BY T A Fisher & Sons Ltd

Against the refusal of Full Planning Permission

by

West Berkshire Council

ON

LAND TO THE REAR OF THE HOLLIES, READING ROAD, BURGHFIELD COMMON

For

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

Application Reference no. 22/00244/FULEXT
Appeal Reference no. APP/W0340/W/22/3312261

Rebuttal

by Dr Keith Pearce BSc PhD MBA MSc FEPS of Katmal Limited

in respect of Proofs of evidence by WBC, AWE and ONR

# Contents

# 1. Scope of Rebuttal

1. My name is Keith Ian Pearce and I am an independent Consultant. Details of my qualifications and experience are included in my Proof of Evidence (PoE) (CD 10.1).

2. Grant Ingham (ONR Emergency Preparedness and Response (CD 12.24) has questioned my experience in relation to multiagency emergency response. Paragraph 18 of his Proof of Evidence suggests that "*It is important to recognise that although the Appellant can express a view on the content of the OSEP, it will not have had the benefit of access to the professional insights this wider expertise provides*". In fact, I have in the past been an active member of the Nuclear Emergency Planning Liaison Group (a multi-agency, senior officer concern), Nuclear Emergency Arrangements Forum (a meeting of senior UK emergency planners), been a member of (and briefly chaired) the Local Authority Working Group (a grouping of local authority emergency planners), and have worked with local authorities and multi-agency groups around the UK on different projects as well as being involved in many level 2 exercises (the test of the off-site plan) in the preparation, execution (as assessor and participant), debriefing and reporting stages (including being part of the national lessons learned process).

3. My Rebuttal PoE addresses a number of points in the Proofs of Evidence submitted by the local authority (CD 11.8) the Rule 6 Parties AWE/MOD (CD 13.42) and ONR (CD 12.24, CD 12.25 and CD 12.26) where I consider that we differ in our opinions and where I consider it would be helpful to the Inspector for me to respond at this stage. Where a specific point is not covered below, it does not mean that the point is accepted.

# 2. Proof of evidence Local Authority Emergency Planning

Prepared by: Carolyn Richardson (CD 11.8)

I found several minor inconsistences and inaccuracies in this report that I will not detail.

## 2.1. Scope of accident

4. I think that it is wholly inappropriate to cite the national risk register's assessment of the worst nuclear accident that has a reasonable likelihood of occurring in the whole of the UK (including the Sellafield site and all the nuclear power reactors) and imply that it is relevant to the AWE(B) site as the author has done (Paragraph 5.22). I believe that the expected casualties, the financial costs, the number of people evacuated, but maybe not the public perception, to be greatly exaggerated.

## 2.2. Scope of evacuation and decontamination

5. In paragraph 7.15 the author expresses concern that changes in the DEPZ would put responders under exceptional pressure whereas, of course, the change in the DEPZ has no impact on the severity of any future accident at AWE(B) and should not have an impact on the pressures of response (which would be intense – but this is the reason for advance planning/practice of the appropriate emergency response).

6. It is not realistic "*that a widespread area across the whole of the DEPZ be contaminated*" (also paragraph 7.15) from a short-term release. Widespread contamination, as opposed to contamination in a limited downwind plume, requires the release to continue at a significant rate through changes in the wind direction. Any such short-order changes in wind direction (and speed) would spread the contamination more thinly, reducing the impact to individuals. But we expect that the main release will take place over a short time period.

7. In paragraph 9.6i the author states that urgent evacuation is likely to relate to any property within 600 m of the site boundary whereas the off-site plan (CD 5.42)[1] places this range at 150m "with subsequent evacuation out to 600m" while the consequences report, which should include all relevant protective actions for the representative range of radiation emergencies[2], makes no mention of evacuation at all. The proposed development site is significantly beyond this range.

[1] Row (d) in table on Page 235
[2] REPPIR Guidance (CD 5.39) to regulation 7(1) paragraph 183, page 49

8. In paragraph 9.6j (page 41) the author states that evacuation could involve "*any or all of [the] properties within the DEPZ area*" and in paragraph 10.8 (page 49) she suggests that the homes on the development site may need to be evacuated while decontamination takes place. I disagree strongly that these outcomes are realistic. Neither the Consequences Report nor the current OSEP contemplate such a widespread action. The relevant parts of the OSEP are referenced above. And elsewhere in my evidence I have addressed the very limited doses associated with ground dose, ingestion dose and resuspension dose following the initial release.

9. Ms Richardson returns to this theme in paragraph 9.15 where she provides estimates for the number of rest centres required based on an assumption that evacuation may be required across three sectors to the edge of the UPA. This is not a realistic outcome.

10. In paragraph 9.6k the author tells us that a RMU can monitor up to 200 people per day but does not tell us how many RMUs can be fielded nor how many people may wish to be monitored. An adequate advance plan would make suitable arrangements in respect of such matters, noting that the same OSEP covers Tadley (population 14,800) just to the south of AWE(A) and the Majewski stadium (capacity >24,000).

11. If RMU resources are limited their use will be prioritized to those most likely to be contaminated. It may be that one or two members from each affected household or area will be selected based on a review of their movements during the release phase rather than attempt to monitor everyone. Monitoring issues are discussed more broadly in Dr Thorne's rebuttal proof, which I have read in draft.

12. In paragraph 9.21 the author states that homes may be deemed unfit for human habitation and in 10.7 explicitly states the potential for evacuation while decontamination takes place at the appeal site. Given that the residual dose rates after the plume has passed are likely to be well below 1 mSv a year at the proposed development site (and nearer to 0.1-0.2 mSv) this is not realistic or necessary.

