INTEGRATION OF ALARP INTO PROJECT MANAGEMENT PROCESSES – HOW LOW IS LOW ENOUGH?

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The principle of reducing risk to as low as '*reasonably practicable*' (ALARP) is at the heart of UK Health and Safety legislation.

The idea of reducing risk is not hard to grasp. However, the concept of 'reasonably practicable' and its demonstration are not so clearly understood or applied.

The application of the ALARP principle is simple enough. It involves:

- The application of good practice – as a minimum;
- The assessment of risk;
- The explicit consideration of other options or measures to reduce risk;
- The consideration of the cost and benefits (not just monetary) of the options;
- The implementation of options where the benefits outweigh the costs.

This paper is intended to provide a reflection of our experience of this topic, acting as a risk management consultancy for clients on a variety of projects, and a range of timescales and value. The focus of this paper is primarily new projects where, in our experience, there is a clear need for an explicit structure and systematic ALARP process to be part of project management processes from the outset.

THE ISSUES

Within projects, establishing the level of risk for the chosen design is easy enough and methodologies for quantifying risk are abundant. Demonstrating that the selected design has the lowest practicable risk is much harder to achieve. This is a key regulatory requirement. It is not enough to justify the chosen design, a demonstration that other options were considered and the reasons why they were dismissed all help to build the case.

In our experience, as a leading risk management consultancy working with numerous COMAH sites as well as on a number of large industrial developments across the country, we have found that the consideration of ALARP in the design stages is often not carried out appropriately and, if it is undertaken at all, a systematic process is not followed and is rarely documented.

Failing to apply a systematic process for ALARP demonstration, and a strict timescale for implementing the process and for making these type of considerations, can mean they take place too late in the project schedule to have any positive impact. What is considered reasonably practicable while the plant design exists only on paper can be vastly different from what can be justified once it is built. Even within the design stages of the project, the cost of modifications increases as the schedule advances. Projects seem to be allowed to progress to a point where good risk reduction considerations are ignored because it's 'too late', either because any redesign will cost too much, or because there isn't time to go back and do it justice.

Our view is that often the concept of ALARP is missing at the very early design stage and so justification of the design is engineered retrospectively. So rather than consider different design options and identify the one that is lowest risk, the company finds itself stuck with a design presented by the design consultancy. Innovative solutions to risk problems seem generally not to be encouraged, usually because project design teams are under enormous budget and time pressures, and either whether or not the design is ALARP is just not considered or it is thought that spending too much time going through a rigorous process, at a very early stage in the project, would be an unnecessary waste of resources. All too often we find we are being asked to help justify a design decision which wasn't given enough thought, and may in fact, not be truly ALARP. But the cost of going back and redesigning wouldn't be justified.

In summary; the fundamental issues are:

1. A failure to apply a systematic process at the outset;
2. Considerations of ALARP are often too late;
3. Focus on costs, including those associated with redesign, without proper review of benefits;
4. A lack of support for innovation, and;
5. An absence of documented evidence.

THE SOLUTION

A STRUCTURED PROCESS

The sound application of the ALARP principle requires a formal and structured process of review which is revisited regularly by the engineering design team during the different project design stages. The process required involves a continuous and systematic practice of questioning and justifying options. This is by no means a new idea. Trevor Kletz has long argued this view in papers dating back several decades. He talks about the early process as a 'HAZOP of the flow sheet', or a 'front-end HAZOP'.

The application of the ALARP principle should take the form of regular design review meetings, where the team criticises and questions every design choice, asking 'could we do this in a safer way?'.

All choices need to be questioned. Including for example:

- Location;
- Layout;
- Process (mechanism, conditions, materials);
- Plant (materials, equipment, components), and;
- People, e.g. reliance on intervention.

Each and every element of the design should be scrutinised for opportunities to make systems and plant safer, with implications for safety to people and the environment at the forefront. Such risk-based decisions can only be properly taken if the risk has been appropriately assessed and understood at the right time during the project design process.

This methodical approach to applying the principles of ALARP should not be seen as a burden which will delay a design team who are often under pressure to complete their tasks quickly. It does not require long or complicated risk assessments which would involve large additional cost to the project. Much of the consideration of alternative options, which are then either selected or rejected, can be done sensibly by the design team by integrating the ALARP review process into the normal design team meetings. The design team will be able to make judgements based on their expertise, through discussions which are structured by the use of a proforma. A proforma which sets out a robust, and systematic framework for ALARP considerations. This design team discussion should then be captured within the proforma template. This works in a similar way to the systematic guidewords used for hazard reviews such as HAZOP, which encourage a consistent approach to the discussion and ensure the right questions are asked in a structured way. It is essential that these are documented and kept as part of the audit trail for future reference if ever required. So the rejected choices as well as those that go ahead can be traced back to the original design discussions.

