

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

New Reactor Build

AECL ACR 1000 Step 2 ALARP Assessment

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1. Introduction

This report deals with assessment of the ALARP approach detailed in the Submission (1) provided by AECL for the ACR1000 and concludes that the requirements of GDA Step 2 have been met in this respect.

2. ND Assessment

2.1 Requesting Party's Case

AECL's case is outlined in section 2.2 of their Head Document (Ref 1) and expanded on in a specific ALARP submission (Ref 2).

AECL describe a process of progressive safety improvement with the evolution of the ACR-1000, claiming continuous improvement over a 60 year period of design, construction and operation. The ACR-1000 is said to retain proven strengths of CANDU reactors whilst incorporating improvements in safety.

Section 2 of the ALARP submission is a summary of AECL's interpretation of the ALARP process in the UK. In section 5 of that report, AECL describe a design process that involves the adoption and use of appropriate standards and extensive operational feed back. Section 6 notes that the PSA is not yet complete (though PSA studies have been used in the design assist process) and give a commitment to carry out further ALARP assessment. AECL also claim that the ACR-1000 enhancements are expected to demonstrate improvements over historical CANDU performance for worker dose.

The ALARP submission highlights a number of safety enhancements in sections 7 and 8 such as improved safety margins, additional gravity driven water source for safety systems, and passive coolant injection. AECL conclude in section 9 that they have effectively followed ALARP principles in the design of the ACR-1000.

2.2 Standards and Criteria

In respect of ALARP, Step 2 of the GDA guidance (Ref 3) requires the Requesting Party (RP), in section 2.2, to provide "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 SFAIRP". The GDA guide goes on to say that HSE will undertake "an assessment directed at reviewing the design concepts and claims" and specifically in point 2.2 "the approach to ALARP".

Hence whether or not ALARP has been demonstrated is not being assessed in Step 2; rather we are looking at high level claims on how ALARP will be shown to be met by the RP. Based on ND's ALARP guide (Ref 5) the following assessment points were identified for Step 2:

1. An awareness of the HSW act, particularly sections 2 and 3 and confirmation that the RP recognises the duty to comply with the law.
2. 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. Understanding that gross disproportion between risk averted and the cost of averting the risk is the test of reasonable practicability.
4. Low numerical risk figures are not the sole support for the risk being claimed ALARP.

5. 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 we 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 (we will test that justification in Step 3 or 4).
7. There is a clear conclusion that there are no further “reasonably practicable” improvements that could be implemented – this could use a T/AST/005 section 6.21 argument (Ref 5) (see below).

2.3 ND Assessment

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

Assessment point	Comment
1	Section 2 of the submission explicitly discusses the HSW act, and recognises ALARP as a legal requirement.
2	Section 2 is a reasonable description of the UK process and shows understanding that ALARP requires a comparison of an improvement in safety with costs (time, trouble or money) of implementing that improvement
3	AECL explicitly note that further risk reduction must be shown to be grossly disproportionate to show a dose or risk is ALARP. They go on to quote HSE figures from the Sizewell B public inquiry.
4	Section 6 discusses the role of BSLs and BSOs, noting ALARP between these levels. There is nothing in the report to suggest that AECL believe meeting BSOs is equivalent to ALARP, indeed section 2 of the ALARP submission recognises the main thrust is sound engineering, and the Head Document (Ref 1) lists “sound engineering design and construction, founded on proven technologies and conservative standards” as a major part of the ALARP demonstration.
5	AECL has selected a number of safety improvements over baseline plant and understand the consideration of options during ongoing design (section 2). In Section 6 they give a commitment to carry out a further ALARP assessment to identify opportunities for further risk reduction.
6	Section 5 of the ALARP submission notes the importance of selection and use of appropriate standards. The standards used are identified elsewhere in AECL’s submission (e.g. 2.9, 2.10, 2.13 and 2.14 of the Head Document). The merits of the justification of these standards will be the subject of ND’s individual topic assessment reports
7	In section 9 of the ALARP submission, AECL say that although they have not formally applied the [UK] ALARP process, the design has followed the

	principles of that process. There is also a commitment to revisit the process on completion of ongoing analysis (e.g. the PSA).
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Overall the PSR indicates that AECL has a reasonable grasp of the ALARP concept and has presented sufficient material for a detailed assessment to begin in Step 3, though it's worth noting that some of the analysis is not yet complete and that will require the ALARP considerations to be revisited.

Points for ND to follow up include:

- Justification of codes and standards will be ongoing, led by the individual topic assessors.

3. Conclusions

AECL 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. We do expect further points to arise as the assessment intensifies in Step 3.

4. Recommendations

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

5. References

1. ACR-1000 Submission for Step 2 of UK Generic Design Assessment, Part I - HSE NII Requirements. 10820-ASD-004-H. Rev 0
2. Review of the ACR-1000 Against the UK requirements on ALARP. 10820-01000-ASD-001-H Rev 1.
3. HSE Nuclear Power Station Generic Design Assessment (GDA) – Guidance to Requesting Parties, Version 2, 16 July 2007.
4. T/AST/051 Guidance on the purpose scope and content of Nuclear Safety Cases.
http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/index.htm
5. T/AST/005 Demonstration of ALARP
http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/index.htm