## 2.3. Learning from experience

13. In Section 8 of their Proof of Evidence the author discusses the history of nuclear and other accidents and what was learned but uses the section to exaggerate the implications of a reasonably foreseeable accident at AWE(B).

14. Three Mile Island (1979) was a reactor accident that the operators initially struggled to understand and the authorities struggled to cope with. There was no coordination in the preparation of messages to the public and this added to the confusion as the situation on-site changed. As a result of this lesson all nuclear emergency plans have a media cell of some description which aims to provide trustworthy information from within the response and attempts to align the lines being taken by the media outlets. This is intended to reduce misinformation and mixed messages which cause unnecessary alarm (and potentially long term physical and mental health effects).

15. Another important learning point was to separate out the on-site and off-site responses and to have a dedicated off-site centre which has since evolved into the Strategic Coordination Centre (SCC).

16. Three Mile Island was a reactor accident where the situation in the reactor changed over several days. This prolonged type of event is not envisaged by the AWE(B) consequences report.

17. The Chernobyl accident (Section 8.3b) occurred on a uniquely Russian design of reactor that released huge quantities of fission products into the environment over a period of days. The continental range of impact could not be replicated by AWE(B).

18. We learned a lot from the Fukushima event (Section 8.3c) which involved multiple challenges within the context of a larger scale disaster. It led to a thorough review of our emergency plans and their capabilities regarding severe accidents and complex events. The AWE Stress test (CD 5.30) concluded that there was no sudden large step change in accident consequence that might result from multiple challenges[3].

19. The Salisbury nerve agent poisoning (Section 8.4b) has similarities, but also important differences, to a potential accident at AWE(B). The important difference was the nature of the contaminant which was in the environment at seeming random locations in tiny quantities but quantities that could prove damaging to health, if not fatal if ingested. This is in stark contrast to the low-level hazard represented by predicted levels of plutonium at the proposed development site.

[3] Paragraph 72 on page 13

20. The investigation and clean up was very complex. What was interesting was that life continued as usual outside the police cordons. The public heard and generally heeded the advice being given. Those who thought they might be affected were processed by determining how close to known hot spots they had been and monitoring of those considered to be at risk. People generally carried on with their lives, working within the restrictions imposed.

21. The Buncefield fire (discussed in paragraph 84.a), flooding (Section 8.4b), the Grenfell Tower fire (Section 8.4c), COVID19 (Section 8.4e) and a water outage (Section 8.4f) produce very different short term and long term challenges and consequences so, while there is learning to be gained about the public response and how to help them (in particular to try to minimise stress and ensuing long term physical and mental health issues – through publication post-event of accurate information), there is little of relevance to add to a discussion about the merits of building a limited number of homes at the proposed development site.

22. In the section about Covid (Section 8.4e) the author suggests that in the event of an accident at AWE(B) carers would need PPE or depending on the hazard may not be able to enter the area and therefore specialist responders would be needed. Given the short-term nature of the airborne hazard and the expected dose rates at the proposed development site this seems to be an exaggeration. Given a properly understood risk assessment, prepared in the Scientific and Technical Advice Cell[4] or by their RPA, there is no good reason why carers or emergency services cannot work in the outer areas of the DEPZ or upwind of the event. There would be no need to deny or delay care to any person as far from AWE(B) as the proposed development site.

## 2.4. Time available to shelter

23. In paragraph 9.2 the author states that it will take AWE up to 15 minutes to trigger the telephone warning system and that this allows 10 minutes for those outside to get into suitable shelter.

24. But, even at the unusually slow wind speed of 2 $m.s^{-1}$ the plume will have reached 1.8 km by 15 minutes (2 $m.s^{-1}$ x 15 minutes x 60 seconds/minute) and 3 km by 25 minutes. On the reasonable assumption that almost all of the dose is caused by the explosive distribution and

[4] A component of the OSEP based in the SCC.

rather little by the continuing release and resuspension then people within 1.8 km of the site will not benefit from the alarm and only those who are beyond that range and can move rapidly from outside to inside before the plume reaches them will benefit from the alarm and the advice. However, given that this weather category is associated with cold nights, it is likely that most people will be indoors before the alarm.

25. At UK average wind speeds nearer 5 $m.s^{-1}$ (i.e., average category D conditions) the main plume will be beyond the extent of the UPA before the alarm is raised, although the dose at the appeal site will be significantly lower on account of such wind/weather conditions.

# 3. Proof of evidence AWE Safety including nuclear safety, REPPIR-19 and continuity of AWE B's Operations

Person AW AWE (CD 13.42).

## 3.1. Uranium

26. I note that person AW confirms the presence of enriched uranium, which is not mentioned in the consequence report but is in the OSEP (Paragraph 3.4 of CD 13.42). This clarifies the situation but does not really affect any of the arguments presented by either side[5].

## 3.2. Assessing a wider range of hazards

27. It is correct to say that REPPIR-19 caused "*removal of the requirement to assess only reasonably foreseeable hazards and introduction of a new requirement to assess all hazards*" (Paragraph 4.12 of CD 13.42) but this should not be taken to imply that detailed planning was extended by REPPIR-19. Detailed planning is only required for faults more frequent than $10^{-5}$ $yr^{-1}$ (1 in 100,000 years) (maybe down to $10^{-6}$ $yr^{-1}$ (1 in a 1,000,000 years) for sensitivity studies)[6], similar to the ranges used in REPPIR-01, and so **these less likely hazards that are to be assessed do not impact on the extent of the UPA nor the prompt protective actions that might be considered**.

