

**HEALTH & SAFETY EXECUTIVE
NUCLEAR DIRECTORATE
ASSESSMENT REPORT**

New Reactor Build

Westinghouse AP 1000 Step 2 ALARP Assessment

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1. Introduction

This report deals with assessment of the ALARP approach detailed in the Submission (Ref 1) provided by Westinghouse Electric Company (WEC) for the AP1000 and concludes that the requirements of GDA Step 2 have been met in this respect.

2. ND Assessment

2.1 Requesting Party's Case

WEC's case is outlined in the UK Compliance Document for the AP1000 Design (Ref 1), to which a major reference is the UK AP1000 Safety, Security and Environmental Report (SSER) (Ref 2). The latter is a UK version of WEC's Design Control Document (DCD) Revision 16, which was compiled to meet US Nuclear Regulatory Commission (NRC) requirements (Ref 3). The SSER contains a large amount of information relevant to the UK, but there is not a one to one correspondence with Nuclear Directorate's (ND) requirements stated in the GDA guidance (Ref 4) and the ND Technical Assessment Guide (TAG) on the purpose, content and scope of nuclear safety cases (Ref 5). Ref 1 is intended the bridge this gap.

WEC addresses ALARP in Section B of Ref 2, describing a process of progressive safety improvement with the evolution of the AP1000 design, claiming significant reduction in risk from previous PWR plants. WEC also deal with both worker and public safety for accidents and normal operation and go on to report cost benefit analyses (CBA) for Severe Accident Mitigation Design Alternatives (SAMDA) which indicates that only trivial amounts would be worth spending given the already low risks for accidents.

The argument is not based solely on low numerical risk estimates, real safety improvements for operational dose – such as materials selection and equipment design to minimise radiation levels – are included. For accident risk, WEC reference its consideration of a large number of SAMDA to reduce the impact of severe accidents and the design includes positive improvements (c.f. existing Westinghouse PWR plants) in this respect (e.g. in-vessel retention).

2.2 Standards and Criteria

The GDA guidance (Ref 3) for Step 2 requires that Requesting Party (RP), in section 2.2, provides "A description of the process being adopted by the applicant to demonstrate compliance with the UK legal duty to reduce risks to workers and the public so far as is reasonably practicable (SFAIRP)". The GDA guide goes on to state that HSE will undertake "an assessment directed at reviewing the design concepts and claims" and specifically in point 2.2 "the approach to ALARP (as low as is reasonably practicable)".

Hence whether or not ALARP (which is equivalent to SFAIRP) has been demonstrated is not being assessed in Step 2 of the GDA process; rather ND is looking at high level claims on how ALARP will be shown to be met by the RP. Based on ND's ALARP guide (Ref 6) the following assessment criteria were identified for Step 2:

1. An awareness of the Health and Safety at Work etc Act 1974 (the HSW Act), particularly sections 2 and 3 and confirmation that the RP recognises the duty to comply with the law.
2. An understanding of the concept of ALARP – i.e. a balance between risk averted and the sacrifice, in terms of money, time, trouble etc, to avert the risk.

3. An understanding that gross disproportion between risk averted and the cost of averting the risk is the test of reasonable practicability.
4. That low numerical risk figures are not the sole support for the risk being claimed ALARP.
5. That options for improvement have been considered. The designs are all evolutionary, so they have clearly built on lessons from the past and from earlier variants. Hence ND would expect to see a rationale for the safety improvements they have adopted and the proposed improvements (i.e. options) that were rejected during the design process. This would include outline information on how the various options were identified, analysed and sentenced. (For Step 2 existence of the approach is sufficient).
6. That there is a claim that the standards used represent Relevant Good Practice (ND will test that justification in Step 3 or 4).
7. That there is a clear conclusion that there are no further “reasonably practicable” improvements that could be implemented – this could use a T/AST/005 (Ref 6) section 6.21 argument (see below).

2.3 ND Assessment

The table below contains a judgement on how well WEC’s Step 2 Submission addresses the demonstration of ALARP against each of the Step 2 criteria listed in the previous section.

