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INTERNATIONALE
LÄNDERKOMMISSION
KERNTECHNIK

Baden-Württemberg · Bayern




ILK Statement:

Safety Management in Nuclear Power Plants – Status and necessary Requirements for Development

Für deutsche Fassung bitte umdrehen!

April 2009
No.: ILK-32

Foreword

The International Committee on Nuclear Technology (Internationale Länderkommission Kerntechnik, ILK) was established in October 1999 and since 2009 it is carried by the German states of Baden-Württemberg and Bavaria. It currently consists of 9 scientists and experts from Finland, France, Germany, Switzerland and USA. The ILK acts as an independent and objective advisory body to the two German states on issues related to the safety of nuclear facilities, radioactive waste management and the risk assessment of the use of nuclear power. In this capacity, the Committee's main goal is to contribute to the maintenance and further development of the high, internationally recognised level of safety of nuclear power plants in the southern part of Germany.

ILK has repeatedly addressed the topic of safety management for ensuring proper safety culture in nuclear power plants. ILK statements giving special consideration to this point are, in particular, Maintaining Competence of Staff (ILK-17), Regulator's Management of Licensee Self-Assessments of Safety Culture (ILK-19) or Further Developments of Periodic Safety Reviews (ILK-27). Following the 51st ILK meeting the ILK adopted the current publication in April 2009. This publication provides advice on potential improvements of the licensee safety management by using early indicators and ILK demands a systematic observance of international research. The statements focus on aspects of the MTO (Human-Technology-Organisation) concept or socio-technical concept.

The chairman

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1 Outline and Scope of Deliberation

International experience shows, that

> "Operators and regulators are not always effective in identifying and proactively responding to early symptoms of emerging problems." (IAEA Safety Review 2007)

To avoid any decline in safety performance of nuclear power plants, IAEA requires that licensees remain vigilant and objectively self-critical. As a key to this, a proactive approach to the management of safety and safety culture should be established so that problems are detected and solved at an early stage. In order to do this, the management system should use early warning signs that are known to precede organizational failures. The regulatory authorities should monitor that the licensees are using these warning signs. Attributes of a strong safety culture are listed in IAEA Safety Standard GS-G-3.1, while IAEA Draft Safety Guide DS 349 provides typical symptoms of a decreasing safety culture.

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The interpretation of the safety culture concept by ILK is following INSAG statements (INSAG 4, 13, 15) whereby the action related attitude and the existing abilities at the regulatory level, the company level, the management level and the level of the individual staff effect the priority of nuclear safety. Safety culture is considered an element of a comprehensive company culture and a dependent component of it.

Since a deliberation of safety culture aspects that are related to organization and staff is comparatively rare, the following statements will focus on these aspects of the MTO (Human-Technology-Organization) concept or socio-technical concept. IAEA Safety Standard GS-R-3 provides additional general requirements on safety management.

Statement

The IAEA Draft Safety Guide DS 349 describes the interaction of humans, technology and organization within safety management. Concerning leadership it is stressed:

> "Leaders should create cultures by their actions (and inactions) and by the values and assumptions they communicate. A leader is someone who has an influence on the thoughts, attitudes and behaviour of others. Leaders cannot completely control the safety culture, but they influence it. Leaders throughout the organization should set an example for safety, for example through their direct involvement in training and field oversight of important activities. Individuals in the organization generally deliver the levels of performance that leaders personally demonstrate. …Visible and active support, strong leadership and the commitment of senior management are fundamental to the success of the management system."

It has to be pointed out that safety culture does not present a fixed state especially regarding organization and staff, but instead it represents a process. Findings from plants in Germany and worldwide document that the work on safety culture via safety management has to be continuously updated, strengthened and enhanced.

Resources which can be used are foremost related to the identification and use of "early warning signs" (early indicators) of the need to improve safety management (in other areas the term primary prevention is applied sometimes). Early warning signs already facilitate the prevention of the development of deficits in safety management, rather than dealing with deficits only after incidents have taken place. A vital problem is that early warning signs for a safety management which is in need of improvement are based on assumptions since the incident has not taken place yet and even will not take place in case of preventive intervention. Thereby it is generally unsettled whether the incident did not happen due to the preventive measures or whether it would not have happened without them since the assumed early indicator in reality is not such an indicator. Therefore, the early indicators that are discussed later on are plausible and correspond with practical experience, however, in a strict sense they are not scientifically validated.

2 Advice on Potential Improvements of the Licensee Safety Management

Early indicators for resources within safety management are related to the following issues:

1. Meeting, respectively neglecting, the role model function of all management levels in terms of IAEA DS 349 provides especially meaningful indications on potential improvements of safety management. This concerns both management by design of work conditions and staff qualifications and personal management activities.

2. Continuous analysis of national and international peer reviews regarding the adoption of recommendations, the analysis involving all direct and indirect stakeholders including company management, the deduction and systematic application of suitable measures as well as receiving evaluations of the taken measures.