## 3.3. Inclusion of consequences which are less likely, but with greater impact.

28. The issue as to any necessity to use cat F(2) in setting the UPA range is not relevant to this appeal.

29. In paragraph 5.12, Person AW quotes REPPIR-19 Schedule 3(3) which clearly states that the calculations must take account of "the likely consequences" and "consequences which are

[5] Almost all of the dose received by members of the public would be first-pass inhalation. One small difference is that U-235 will be present together with its short-lived progeny Th-231. This has more x-ray/gamma emission than Pu-239, so the ground-shine component after an accident though small will be somewhat larger than for plutonium. Ingestion and resuspension doses would be expected to be small.

[6] See REPPIR guidance (CD 5.39) paragraph 152. "*In the REPPIR risk framework under regulation 4, the value of 1 in 20 000 in a five-year period is the lowest likelihood considered in the national risk assessment (paragraph 172). It is considered to be appropriate to use this as the lowest likelihood for which detailed emergency planning should be required and the point at which outline planning (or even no emergency planning in the case of low-consequence events) is sufficient".* (Note 1 in 20,000 in a five year period is identical to 1 in 100,000 in a year or $10^{-5}$ $yr^{-1}$).

less likely but with greater impact".[7] Contrary to Person AW's paragraph 8.2, this is the justification for my observation that one would expect to see two assessments.

## 3.4. Shift working

30. We are given new information in 5.14 "*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".*

31. If the work undertaken at night includes the conditions that could lead to the explosive distribution then it is plausible for the accident to occur in category F(2) weather. This does not affect my arguments and the outline risk assessment I have presented still holds.

## 3.5. Release duration

32. In my report I surmise that any plume produced by an explosive distribution would be of short duration and that dose uptake by people downwind would only occur as the resultant cloud drifted by them.

33. Person AW refutes this. "*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).*" In fact, I do discuss this possibility in my PoE (CD 10.1 Paragraph 82) where I suggest it would be at a very much lower release rate (a point not contradicted by Person AW's evidence).

34. Person AW continues "*Therefore, AWE recommended the most suitable urgent protective action to be sheltering for up to 48 hours in line with the assessment above*".

35. Person AW reports that, in their dose estimates, they integrated the dose uptake over two days following the release as required by the REPPIR guidance[8] and then seems to suggest that because they assess the dose over two days and the integrated dose (i.e. total dose over this period) is above the shelter threshold then it is sensible to advise shelter for those two days.

[7] Page 141 on REPPIR-19 ACOP (CD 5.39)
[8] The requirement to integrate potential dose uptake over two days was to give a generous estimate of the dose that could be averted by prompt protective actions.

36. What we are not told by Person AW is what fraction of the two-day dose is given in the first few minutes and what results from the continuing passive release. If, as might reasonably be expected, most of the release and therefore most of the dose results from the initial explosion, we would conclude that for a total two-day dose of 7.5 mSv the remaining avertable dose after the initial plume transit would be well below 7.5 mSv.

37. If (say) 90% of the 7.5 mSv would be received in the first hour (say) then the avertable dose by sheltering for the remaining 47 hours would be 0.75 mSv which is well below the lower ERL of 3 mSv. In these conditions a health physicist reading from the ERL guidance would not recommend shelter if the opportunity to shelter before plume arrival had been missed - there is little dose to be averted from finding people who were outside during the plume transit and hurrying them indoors for the remainder of the two days. Similarly there is little further dose to be averted by keeping those who were indoors during plume transit indoors for another two days.

38. Furthermore, with a low continuing release rate, air concentrations outdoors could be lower than concentrations indoors, which could be controlled by resuspension and recirculation of aerosols that penetrated the building during the few minutes of passage of the original plume.

39. In paragraph 5.22 the author states that "*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*".

40. This is the same point as above.

41. I stand by my suggestion that the airborne activity is likely to drop soon after the plume arrival at points downwind. After it has passed there is little to be gained in terms of dose averted by continuing shelter and it may, in fact be better to ventilate homes. However, I accept (and have not at any time disputed) that there are other considerations that bear on whether the position indicated by the applicable physics would reflect decision-making at the time, and it does not matter for any material part of the argument on this appeal.

### 3.6. PHE Recommendation to accept UPA assessment.

42. In section 6.2 Person AW gives weight to PHE's statement advising acceptance of the AWE advice given in the Consequence Report. However, a reading of the PHE advice paper

(Appendix 1) raises some doubt about the foundation of that advice. Since I have not mentioned it before in my evidence, and Person AW has cited it, I will briefly review the PHE advice paper.

43. In the paper PHE:

- Admits that they have "*not obtained details of the dose assessment analysis on which AWE's Consequence Reports are based, and has not undertaken any confirmatory calculations.*"[9]
- Reported that "*AWE does not refer to this framework* [The REPPIR Radiation Risk Framework] *in the consequence reports, and therefore PHE cannot comment on whether a sufficiently large range of potential accidents has been considered.*"[10]
- Supported the choice of "less likely" weather, considering that to be a requirement of REPPIR[11].
- Reported that the Consequences Report does not give any information about the need for evacuation which "*would only be justified in areas where doses in excess of 30 mSv could be averted (i.e. the lower ERL for evacuation)".*[12]
- Report that "*in supplementary information provided by AWE it is stated that due to the very short duration for the release AWE considers evacuation close into the site would not be viable in the timeframe of the release and as such would not offer tangible benefit".*[13] (Stated in relation to AWE(A) but applies to some of the AWE(B) DEPZ as well)
- Admit that "for Aldermaston, AWE **"there could be no time to inform the public and for them to shelter to obtain any dose saving**."[14] This also applies to those areas close to AWE(B).

