Session Six
ALARP or SFAIRP, or reasonably practicable – what does it mean and how do you meet the requirements?

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Reducing approval times
ALARP: What is ‘reasonably practicable’?

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Requirements for reducing risk

The basic requirement for control measures for MAEs is that they must collectively reduce the risk to the health and safety of people to a level as low as is reasonably practicable (ALARP).

Control Measures (Barriers)

Fault Tree

Event Tree

Figure 1: Bowtie Example

Reduction of risk to ALARP is dependent on identification of hazards having the potential to cause MAEs and proper selection of the necessary control measures for each of them. This has several aspects, all of which will in general apply to each facility.
Risk assessment provides information necessary to test this requirement, and it is this information that must be included in the safety case.

The knock-on effects of hazards must be considered, i.e. any chain of events, causes and contributing factors leading to MAEs.

For any MAE there may be several independent hazards or combinations of hazards, each of which could lead to that event, and several control measures which may be particularly important because they may impact on one or more of those hazards. Piper Alpha is one such event that has been analysed thoroughly. [1]

Figure 2: Risk Heat Chart example

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Figure 3: Piper Alpha Disaster Root Cause

The potential for escalation of major accident events needs to be considered, i.e. the cumulative consequences of apparently separate events that may be triggered by each other.
In cases where a large number of different hazards and potential incidents exist, the cumulative risk may be significant even if the risk arising from each is low. For example, the cumulative effects of many sources of risk in an offshore accommodation area may identify an unacceptable risk even if each source is low risk.

Consequently the demonstration that risks from MAEs are eliminated or reduced to ALARP may need to be made for hazards individually, in groups, and as a whole.

How to demonstrate ALARP
There is no single correct way to “demonstrate” ALARP. However, it is expected that for each MAE identified for the facility, the demonstration would contain elements of the following process:

- Identification and consideration of a range of potential measures for risk reduction (both those adopted and those rejected);
- Systematic analysis of each of the identified measures and a view formed on the safety benefit associated with each of them;
- Evaluation of the reasonable practicability of the identified measures and the adoption or rejection of each; and
- Recording of the process and results, to be summarised in the safety case.

Demonstrate that all practicable risk reduction measures have been implemented

Justifying what HASN’T been implemented is as important

Balance
The balance between benefits in terms of reduced risk and the costs of control measures will play a part in achieving and justifying ALARP.

Figure 4: Get the balance right
If a control measure has a benefit that greatly outweighs the cost, this control measure would almost always have to be implemented, or very good reasons provided for not doing so.
If the cost greatly outweighs the benefit, demonstrating that the control measure is not appropriate is straightforward, as other options will almost certainly exist that are able to achieve a similar level of risk reduction at lower cost.

If benefits and costs are both high, or are both low, more careful consideration may be required before selecting or rejecting control measures.

The operator may be able to rank available control measure options according to their benefits and costs in qualitative or quantitative terms. This will enable the operator to show that the appropriate balance has been achieved, where further steps to reduce risk would incur unreasonably high cost with little gain.

For existing facilities, in undertaking risk assessment and providing justification, operators should also consider if newly adopted control measures could pose additional hazards or contribute to incident scenarios, e.g. during installation or commissioning of new control equipment, or arising from ‘spurious’ operation of control measures.
**Analysing and Quantifying the Cost**


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**ICAF (Implied Cost of Averting a Fatality)**

\[
\text{ICAF} = \frac{\text{Cost of Safety Improvement}}{\text{Reduction in PLL over the Facilities Life}}
\]

<table>
<thead>
<tr>
<th>Cost To Avert One Fatality (AUD)</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10,000</td>
<td>Highly effective; always implement</td>
</tr>
<tr>
<td>10,000 – 100,000</td>
<td>Effective; always implement</td>
</tr>
<tr>
<td>100,000 – 1,000,000</td>
<td>Effective; implement unless risk is negligible</td>
</tr>
<tr>
<td>1,000,000 – 10,000,000</td>
<td>Consider; effective if individual risk levels are high</td>
</tr>
<tr>
<td>10,000,000 – 100,000,000</td>
<td>Consider, at very high risk levels, look also for alternatives</td>
</tr>
<tr>
<td>&gt; 100,000,000</td>
<td>Ineffective</td>
</tr>
</tbody>
</table>

*PLL = Probability of Loss of life

**Implementation**

Implementation arrangements should be included for any risk control measures that are planned but not yet in place, i.e. scheduled implementation. Specific and explicit commitments should be included that demonstrate the operator's intention not to operate their facilities at an increased level of risk, in that activities will not be carried out until such time as the corresponding control measures have been fully implemented.
Figure 5: Have a Plan

Regulatory Requirements
While there is no explicit requirement within the regulations to record in the safety case the full range of control measures that has been considered, the content and level of detail needs to be sufficient to gain an appreciation of the scope and process for undertaking the consideration including sources of data and rationale for excluding or discounting items from consideration. It is difficult to see how an operator could show that risks are as low as reasonably practicable without making reference to other, discarded risk control measures.

Given all of the issues that may need consideration in demonstrating that the necessary control measures have been identified, it is appropriate to develop an approach that is logical, structured and efficient. For example, it would be inefficient to assess the effect of a control measure in detail if it was not practicable from a cost perspective. Equally, if there are control measures that can eliminate hazards, there may be little purpose in devoting significant effort to the assessment of measures for reduction or mitigation of the identified associated MAE.

Performance Standards
Performance standards should be set for MAE control measures, and the safety case will need to include a convincing argument that these standards are appropriate. This is required to provide evidence to enable THE DMP to make a decision on whether the safety case is appropriate to the facility in accordance with the regulations.

Evaluation
For safety case acceptance purposes, THE DMP will evaluate the operator’s approach in terms of its robustness, transparency and appropriateness to the facility. The operator should therefore define the underlying rationale, criteria and decision-making basis for the case.

The description must be convincing; this means that the rationale for deciding the completeness of the hazard identification and the adequacy of the measures employed should be supported and accompanied by all assumptions made and conclusions drawn. Where appropriate, it should present/summarise the results of supporting studies that have been performed.

The description should demonstrate that the process was systematic which means that it followed a fixed and pre-established scope. Finally, the degree of analysis in support of the demonstration should be proportionate to the risk and to the complexity of the facility, hazards and the control measures.
Critical factors for success

DMP expects the operator to address at least the following specific factors in their consideration of ALARP in the safety case submission:

- **Timeliness.** The earlier an operator undertakes an ALARP evaluation, the greater the ability to reduce risks to a level that is ALARP.
- **Safety case content that is consistent with the requirements specified in the regulations;**
- **Involvement of people who know the facility or a very similar operation;**
- **Access to a wide range of reference material such as standards, safety alerts, etc.;**
- **Description with an sufficient level of detail that explains the means by which the operator ensures suitability of the design, construction, installation, operation, maintenance or modification that is appropriate to the facility;**
- **A transparent and robust presentation of evidence showing that the adopted control measures reduce risk to ALARP; and**
- **A transparent and robust presentation of evidence that the SMS provides for and will continue to provide for reduction of risk to ALARP, and that the SMS is comprehensive and integrated.**
References


[3] NOPSEMA, N-04300-GN0166, ALARP