Communicating on risk and safety in terms of awareness

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Abstract

“Safety awareness” is proposed as a possibly constructive concept for the purpose of promoting initiatives in nuclear safety work and gaining improved understanding when communicating on nuclear safety. Safety is thus conceived as resulting essentially from and actually constituting awareness of critical factors in regard of safety. The concept aims specifically at promoting the view of “safety” as “awareness of required conditions for being in control of risk”. It aims as well at making clearer sense in calling for constant improvement of safety, according to practice in a safety culture.

This proposed view would be expected to lead to applying the usual types of safety criteria but offers the merit of attracting due attention to “awareness goals” in process oriented safety management which are fundamental to maintaining and improving safety.

Applications are discussed in regard of communicating on nuclear safety between decision-makers and the general public, developing and maintaining safety culture, integrating specialist expert contributions in over-all safety assessment, setting safety goals and using safety indicators.

1. Introduction

In our paper we discuss a way of viewing “safety”, particularly nuclear safety, that could prove useful in communicating on the matter between experts, political decision makers, media and the public. The subject is relevant in regard of “values in decisions on risk”, the key issue of this Symposium, as safety is typically subject to improvement, and safety management is thus indeed concerned with (residual) risks and making decisions on them.
Communicating on nuclear safety is part of the research agenda of the Nordic Nuclear Safety Programme (NK.S) for the four-year period 1998-2000 [1, 2]. The considerations presented below reflect an approach taken in the project.

2. Safety comprehended in terms of awareness

The meaning of the word “safety”, particularly in the context of nuclear safety, is neither precise nor self-evident. This makes it rather difficult to communicate successfully on the matter, thinking for instance of conveying an understandable view of the safety of a nuclear power plant as typically highly safe while potentially highly dangerous. The ambiguity of the safety concept is reflected, among other things, in the existing variety of “safety goals” (zero accidents, minimum of incidents, probabilistic goals etc.).

We have been considering the possibility of infusing a sense in the word “safety” that would help to avoid regarding safety as something already established that can be relied on (a view contrary to safety culture), and promote instead a perception of “safety” as “awareness of required conditions for being in control of risk”.

There are two types of awareness required in regard of safety:

1. **Awareness of the risks and what is required to ensure safety (functional assurance);**

2. **Awareness of what is required to assure that the imposed safety requirements will be permanently met in actual practice (quality assurance).**

The two types of awareness called for may be considered *prime safety objectives* and have certainly anyway governed the development of safety thus far. They represent a *view*, however, that is important to emphasise in promoting initiatives in the safety work and efficiency in communicating on the safety matters.

3. Communicating on safety in terms of awareness

While transparency of the safety case is vital to communicating on it in a meaningful way, nuclear safety matters are often anyway complex and cannot be easily communicated in technical terms to, e.g., political decision-makers and the public. It is in fact unlikely that sufficient *technical understanding* can ever be conveyed to enable even an informed layman to judge for himself on nuclear safety to appreciable extent.

Communicating with political decision-makers and the public should therefore probably aim at conveying in the first place *principal ideas and ways of thinking* to ensure safety. Technical safety features of particular interest should be highlighted but with the purpose in mind of illustrating the ideas and the thinking rather than bringing forward specific safety arguments. The concerned layman, desirous of knowing if he can trust the experts, is indeed more likely to ask questions like “is there enough dedication and awareness of the risks and the safety matters among
those who are responsible for the safety?" than to enquire on specific technical approaches.

We thus believe that taking the proposed approach could improve on the trust achieved in communicating on safety matters. As an example, in explaining the advances in nuclear safety, considerable emphasis used to be placed on the containment venting filters in the systems for mitigation of severe reactor accident that were provided in, among others, the Swedish reactors after the accident in Harrisburg in 1979. Although the filters serve an important safety purpose, the particular emphasis given to them in explaining about nuclear reactor safety may well convey a false view of relying unduly on the outmost line of defence in the "safety defence-in-depth system". The safety concept should accordingly be depicted more in line with the safety defence-in-depth principle and emphasising the innermost lines of defence, notably the quality system to avert possible disturbances and the safety systems to prevent anyway occurring disturbances to lead to accidents.