44. It is fair to claim that PHE concluded that the council should accept the conclusions of the AWE(B) consequence report[15] but there are questions about the limitations of the review behind the recommendation and it should not be taken as a comprehensive and detailed endorsement of the consequence report.

## 3.7. Risk estimates and the tolerability of risk

45. Section 10.3.1 of Person AW's PoE includes a statement to the effect that my dose estimates are not a sound basis for a risk assessment (this refers to paragraph 121 in my PoE (CD 10.1)) Since I've used models closely related to those that they use, invalidating my methodology would undermines theirs. I've shown two ways in which the doses and a point can be estimated from knowing the dose at a different point downwind, one using a simple

[9] Top of page 3
[10] Second paragraph of Section 1 on page 3.
[11] Paragraphs 1 and 3 of section 2 on page 3.
[12] Paragraph 2 of the Aldermaston Site section on page 4
[13] Paragraph 2 of the Aldermaston Site section on page 4
[14] Paragraph 1 of Section 4 on page 5
[15] Section 7 on page 6

relationship (taken from a Nuclear Installations Inspectorate[16] paper[17]) and the other a graphical method. They give similar answers. As stated in my documents, there are clearly some uncertainties (as is normal with this sort of modelling exercise) but there is reason to consider that they are fit for purpose.

46. In paragraph 10.4 Person AW reports that I have only assessed the risk from one fault and that a true reflection of risk must be based upon the "summated frequencies of all fault sequences". There is a fair point here but it is more accurate to say that a true estimate of risk would be based not on the summated frequency of fault sequences, but on summation of the product of frequency and consequences for all relevant fault sequences. More significantly, Person AW's point does not go anywhere. I have adopted a precautionary approach, assigning to the fault a frequency towards the top end of the scale[18], and the assessment generated (one in a thousand million years) is still several orders of magnitude below the individual risk of death of one in a million per annum for both workers and the public that the HSE states corresponds to a very low level of risk and should be used as a guideline for the boundary between the broadly acceptable and tolerable regions (CD 16.22)[19] . The conclusion that the risk is very low holds.

47. Person AW then supports my conclusion that the AWE(B) site does not represent a great risk to health or life for those living in or near the proposed development site (CD 5.23)[20] with the statement that "*I can confirm that AWE has met their duty in demonstrating that risks from their operations are tolerable and ALARP*" (10.5).

48. This is a very important statement.

49. In the Tolerability of Risk discussion (CD 16.22) HSE use the term "tolerable" with a precise meaning "*In this context, 'tolerable' does not mean 'acceptable'. It refers instead to a willingness by society as a whole to live with a risk so as to secure certain benefits in the confidence that the risk is one that is worth taking and that it is being properly controlled. However, it does not imply that the risk will be acceptable to everyone, ie that everyone would agree without reservation to take the risk or have it imposed on them*"[21].

[16] Forerunner of the ONR
[17] Highton and Senior (NuSAC(2008)P12) page 8 (CD 16.21)
[18] Paragraph 131 on page 33
[19] Paragraph 130 on page 45
[20] Paragraph 136 on page 32
[21] Paragraph 12 on page 8

50. **Person AW's statement that AWE(B)'s risks are shown to be tolerable and ALARP (and agreed to be such by the ONR) should be sufficient to allay the fears expressed by the local authority (CD 11.1) in their AWE main issue that public safety is at risk if this proposal goes ahead**.

## 3.8. Reference to earlier reports

51. In sections 9.1 – 9.3 Person AW tries to undermine my arguments by cautioning against using superseded documentation while agreeing that the 2018 ONR report was describing the same "*detonation leading to release of radiological material resulting in an inhalation dose to members of the public*" (From paragraph 9.1).

52. They return to this theme in 10.3.2 which reports that "*Dr Pearce has assumed that the initiating event for the 2019 HECA is the same as for 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***".

53. But in reaching this "assumption" I was influenced by the statements:

- "*It should be noted that for both sites there has been no change in activity, safety or risk, but a change in criteria required to evaluate the risks against*" in the local authority DEPZ discussion paper, (CD 5.51)[22] and
- "*The increase in the extent of detailed emergency planning at AWE Burghfield is driven by REPPIR 2019 requirements and the need to base the assessment on a less likely weather category that could result in different dispersal characteristics. It is important to note that the increase is not indicative of any change in processing, safety standards, or process risk in respect of our operations or facilities*". On the AWE website (Appendix 2).
- "*AWE have stated that the expansion of the DEPZ is mainly due to the use of Category F weather conditions in the plume dispersion analysis where previously Cat D conditions were used*" quoted as being said by the ONR in the Crest Nicholson judgement (CD 8.4 paragraph 46).

54. The assertion that ***there is no basis for assuming that the initiating event is the same*** is unsupportable.

[22] Paragraph 5.3.2

55. Person AW, while casting doubt on my use of historic records and my modelling of the change of dose with location, fails to point out any errors (as opposed to recognised uncertainties applicable to all such modelling) or faulty conclusions that might have occurred as a result of this exercise.

## 3.9. On the significance of dose

56. In paragraph 10.10 of their PoE Person AW takes me to task for showing that the REPPIR framework describes the impact of doses in the range 1 – 10 mSv as "minor" and 10 -100 mSv as "moderate" and quoting REPPIR's outline of the potential radiological consequences of these dose bands. Person AW suggests that I should have instead quoted ONR's Safety Assessment Principles which, he says, label doses above 0.01 mSv as "significant".

57. The Safety Assessment Principles (SAPs) document (Appendix 3) is important in the safety case world. It identifies thresholds of dose that require a potential fault to be investigated (to have their likelihood and consequences estimated and for efforts to be made to reduce these by better design and/or operation).