3. The step-by-step deduction of safety relevant targets for work organization including shift staffing according to best-practice or benchmarking principles in cooperation of the licensee's management as the basis of their self-assessments as well as external assessments.

   Self-assessment by management should serve to identify, correct and prevent management problems that hinder the achievement of the organization's objectives. At all levels in the organization individuals and management should periodically check present performance with regard to management expectations, worldwide solutions of excellence and regulatory requirements to identify areas needing improvement. Self-assessment targets of a good operational management should also be negotiated across companies and should come with the anticipation that all partners will fulfill them. The authorities should check whether the licensee performs the self-assessment of safety culture as recommended in ILK statement ILK-19 in an appropriate manner.

4. The use of proven principles of participative organization and work design for safety management, in particular regarding agreements on objectives on safety relevant issues, the suggestion system in terms of a continuous improvement process on safety relevant suggestions taking into account selected procedures of knowledge management to identify, report and maintain safety relevant knowledge. The IAEA Safety Standard GS-G-3.1 stresses:

   "Tried and trusted principles of participatory organization and work design for safety management, in particular concerning target agreements on safety-related professional behavior as well as the use of a suggestion scheme for safety improvements all contribute to continuous improvement processes. Criticism of new approaches should be encouraged and be communicated in a systematic way."

5. The assessment of training *content* of the whole staff, i.e. including management, as a potential early indicator for potential improvements of the safety management. Safety related resources within the area of training include (Dieckmann et al., 2000; Kluge et al., 2008; Badke-Schaub et al., 2008 as well as IAEA 1996, 2004) a systematic assessment of training needs taking into account the different staff groups including company management; establishing justified guidelines for the systematic selection and systematic design of the trained scenarios; a systematic integration of the so-called non-technical skills, i.e. systematic collection of information, deriving of appropriate conclusions, decisions as well as team work for problem solving for high-reliability organizations into the training for technical abilities for staff and management; the causal explanation of safety relevant events and issues, or even non-safety relevant ones in particular cases, which are inconsistent with standards as a contribution to safety culture since this approach can train an analytic questioning attitude and provide a strengthening of the critical attitude towards the organization of the working processes as a whole and one's own actions.

6. The analysis of training *methodology* can provide clues to potential improvements of the safety management since available knowledge alone does demonstrably not guarantee appropriate performance of actions in operational practice. In order to achieve this, robust connections have to be established between knowledge and action. Distinct training methods for the different fundamentals of safe behavior, i.e. for skills, knowledge and strategies are therefore necessary as well as justified assessment rules of the actually achieved learning progress taking into account the aspects of stability (reliability), validity for potential events and transfer robustness from the simulator into working practice.

7. Human mental capacity is limited. Therefore, systematic requirement analyses are needed. Shift supervisors in particular can be overburdened in certain situations through multiple requirements. Multitasking and indication of staff overload are potential early indicators of decreasing safety. In this respect the work design according to relevant international standards (e.g. DIN EN ISO 6385 and related standards on task design, DIN EN ISO 10075/1-3 on mental workload (stress) and demand) can provide a contribution to safety management.

8. Finally, the design of operating manuals can contain clues for potential improvements of the safety management. The mandatory use of operating manuals in certain situations should be supported by a systematic user-friendly design of the operating manual in analogy to user-friendly software-design (ISO 9241). The tendency to ignore the supporting tools and the danger of an erroneous use corresponds to an increased complication in the use of these tools. Therefore, the design of the operating and emergency manuals should be optimized according to criteria of cognitive ergonomics and tested at the simulator.

3 Systematic Observance of International Research on Safety Management

If a national research program on safety management for nuclear power plants in Germany is relinquished the import of insights should be systematically ensured by the regulatory bodies and the licensees. Regulatory requirements are no replacement for self-defined targets as they do not cover all issues, represent minimum requirements and are partly too general.

On the one hand, this regards the verification of the potential for transfers of relevant procedures from other risk technologies (e.g. incorporating safety management aspects into the suggestion system, working with agreements on objectives, using principles of the so-called error culture).

In addition, it regards the necessary transfer of the results of international research on safety management in nuclear power plants (e.g. within EU: the cognitive ergonomic design of control areas for the transfer from analog to digital control room instrumentation (activity-driven design of collaborative digital tools) by the Finnish National Research Program for Nuclear Safety).

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(Members are listed in alphabetical order)

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ILK-13 ILK Statement on the Proposals for EU Council Directives on Nuclear Safety and on Radioactive Waste Management (May 2003)

ILK-14 ILK Statement on the Recommendations of the Committee on a Selection Procedure for Repository Sites (AkEnd) (September 2003)

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- Proceedings of presentations held at the 2nd ILK Symposium "Harmonisation of Nuclear Safety Approaches – A Chance for Achieving more Transparency and Effectiveness?" in October 2003

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