Assessment point	Comment
1	Section B.1 of Ref. 1 shows an awareness of the HSW Act and states a duty to meet ALARP. (It does not mention SFAIRP or its equivalence to ALARP).
2	Section B.1 of Ref. 1 shows that WEC understands that there is a balance to be struck between the risk to be averted and the “cost” of doing so.
3	The term “gross disproportion” is used in Section B.1 of Ref. 1, but it is not discussed elsewhere in Ref. 1. ND will need to explore this issue more fully in Step 3 and beyond to ensure that its implicit inclusion in WEC’s design processes is borne out in fact.
4	Numerical PRA results are quoted in support of the argument but WEC does not rely on this alone. The majority of the discussion cites Westinghouse Design Expertise, Utility Operations Feedback, US nuclear industry codes and standards and US NRC regulatory safety requirements and review as major factors in the design and states the major design features and improvements resulting from these. In addition, there is discussion of SAMDA design options considered.

Assessment point	Comment
5	<p>Attachment B.4 of Ref. 1 summarises 14 SAMDA options which were considered. The outcome, in respect of each alternative, is not entirely clear from the attachment. However, reference is made to Ref 2, Appendix 1B, which makes clear that all but one alternative was rejected on the grounds of “not meeting a cost benefit ratio of 1 or greater”. That section also refers to the evaluation of design alternatives “in other SAMDA analyses” which have been incorporated into the design, but these analyses are not referenced, although a non-exhaustive list is presented in Section 1B.1.9 of Ref 2.</p> <p>WEC will need to justify that the methodology used for choosing, or rejecting, specific design alternatives has led to an ALARP design.</p> <p>ND will test the evidence for the extent and appropriateness of the overall optioneering process as part of Step 3 / 4.</p>
6	<p>The standards used are identified in Attachment B.2 of Ref 1, which references the DCD Revision 15 (but not Revision 16). It is assumed this reference was intended to be Ref 2. It is stated that the standards list has been developed as a consensus of reactor vendors, equipment vendors, utilities and the NRC, and therefore represent relevant good practice in the design of nuclear power plants.</p> <p>WEC will need to provide a definitive statement of the standards used and justify the choice of standards applied to the design. This will need to include comparison against current national and international standards.</p> <p>The merits of the justification of standards made by WEC will be the subject of ND’s individual assessment topic reports in Step 3 / 4.</p>
7	<p>WEC state in B.1 of Ref 1 that “Although the AP1000 design process does not formally include the UK ALARP guidance, Westinghouse believes the resulting AP1000 design satisfies the UK ALARP guidance.” This is effectively stating that there are no further reasonably practicable improvements that could be implemented.</p> <p>The validity of this assertion will be the subject of ND’s individual assessment topic reports in Step 3 / 4.</p>

Overall the Submission indicates that WEC has a reasonable grasp of the ALARP concept and has presented sufficient material for a detailed assessment to begin in Step 3.

The points for ND follow up (see table above for detail) identified by the Step 2 assessment are:

- The need for more clarity on gross disproportion and whether it has been implicitly incorporated into the design process.
- The methodology used for choosing or rejecting design alternatives, and whether this is equivalent to the application of ALARP.

- The Justification of codes and standards as “Relevant Good Practice”.
- Whether there is sufficient evidence to support the claim that the design satisfies the UK legal requirement of ALARP.

3. Conclusions

WEC has provided an adequate description of the approach to ALARP for Step 2.

Some detailed points for further consideration have arisen during this high level review and these will be followed up during Step 3 and beyond. Further points are expected to arise as the assessment intensifies in Step 3.

4. Recommendations

HSE should accept that WEC has provided sufficient information on the approach to ALARP for Step 2 of GDA.

5. References

1. UK Compliance Document for AP1000 Design.
Westinghouse Electric Company. UKP-GW-GL-710 Revision 0, 11 May 2007.
2. UK AP1000 Safety, Security and Environmental Report. Westinghouse Electric Company. UKP-GW-GL-700 Revision 1, 1 August 2007.
3. AP1000 Design Control Document. Westinghouse Electric Company. APP-GW-GL-700, Revision 16, May 2007.
4. HSE Nuclear Power Station Generic Design Assessment – Guidance to Requesting Parties Version 2, 16 July 2007.
5. Guidance on the Purpose, Content and Scope of Nuclear safety cases.
ND BMS Document T/AST/051.
http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/index.htm
6. ND Guidance on the Demonstration of ALARP.
ND BMS Document T/AST/005.
http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/index.htm