58. In the SAPs faults resulting in doses below 0.01 mSv to the public and 0.1 to a worker are considered to the part of normal operation and are excluded from fault analysis. Above these levels further work is required.

59. In the SAPs document the term "significant" can be taken to mean "*extensive or important enough to merit attention*"[23]. Unlike the terms I used from REPPIR this is not a reflection of the radiological implications of the dose. The criticism by Person AW is unjust and should be withdrawn.

## 3.10. Defence in Depth

60. In Sections 10.5 and 10.6 Person AW cites the concept of Defence in Depth based on INSAG 10 (CD 13.40F) concluding that "*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*".

[23] Significant is defined in my Concise Oxford English Dictionary as (1) having an unstated meaning indicative of something (2) **extensive or important enough to merit attention** (3) *statistics* relating to or having significance.

61. The document in question refers to ICRP and IAEA papers[24] which discuss the protective actions of control of access, shelter, evacuation, administration of stable iodine, injury management, interventions in food chain, relocation and decontamination but makes no mention of restricting population density near to the site.

[24] Paragraph 89 on page 21

# 4. Proof of evidence – ONR, Emergency Preparedness and Response

Grant Ingham (CD 12.24).

## 4.1. Level of protection

62. Paragraph 9 requires that "*future residents must be afforded the same level of protection as the existing population*". This should be taken to mean that they should receive the prior information leaflet once every three years and a telephone warning call, advising them to shelter, in the unlikely event of a radiation emergency. Those are duties that fall on the local authority and are not too onerous.

## 4.2. Breaking shelter

63. In paragraph 20 the author states that suggesting that people can break shelter and return to normal life within a few hours of an event has not happened within their experience of exercises or case studies, not that it could not happen.

64. My suggestion that people can, based on the relevant science, be allowed to break shelter quite quickly is based on my understanding of a prompt (explosive) release of an alpha-emitting dust and the rapid reduction in avertable dose rate unusually soon after the initiation. It would not happen for a reactor accident that involved damaged fuel which helps explain why it is not often exercised[25]. I have commented further on this aspect above.

## 4.3. Evacuation for post-accident monitoring

65. I agree that "*the species of radioactive material which would be involved is particularly challenging to monitor*" (paragraph 21 of PoE). However, as Dr Thorne explains in his rebuttal PoE, there are ways in which it can be done / prepared for against a reasonable timeline. Based on the public's reported behaviour in real past emergencies (and taking into account predicted dose levels in the outer parts of the DEPZ) it is not obvious that there would be "*initial, widespread confusion and panic*" as the author fears.

66. In view of the low residual doses expected after the initial plume has passed by (CD10.1)[26], I do not agree that "*It is reasonable for the OSEP to consider the need to relocate residents*

[25] I have significant experience with the decision-making process within nuclear emergency response having been a CESC Health Physicist, responsible for formulating Company HP advice for injection into the SCC, and a CESC Emergency Controller, leading the Company's response to an emergency. The Company in question operated 10 Magnox reactor sites.
[26] Paragraph 171 on page 43

*whilst this complex*[27] *work is undertaken*" if it is implied that this relates to the proposed development site (as opposed to the 150m and 600m zones referenced in the OSEP). There is nothing in the OSEP contemplating evacuation of sites as far from AWE(B) as the appeal site.

## 4.4. Public response

67. The attempt to control irrational fear and untoward response from the public is part of emergency planning. One way to help this process is not to over-react - do not be too dramatic in the language used to advise shelter, do not be too draconian in enforcement of protective actions, do not apply them over a far wider area than needed, and relax them (with good information) in a timely manner. None of this is easy, but the purpose of advance planning is to make it easier. However, the fear of the public response to an emergency (paragraph 21) is not sufficient reason to prevent a limited number of houses being built in an already developed area.

68. While this discussion highlights how difficult an emergency response and recovery may become in certain respects, it does not show that the proposed development would make a material difference to that level of difficulty.

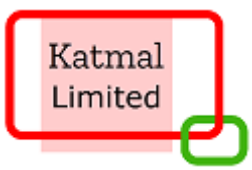
## 4.5. Concerns about the state of the OSEP and reassurance

69. In paragraph 25 the claim is made that strains within the OSEP exist on matters related to national capabilities and other matters related to strategic decisions that are somehow sensitive to demographic changes. I do not see how these "big picture" issues can be affected by a limited number of additional homes in a built-up area.

70. It is reassuring that ONR considers the OSEP to be adequate for the extant DEPZ (paragraph 26) which presumably includes any recent increases in development and population. It is hard to believe that a limited number of homes, as represented by this development, could change this conclusion.

[27] It should also be noted that the complexity of the process takes place in the laboratory. If houses and gardens were to be surveyed it would consist of samples being taken or surfaces wiped and the bagged samples and wipes taken away.

Appendix 1 – PHE review of the Consequences Report



Public Health England

*Protecting and improving the nation's health*

**Emergency Response Group**
Centre for Radiation, Chemicals and Environmental Hazards

Version: 1.0
Date: 10th January 2020
File Ref: ERG/Policy/National/REPPIR19

# PHE CRCE response to West Berkshire Council on the Atomic Weapons Establishment Aldermaston and Burghfield Site Consequence Reports

Regulation 7 of the Radiation (Emergency Preparedness and Public Information Regulation 2019, known as REPPIR2019, requires site operators to provide the Local Authority in which their site is based with a Consequence Report which sets out any minimum geographical extent from the premises that should be covered by the Local Authority's off-site emergency plan for the site.

Local Authorities may request advice from Public Health England, Centre for Radiation, Chemical and Environmental Hazards (PHE CRCE) in support of their interpretation of this Consequence Report as an input into the process of determination of the Detailed Emergency Planning Zone and other arrangements include in the Off-site Emergency Plan.