In order to put the layman in a best possible position to form his own judgement on the safety matters, he should thus be communicated for main part in general terms of safety awareness requirements, in the sense just described, being observed in the industry and on part of the safety authorities. The requirements will of course have to be expressed in appropriately commonplace terms but would still enable structured discussion on the safety matters between the experts and the laymen.

4. Awareness and Safety Culture

Understanding safety in terms of awareness of what safety actually requires is clearly in line with the concept of safety culture. Striving for safety awareness, by reviewing from time to time the safety concept in regard of its designed features as well as of the working practices in operation, surveillance and maintenance, is thus typical of safety culture. Lacking safety awareness as a result of limiting the safety concerns to, e.g., complying with established safety requirements signifies, on the other hand, a degraded safety culture.

Safety culture is thus distinguished by fostering constant commitment to safety improvement. However, striving all the time for improving safety of a nuclear plant may not make clear sense viewing merely numbers or technical capabilities of safety features that are currently available. Viewing instead safety to be a question of awareness – thorough understanding of what safety requires and assurance that all conditions for the safety that have been established are indeed under control – makes clearer sense as safety awareness can obviously always be improved.

It should be realised that the currently prevailing safety concept and practices may for great part reflect awareness that was gained in the past but is now forgotten, e.g. due to the turnover of operating staff over the years.

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1 Communication channels that allow the layman to evaluate the authenticity of experts is one of the essential elements of transparency, see below.
5. Awareness Criteria and Safety assessment

For overall safety assessment of a nuclear power plant, as made by the utilities and independently by the safety authority, it must be ensured that the highly specialised experts contribute their expertise on well-understood premises in regard of aspects of the safety case of which they are less familiar. All involved experts need therefore communicate among themselves at an appropriate, general level in order to establish requirements for the necessary awareness of the prerequisites for meeting the ultimate, detailed safety requirements. Such awareness is typically concerned with, e.g., risk types or particular safety objectives to be accounted for, needs of specific competence, procedures, quality assurance etc.

The required general safety awareness on part of the experts can be ensured by identifying awareness criteria, which have to be met through the working processes in the organisation.

The approach taken in the recent years by, e.g., the Swedish nuclear safety authority in its inspection activities is thus increasingly concerned with assessing the working processes at the plants in regard of their suitability for ensuring that ultimate safety requirements at the detailed levels will be met. The attention is accordingly shifting from, e.g., verifying compliance with detailed regulations and operational performance criteria to observing the working processes at the nuclear plants in regard of their suitability and adequacy for ensuring safety.

Transparency of the safety case is obviously still an important factor in ensuring necessary awareness.

6. Awareness criteria and Safety Goals

As explained above, the two main types of awareness called for – in regard of functional and quality assurance – may well be considered prime safety objectives. They may be defined at any hierarchical level but would be particularly useful when defined at a general level. The awareness at general level would mainly concern prerequisites (e.g. types of competence required) for meeting the ultimate requirements at detailed level (e.g. required capacity of a particular safety system or type of structural material required for corrosion resistance).

Traditional safety goals may be assessed in regard of how well they represent needs for gaining, in combination, required safety awareness. The goal to “completely avoid” severe accidents which is sometimes used may be taken as an example of goals providing little guidance and little opportunity to learn from experience in regard of the outcome. While this type of goal in fact requires, for being practical, that some statistically significant accident rate can be observed, severe reactor accidents are literally intolerable.

Another operating goal, set, e.g., by the Swedish nuclear safety authority, is that there should be “no incidents revealing severe shortcomings in regard of the safety defence-in-depth system”. This goal is useful as it attracts attention to an important aspect of the feedback of operating experience. The probabilistic safety targets serve a similar but largely extended purpose, as the feedback of operating experi-
ence can then also be used for validation of the probabilistic modelling of the plant, thus allowing deeper understanding of what is required for safety.

