



Photo: Leif Johnny Olestad

Comparing Risk Criteria in Safety-Critical Industries

As part of a Nordic project dealing with the use of probabilistic safety criteria for nuclear power plants, a comparison was made with risk criteria used in the European railway industry and the offshore oil and gas industry. Carried out by Relcon Scandpower and VTT Technical Research Centre of Finland, the project was initiated by NKS (Nordic Nuclear Safety Research) and the Nordic PSA Group NPSAG. It also shares links to the OECD Nuclear Energy Agency's (NEA) work involving probabilistic safety criteria in the NEA member countries.

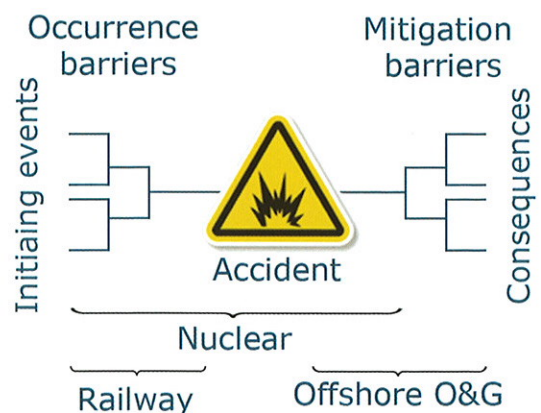
Safety goals for nuclear power plants are defined in different ways in different countries and implemented in different manners. Many countries are currently developing safety goals in connection with the transition to risk-informed regulation of nuclear power plants already in operation and new designs. Risk criteria are defined at various levels, from societal and individual risk to off-site radioactive release, reactor core damage and lower-level system reliability. Subsidiary criteria, on the other hand, are primarily defined at the level of core damage and large radioactive release frequency. Risk criteria have a different status in different countries. Several countries operate with strict regulatory limits, while most countries use indicative target values. The status of existing plants and new plants may also vary. A number of countries apply the ALARP principle, which involves risk criteria with associated limits and objectives.

The survey of risk acceptance criteria in the offshore oil and gas industry focused on Norwegian and UK requirements. In this industry both qualitative and quantitative risk acceptance criteria are used to express a risk level with respect to a defined period of time or phase of activity. Both the number of precursor events requiring handling and the number of accidents requiring mitigation are high compared to the nuclear industry. Accordingly, the criteria have a relatively strong focus on consequence mitigation. The criteria also have a broad scope, covering a range of accident events and safety functions. There is also greater focus on the various operating phases (design, construction, operation, maintenance and decommissioning) than in the nuclear industry. With regard to defense in depth, the criteria stipulate requirements for various safety functions. As in the nuclear industry, the ALARP principle is often applied.

For railway systems, the survey focused on risk criteria defined for the European Train Control System (ETCS). There is a high degree of standardization in the railway industry to enable trains and personnel to cross national borders. Harmonization has been achieved by letting an industry working group propose risk criteria that are subsequently approved by the authorities. The proposed criteria comprise consensus requirements based on an amalgamation of national practices, mainly from Germany and France, with basic principles relating to general health risk (the MEM principle) and continuous safety improvement (the GAMAB principle). Systematic procedures are in place for creating subsidiary goals by defining a tolerable hazard rate (THR) for the individual subsystems. A framework for cross-acceptance is being developed at the European level – the Common Safety Method (CSM) – to demonstrate the safety levels of the railway system. (See the related article on page 9.)

The full report (NKS-172) is available at www.nks.org/en/publications/.

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Scope (simplified) of risk criteria in the three industries.