West Berkshire Council requested that PHE CRCE provide advice on the Consequence Reports for the Atomic Weapons Establishment (AWE) sites Aldermaston and Burghfield as described under the Standard Service in the document 'Guidance for Local Authorities on PHE CRCE Support for REPPIR19 Consequence Reports'.

This document contains PHE CRCE's response to West Berkshire Council.

# PHE comments on AWE's Aldermaston and Burghfield Consequence Reports

On behalf of West Berkshire Council

## Information received

### Consequence Reports (CR):

AWE (November 2019). Atomic Weapons Establishment. AWE Aldermaston. Consequences Report. 01AAIG-69573752-712, Issue 1.

AWE (November 2019). Atomic Weapons Establishment. AWE Burghfield. Consequences Report. 01AAIG-69573752-709, Issue 1.

Response from AWE to supplementary clarification questions posed by PHE CRCE to AWE received by email on 09th January 2020 at 09:59.

## REPPIR 2019 – Schedule 4 Checklist

The following information is required to be included in the consequence report

| | | |
|---|---|---|
| Reg 7, Sch 4, 1 a | The name and address of the operator | ✔ |
| Reg 7, Sch 4, 1 b | The postal address of the premises where the radioactive substance will be processed, manufactured, used or stored, or where the facilities for processing, manufacture, use or storage exist | ✔ |
| Reg 7, Sch 4, 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. | ✔ |
| Reg 7, Sch 4, 2 a | The proposed minimum geographical extent to which urgent protective action may need to be taken | ✔ |
| Reg 7, Sch 4, 2 b | The minimum distances to which urgent protective action may need to be taken, marking against each distance the timescale for implementation of the relevant action. | ✔ |
| Reg 7, Sch 4, 3 a | The recommended urgent protective action to be taken, together with timescales for the implementation of that action | ✔ |
| Reg 7, Sch 4, 3 b | Details of the environmental pathways at risk, to support the determination of food and water restrictions | ✔ |
| Reg 7, Sch 4, 4 | The rationale supporting each recommendation made in the consequences report. | ✔ |
| Reg 7, Sch 4, 5 a | The rationale for the minimum distances for which urgent protective action may need to be taken | ✔ |
| Reg 7, Sch 4, 5 b | The rationale for no off-site planning, if agreed between the operator and local authority | n/a |
| Reg 7, Sch 4, ACOP 670 | The appropriate distance for outline planning | ✔ |

PHE has not obtained details of the dose assessment analysis on which AWE's Consequence Reports are based, and has not undertaken any confirmatory calculations. PHE's comments are based on the contents of the Consequence Reports alone.

## 1. A range of accidents

AWE has analysed the consequences of a range of potential accidents at both sites. For Aldermaston, these include atmospheric releases (some driven by fire) where the dominant materials are plutonium or tritium. For Burghfield the dominant material is plutonium, again by atmospheric release. The analysis of these are used as the basis for protective action recommendations.

REPPIR includes a risk framework of likelihood and impact against which potential accidents can be compared in order to identify those which should be analysed. AWE does not refer to this framework in the consequence reports, and therefore PHE cannot comment on whether a sufficiently large range of potential accidents has been considered.

AWE refers to potential emergencies involving the "emanation of radiation" from the Aldermaston site (e.g. accidental criticality). For this type of emergency AWE has identified no need for local food or water restrictions because no radioactive material would be released, but no information was provided in the Consequence Report on any other consequences of such an emergency, or whether any protective actions might be appropriate. In the supplementary information provided by AWE this has been clarified that a number of locations on the site where this is a potential scenario have been considered and that the location closest to the site boundary is such that the maximum protective action distance for this type of accident is within that for the bounding scenario which drives the overall recommended distance. Furthermore, AWE provides assurance that there is scope for 'swift targeted action' for ensuring that the public affected by such an accident would be protected.

## 2. A range of weather conditions

AWE has analysed the consequences of atmospheric releases of radioactive material for a range of weather conditions. The Consequence Report mentions "Category F weather conditions… (with a) mean wind speed of 2 $ms^{-1}$", "55%Cat D weather conditions", and it is stated that the report's recommendations are based on "a weather category that is less likely", which occurs "around 12% of the time in the local geographical area".

PHE have interpreted "weather category" as referring to the Pasquill Stability Category, which is a parameter used in atmospheric dispersion modelling that describes the stability of the atmosphere. Categories range from A for an unstable atmosphere, through to D for a neutral atmosphere, through to F or G for an unstable atmosphere. In the UK, Category D conditions are common and are typified by a cloudy sky, a gentle breeze, with or without rain. Category F conditions are less common; an example would be a clear, cold night, with just a light breeze.

REPPIR requires "less likely" weather to be considered. PHE interprets this as the weather that gives 95$^{th}$ percentile consequences. Information, supplementary to the Consequence Report, provided by AWE states that Pasquill stability categories A to F where considered and that F was found to be dominant in determining the recommended distance. Category G was omitted on the basis that its probability of occurrence is less than 2% and thus outside of the 95$^{th}$ percentile requirement.

Clarification was sought on whether rain had been considered in the analysis for the Consequence Report. The supplementary information provided by AWE confirms that releases occurring whilst it is raining would decrease the inhaled dose at a given distance when compared to dry conditions and

so the dry, stable conditions for Category F weather dominate the recommended distances for both sites.