7. Awareness criteria and Safety indicators

On perceiving “safety” as awareness of required conditions for being in control of risk, safety indicators should reflect the extent of such control, or the lack of control (uncertainty). In the following, the term “indicator” is used to designate any type of observation that may be made on a regular basis and can be assumed to have a bearing on performance in general (performance indicators) or specifically in regard of safety (safety indicators).

Like in the case of safety goals, safety indicators are useful to the extent the use and follow-up of them contribute to the awareness of important factors and conditions pertaining to safety.

Performance indicators, commonly employed in monitoring operation of nuclear reactors (as the WANO indicators [3] and various utility specific indicators), are typically indicators of general quality assurance and offer important insight in this respect. Examples include energy availability, occurrence of repeated errors, occurrence of human errors, promptness in acting on remarks made in quality audits etc. This type of indicators obviously lacks specific safety significance.

Other indicators, like containment tightness measures and normal radioactive releases, occupational radiation dose and industrial safety accident rate, reflect quality assurance together with certain aspects of operational safety while lacking specific safety significance in regard of potential reactor accidents.

Observed rates of initiating events, constituting potential challenges to safety, together with measures of the reliability of the safety systems and their components obtained through feedback of operating experience, constitute sets of specific safety indicators in regard of potential reactor accidents. By using probabilistic modelling of the plant systems these indicators can be combined into probabilistic risk measures, like core damage frequencies and corresponding frequencies of major radioactive releases, allowing a comprehensive basis of safety awareness to be established.

There are certain types of events and circumstances to be observed as constituting important safety indicators in regard of the functional part of the safety awareness:

- *discoveries* of deficiencies affecting the safety otherwise than in regular inspection and surveillance
- *discoveries* of shortcomings in the safety defence-in-depth system
- *discoveries* of phenomena unaccounted for in the safety concept. The attention paid to safety significant matters in current research and development

This type of observations should thus cause the awareness in regard of the safety matters to be generally questioned and efforts to be made to extend and verify the knowledge bases.
8. Awareness criteria and transparency

The RISCOM pilot study [4] states that transparency rests on three cornerstones: facts, values and authenticity. It should be possible for the decision-makers and the public to evaluate the factual basis, the value basis as well as the authenticity of experts and stakeholders. The report recognises that laymen will never be able to evaluate all the technical aspects of a safety case, and concludes that this must be compensated for with procedures that allow the evaluation of expert’s authenticity – a requirement for trust.

The use of awareness criteria instead of technical requirements facilitates transparency. The factual part of what needs to be evaluated is awareness rather than technical criteria – which facilitates the necessary communication. First, the awareness criteria are more easily understood than technical criteria, secondly the evaluation of experts authenticity also becomes easier communicating in these terms.

9. The NKS/SOS-1 project

The aim of the NKS/SOS-1 project [1,2] is to enhance the understanding about requirements for nuclear safety by increased transparency and better risk communication. The target group is broad and includes decision-makers, experts, media and the general public. The project covers three main areas:

1. Risk assessment
2. Safety assessment – safety analysis
3. Strategies for safety assessment

The concept of awareness criteria is clearly a key component for consideration in all the three areas of the project.

The project started late in 1998 and will continue until the year 2001.

10. Conclusions

We conclude that the approach taken to communicating on safety among experts and between experts and the society in terms of “safety awareness criteria” may prove useful for achieving purposes like better understanding of nuclear safety matters among the public and maintaining a high safety culture in the industry. The related aspects will accordingly continue to be explored in the current Nordic Nuclear Safety Research Project NKS/SOS-1 during 1998-2001.

References


3. WANO Performance Indicator Programme, Implementing Guideline - IG 19.1, Revision 4