Without a structured process, it is impossible to demonstrate that the proper considerations have been made, and that the design is truly ALARP.

INTEGRATION INTO PROJECT MANAGEMENT PROCESSES

Design teams are generally very good at addressing the need for hazard identification. HAZOPs are carried out routinely and they form part of a list of items that project management processes require to be ticked off before the transition between detailed design and construction stages. What is required for implementing a systematic ALARP review process is different. It can and should be done at a much earlier stage in the design process than HAZOPs would normally be undertaken. In the same way as a HAZOP is seen as a critical process in the project timeline, so ALARP reviews should be too.

The HAZOP asks '***what could go wrong?***' and helps reassure the project team it is doing everything it needs to be doing to control the risk. The HAZOP does *not* ask '***could we have used a different process where that hazard wouldn't have existed at all****?*'. This is an important question that needs to be posed. It is the fundamental reason for an 'ALARP review process' – supported by high level risk assessments early on in the design, and repeated regularly in design review meetings. An 'ALARP review process' should be built systematically into companies' project management procedures as part of the appraisal of the project and would sit well within these project initiating processes.

The effective application of the ALARP principle should form a central part of any project and the responsibility lies within the project management.

TIMING

The risks of not applying a systematic ALARP review process early in the design could mean costly late modifications. Late modifications in turn add further costs as project time lines are affected. This can easily be avoided if addressed in the early design stages. Spending a little extra time to implement a systematic ALARP process at the very beginning of the project will be beneficial to managing the overall project budget and timescale more effectively.

To have the greatest impact it is important that these discussions are had early on in the design and continue throughout the lifecycle of the plant design, construction, commissioning and operation. Key project milestones, where this ALARP discussion is vital, should be identified and the project should not be allowed to progress without this vital step having been carried out. This ALARP mindset needs to be integrated into the everyday project management processes.

CONTINUOUS RISK REDUCTION, AND THE CONCEPT OF COST

As previously discussed, the concept of ALARP has been around for some time. The tolerability criteria which determine the 'Tolerable if ALARP' region have not reduced significantly as technology has advanced. In this twenty-first century we should be ever striving towards further risk reduction. The 'tolerable if ALARP' region has become a target. Once we understand that the risk is 'in the yellow' we seem to stop worrying rather than aiming to drive risk down even further through what, in reality, is a risk spectrum rather than discrete risk bands.

The consequence of putting too much emphasis on costs could mean that an alternative option, which has a lower associated risk, would not be followed once a project has progressed to a point where expenditure was greater than the risk reduction achieved by the new design. Re-design should not be considered as a real cost

to weigh against risk benefit. Often, if ideas are incorporated into the design early enough, the cost versus the value of preventing harm will not be significant.

INNOVATION

Successful risk reduction requires a different mind-set and an organisational culture where individuals are free to question and challenge designs. Innovative designers are those who are willing to consider alternatives and not just dust off an 'off-the-shelf' concept designed previously. Having the positive attitude in response to the question '*Why do you do it this way?*'. '*Because we always do it this way*' is not justification enough to avoid putting in place an affective ALARP review process.

Implementing effective ALARP reviews requires a culture where innovation is encouraged and supported. A culture of cost cutting is not conducive to an innovative approach which is the key to driving down risk and saving money in the long run.

DOCUMENTING ALARP

If indeed an ALARP review is undertaken, it is vital that the process be documented thereby providing an excellent audit trail for future reference should this ever be required. The demonstration of ALARP is often requested by the regulator, and so documenting the process will become an invaluable tool. Our experience is that they want to see why design options were 'rejected' just as much as they want to understand why design options were 'selected'. The former possibly is of even more interest to them as it enables the regulatory specialists to check that the design team has really understood the concept of designing out risk, and shows that the appropriate considerations have not been overlooked.

The justification for the design often becomes lost in the detail, especially where there are large teams working on a project. The outcomes of the design review meetings and the justification for selected options needs to be communicated to the whole team and it should never become a 'tick-box' exercise. Those involved in the development of new projects should know that it is important that all design and construction options considered must be documented. This helps to justify the selected option as well as ensure the purpose is not lost.