## 3. Urgent protective actions

**Aldermaston site**

In the Consequence Report for Aldermaston, AWE recommends: “the minimum distance to which urgent protective actions should be taken corresponds to an area with radial distance of 1540m”. Sheltering is identified as the most urgent protective action in order to prevent the inhalation of plutonium or tritiated water. It is recommended that people should be instructed to shelter as soon as is practical. However, AWE also recommends that the existing DEPZ is retained, which effectively makes the minimum radial distance effectively of 2 km for sheltering. This recommendation appears to take into consideration the potential dose to breast-fed infants which is noted as being a small proportion of the potentially affected community. It is PHE’s recommendation that West Berkshire Council follow the advice to retain the existing DEPZ distance in order to ensure that all exposure groups are adequately considered in the planned protective actions.

In comparison to PHE’s Emergency Reference Levels, evacuation would only be justified in areas where doses in excess of 30 mSv could be averted (i.e. the lower ERL for evacuation). The position of the 7.5 mSv dose contour is given in the Consequence Report, but the position of other dose contours is unknown. In supplementary information provided by AWE it is stated that due to the very short duration for the release AWE considers evacuation close into the site would not be viable in the timeframe of the release and as such would not offer tangible benefit. For the purposes of the Consequence Report and this document this does not affect the recommended minimum distance for the DEPZ and consideration of the need to and effectiveness of evacuation should be considered in the production of the off-site emergency plan with support from AWE and PHE.

The sheltering distance is determined by comparing the doses that could be averted by sheltering with PHE’s lower Emergency Reference Level for sheltering, i.e. 3 mSv. AWE quotes from REPPIR that PHE recommends that sheltering provides a dose saving of 40%. Therefore, to avert 3mSv, one would need to be exposed to 7.5mSv (i.e. 7.5 x 0.4 = 3). The position of the 7.5mSv contour, therefore determines the sheltering distance.

More precisely, the 40% dose saving is only recommended by PHE for the inhalation exposure pathway. From various research, PHE has determined that, on average, someone sheltering inside a solidly-built building would receive 40% less inhalation dose than someone outdoors. However, this does not take into account any dose savings from other pathways. For example, PHE also recommends that sheltering in a brick-built home would provide an 85% dose saving from exposure to radioactive material deposited outdoors on the ground. In the supplementary information, AWE have confirmed that the external dose pathways are insignificant in derivation of the recommended distance

In the rationale for the recommended distance, AWE only appears to consider the release of tritiated water. There is no mention of the plutonium release. It is presumed by PHE that this is because the tritiated water release gives rise to the largest doses, and therefore results in the greatest sheltering distance. Further information about the dose calculation would be required in order for PHE to confirm this.

**Burghfield site**

In the Consequence Report for Burghfield, AWE recommends: "the minimum distance to which urgent protective actions should be taken corresponds to an area with radial distance of 3160m". Sheltering is identified as the most urgent protective action in order to prevent the inhalation of plutonium. It is recommended that people should be instructed to shelter as soon as is practical.

The sheltering distance is determined by comparing the doses that could be averted by sheltering with PHE's lower Emergency Reference Level for sheltering, i.e. 3 mSv. AWE quotes from REPPIR that PHE recommends that sheltering provides a dose saving of 40%. Therefore, to avert 3mSv, one would need to be exposed to 7.5mSv (i.e. 7.5 x 0.4 = 3). The position of the 7.5mSv contour, therefore determines the sheltering distance.

More precisely, the 40% dose saving is only recommended by PHE for the inhalation exposure pathway. From various research, PHE has determined that, on average, someone sheltering inside a solidly-built building would receive 40% less inhalation dose than someone outdoors. However, this does not take into account any dose savings from other pathways. For example, PHE also recommends that sheltering in a brick-built home would provide an 85% dose saving from exposure to radioactive material deposited outdoors on the ground. In the supplementary information, AWE have confirmed that the external dose pathways are insignificant in derivation of the recommended distance

Based on the information provided, PHE supports the recommendation of the minimum distance for sheltering made by AWE.

## 4. Timing of urgent protective actions

For Aldermaston, AWE estimates that with a windspeed of 2 $ms^{-1}$, the leading edge of a plume of radioactive material would reach the 1540m distance in approximately 13 minutes, and it would take a further 15 minutes for AWE to notify the Local Authority of an incident; therefore, there could be no time to inform the public and for them to shelter to obtain any dose saving.

The Consequence Report does not indicate the possible duration of any atmospheric releases, although it does state that sheltering may be necessary for a period of up to two days. With no fore-warning of an incident, those members of the public who are outdoors and in the path of the plume could breathe in radioactive material. However, if they were to shelter, they would still receive the benefit of sheltering for the remaining duration of the release. Therefore, there is still benefit in advising people to shelter even if the release is already underway. Even if the release has already stopped, there would still be some benefit from sheltering, i.e. to avoid a proportion of the dose arising from any material that has been deposited on the ground, and from inhaling any material that might be resuspended back into the air.

Efficient ways in which to inform the public of what action to take would need to be included in the off-site plan, especially those outdoors at the time of the release, and especially those closest to the site.

No information on the duration for the postulated release for the Burghfield site is provided but it is acknowledged that the points made for the Aldermaston site regarding timing are equally applicable to the Burghfield site.

## 5. Outline planning distance

AWE reports an Outline Planning Zone, extending to a radial distance of 15km around the Aldermaston site centre location and 12 km radial distance for the Burghfield site, has been determined by the Secretary of State for Defence. This is in accordance with REPPIR regulation 9(1)c.

## 6. Application of reference levels

A Reference Level (RL) is the level of dose above which it is judged inappropriate to plan to allow exposures to occur. RLs are tools for supporting the practical implementation of the optimisation principle by maintaining doses as low as reasonably practicable and are applicable to all areas/planning zones affected by contamination following the radiation emergency. According to REPPIR regulation 20(1), "*The operator or local authority which has prepared an emergency plan in accordance with regulations 10 or 11, as the case may be, must ensure that the emergency plan prioritises keeping effective doses below a 100mSv reference level*".

AWE is not required to, and has not, considered the 100mSv reference level in the Consequence Report. However, for emergency planning purposes, AWE will need to show that residual doses over the first year do not exceed 100mSv. The residual dose is the dose that remains after the planned protective actions have been implemented, i.e. the dose that is received over the following year, including any dose that sheltering and any other protective actions did not avert.

## 7. Conclusion

Based on the information provided by AWE in the Consequence Reports for the Aldermaston and Burghfield sites and the supplementary information provided by email, PHE believes that West Berkshire Council should consider adopting the recommendations of retaining the existing DEPZ distance for the Aldermaston site and implementing the minimum distance of 3160 metres radially for the Burghfield site with sheltering in both cases being the protective action.

Appendix 2 – AWE website news item

# AWE Burghfield DEPZ extended under new REPPIR 19 legislation

18/03/2020

- The Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR 2019) is new legislation. It was introduced by the Government to further strengthen Great Britain's already robust arrangements for radiological emergencies. These changes aim to deliver a consistent approach to radiation emergency preparedness and response across the radiological defence nuclear and civil nuclear sectors.
- REPPIR 2019 places a duty on nuclear operators and local authorities to plan for and manage the consequences of radiation emergencies. The operator of any premises subject to REPPIR 2019 must undertake a Hazard Evaluation and Consequences Assessment (HECA). Based on the results of these assessments, the operator has a duty to propose the minimum area for any Urgent Protective Actions required in the unlikely event of a radiation emergency. Under the new legislation it is then for the local authority, in this case West Berkshire Council, to determine the Detailed Emergency Planning Zone (DEPZ). This is an area in which suitable and adequate emergency response planning arrangements must be put in place to protect the public
- In compliance with the new REPPIR 2019 legislation and following detailed assessment, AWE's technical experts calculated that the DEPZ for the Aldermaston site would remain unchanged (at 1.5km) and the extent of detailed emergency planning for the AWE Burghfield site changes from 1.5km to 3.16km.
- The increase in the extent of detailed emergency planning at AWE Burghfield is driven by REPPIR 2019 requirements and the need to base the assessment on a less likely weather category that could result in different dispersal characteristics. It is important to note that the increase is **not** indicative of any change in processing, safety standards, or process risk in respect of our operations or facilities.

You can find more information about the changes here

The advice on what to do in the unlikely event of a radiation emergency affecting the public at an AWE site has NOT changed under the REPPIR 19 legislation. You can find the advice here

All households and businesses in the public information areas of the AWE sites will receive an updated booklet from West Berkshire Council with this information shortly.

General

Supporting British Science Week

COVID-19 Update

## FILTERS

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## NEWS AND MEDIA CONTACTS

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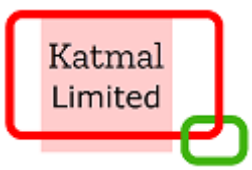
For urgent press enquiries on a non-working Friday or out-of-hours telephone 0118 9825091 and ask for the on-call press officer to be contacted.

(AWE sites work a nine-day fortnight, this means every second Friday sites are closed.)

If you are interested in a press release prior to 2017 please contact us directly to request a copy.

Appendix 3 – Relevant page from the Safety Assessment Principles document



616. Figure 1 (page 210) illustrates the inter-relationship between the three types of fault analysis, DBA, PSA and SAA, and how, in combination, they address the range of potential initiating events with nuclear safety significance off the site.

617. Where the fault analysis is in support of a design under development, the analysis should be against a well-defined reference point in the design process. Where facility-specific or site-specific details have yet to be finalised, all the assumptions made in lieu of these should be stated explicitly and then used to support the later design and construction activities.

| **Fault analysis: general** | Identification of initiating faults | FA.2 |
|---|---|---|
| Fault analysis should identify all initiating faults having the potential to lead to any person receiving a significant dose of radiation, or to a significant quantity of radioactive material escaping from its designated place of residence or confinement. | | |

618. The process for identifying faults should be systematic, auditable and comprehensive, and should include:

(a) significant inventories of radioactive material and also radioactive sources that may be lost or damaged;

(b) planned operating modes and configurations, including shutdown states, decommissioning operations, and any other activities which could present a radiological risk; and

(c) chemical and other internal hazards, man-made and natural external hazards, internal faults from plant failures and human error, and faults resulting from interactions with other activities on the site.

Faults lacking the potential to lead to doses of 0.1 mSv to workers, or 0.01 mSv to a hypothetical person outside the site, are regarded as part of normal operation and may be excluded from the fault analysis. These are the levels above which individual doses should be regarded as significant in Principle FA.2. A significant quantity of radioactive material is one which if released could give rise to a significant dose.

| **Fault analysis: general** | Fault sequences | FA.3 |
|---|---|---|
| Fault sequences should be developed from the initiating faults and their potential consequences analysed. | | |

619. The scope, content, level of detail and rigour of the analysis should be proportionate to the complexity of the facility and the hazard potential.

620. There should be a clear relation between the fault sequences used in the DBA, accident states and scenarios used in the SAA, and the fault sequence development of the PSA.

621. Transient analysis or other analyses should be carried out as appropriate to provide adequate understanding of the behaviour of the facility under fault conditions.

622. For fault sequences that lead to a release of radioactive material or to exposure to direct radiation, radiological consequence analysis should be performed to determine the maximum doses to a worker on the site, to a person outside the site, eg directly