SOME CASE STUDIES

The following case studies are just a few recent examples relevant to this topic. One of the case studies shows what can go wrong if systematic ALARP procedures aren't applied, the other shows how it can work well. The companies and project names and details have been changed to preserve anonymity.

EXAMPLE OF FAILURE

This project involved the installation of a new process on an existing chemical plant.

The company has good project management procedures which include the requirement for hazard reviews to be carried out at set points within the project timeline.

What went wrong

- The initial design was rushed due to pressures to get an outline design out to tender;
- The project management was largely outsourced, so the company procedures were not strictly applied;
- As the company's project management control processes were not followed, different elements of the design were allowed to progress at different rates;
- Significant design changes were undertaken and not reassessed until the detailed design had progressed significantly, in the hope of avoiding assessing things twice;
- It was unclear who had responsibility to ensure hazard reviews were carried out;
- The project management company were not experienced in process safety and were unfamiliar with the concept of demonstrating risks were ALARP.

Turning the corner

As part of the work we were doing with the site, from a COMAH point of view, we held sessions with the engineers to gather information to build our demonstration of ALARP for the project. We quickly realised they had not properly considered the various vessel basis of safety options available to them. Something that would have undoubtedly been picked up, had the project management processes been followed. We urgently held a session to do this. The result was identification of a significantly lower risk design basis for the vessels involved in the process. However this came at a stage where equipment specifications had already been drawn-up. Major redesign work had to be undertaken at significant cost to the company.

The result

The end result was a safer design, one which was favoured by engineers with significant experience of similar processes on other sites. Unfortunately, the re-design entailed significant costs. This highlights the need to ensure that high level assessments of risk and consideration of alternative options take place at the right stage in the project timeline – i.e. right at the outset. Going forward the company will be making more effort to ensure their project management processes are followed by all involved. One improvement will be the involvement of management team members who are removed from the project so as to act as independent reviewers and approvers at key stages in the project timeline. They will have authority to prevent progression if they are not satisfied that the correct reviews have taken place.

EXAMPLE OF SUCCESS

This project involved the development of a fuel storage depot on a brownfield site. This is an example of successful implementation of an ALARP review process.

What went well
The company employed a large project management and design team. We were involved in this team from the early stages. The project strategy included regular iterative risk assessments and consideration of alternative options, with a plan to provide staged informal submissions of the pre-construction COMAH safety report to the competent authority. This strategy ensured that the design team were always thinking about what information was needed to make the demonstration of ALARP. It became the mind-set from very early in the project. Discussions were documented and became an important part of the safety report.

The result
Preliminary risk assessments were made on the outline designs, highlighting areas of concern and prompting the discussion of alternatives to reduce the risk. The preliminary assessments found issues with the plans for tertiary containment. Alternative options were considered and taken forward to the next phase of design with little effort. The cost of implementation of the new design was insignificant.

This is a clear example a structured processes of risk assessment and ALARP demonstration being successfully incorporated into project management processes at the right time.

CONCLUSION

We advise all of our clients to apply a structured process for assessment of risk and demonstration of ALARP. For new projects we urge them to ensure this is encapsulated into their project management processes, to drive it forward with the right people, right processes and at the right time. We have developed a series of 'proformas' with our clients, to be used to structure discussions and capture the essential information; these have been successfully built into our clients normal hazard review processes.

Often we are able to use the structure provided by the COMAH regulations which we believe to be a very good framework for risk management and the demonstration of ALARP. We advise iterative informal submissions of pre-construction safety reports, as this helps to ensure the right conversations are had at the right time and the risk reduction discussions are captured within the demonstration made in the safety report. This technique has been successfully adopted by a large number of our clients, helping their projects run more smoothly where questions of risk control are concerned. In some cases it has even clearly allowed them to save time and money.

Can anyone involved in major design of plant really afford to ignore the proper and systematic application of ALARP?

To summarise, these are the six key items we believe are vital if you are to ensure risk is reduced to ALARP in a way that can be demonstrated; without entailing excessive project costs:

- Apply a structured process for achieving and demonstrating risks are ALARP;
- Integrate ALARP discussions into your project management processes;
- Ensure ALARP is considered early in the design, and continued throughout the project lifecycle;
- Strive for lower risk; don't just settle for yellow;
- Encourage innovative ideas for risk reduction;
- Document the decisions to reject or select.

So how low is low enough? - As low as is reasonably practicable... But we can only be confident and satisfied that we have achieved ALARP if a systematic and structured process has been followed. Such a process should be embraced by the industry, and become standard project management practice.

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