

Co-Chair Conclusions for Parallel Technical Session IV-A

Human and Organizational Factors in Nuclear Safety

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Throughout the session dedicated to *Human and Organizational Factors (HOF) in Nuclear Safety*, a number of key issues were addressed by the panellists and discussed with the experts. These key issues identified the approaches and concrete tools to help strengthen human and organizational factors as a key component of nuclear safety and how they could be better integrated from the design stage through decommissioning of nuclear facilities. These issues were presented from various perspectives, including regulatory bodies, operators, technical support organizations, research and design organizations, education institutions and individual experts in the field.

The presentations and subsequent discussions highlighted that many Member States have taken numerous actions in the area of HOF in response to the Fukushima accident. These actions include changes in legislation regarding the functions and independence of the regulatory body, development of additional HOF regulatory requirements, expectations and guidance, development of prioritization of decisions and to support decisions in severe accident management situations. Other activities include the HOF considerations emergencies such as the planning and conduct of emergency drills and exercises, the creation of regional response centres, organizational changes, identification of specific training (including resilience training) for operating personnel, communications arrangements, and emergency/ security interface. However, these considerations of HOF have primarily been developed to support technical solutions and a significant question raised by the experts was whether HOF have been comprehensively addressed.

Parallel Session IV A considered four main issues.

1) Leadership Aspects

- The experts considered that the understanding of, and commitment to, the importance of HOF aspects by leaders is critical to successful integration of HOF into a nuclear power programme.
- Decisions taken at a high(leadership) level can have an important influence on applying an appropriate response to accidents.

2) Enhancing Competencies and Learning Mechanisms

a. Training

- The experts considered that technical staff and managers in relevant organizations such as operators, regulatory bodies and vendors should be trained in the principles of HOF to progressively embed consideration of HOF into their routine activities.
- Training on HOF and safety culture may include: e-learning tools, tests, workshop and knowledge sharing mechanisms, simulators and simulation developed with automation specialists. Training methods may need to be adapted to the national culture whilst retaining the focus on nuclear safety culture. In some Member States, traditional images or icons are used in posters to facilitate rapid understanding and memorization of the key messages.
- Training and information on HOF should also be targeted at each functional team within an organization. For example, for managers who should ensure the deployment of the HOF strategy

and attribute the means for its implementation; process specialists who can integrate the HOF approach into organizations processes; and trainers and operational experience specialists.

- Contractors and sub-contractors' employees should be able to benefit from safety culture/ HOF training that is harmonized with the training provided to the employees of the operator particularly in changing working environments such as during the construction and decommissioning of nuclear facilities.
- Drills and exercises are an essential mechanism to train staff to deal with emergency situations. They should cover beyond basis events and include all responsible parties/ organizations/ governmental agencies and may also involve other countries. Drills should be regular, real-time, worst case scenarios (including those most demanding in terms of human resources), with minimum complement of the station only, un-announced, but keeping in mind appropriate focus on operation (balance on resources, operating needs and routine training). 'Think out of the box' exercises in training programme can help raise awareness on safety culture issues and address them.

b. Competence

- The competence in HOF of regulatory bodies and operating organizations varies largely and some organizations do not have sufficient competence in this area.
- HOF experts may have various backgrounds and specialities. Specialists working on HOF comprise behavioural scientists, psychologists, sociologists as well as engineers and previous managers, who have been educated in HOF area. This issue raised numerous questions and comments from the experts regarding the appropriate composition of HOF expertise.
- The development of dedicated educational programmes should be encouraged. In some Member States a specific post graduate programme has been developed in HOF in liaison with the nuclear industry.
- Some Member States have one HOF specialist in each of their NPPs and a large team of specialists in its corporate organization and its research and development centre.

c. Organisational learning and knowledge sharing

- The experts emphasized the need for a strong oversight capability of HOF for the life-time of an NPP from initial design to completion of decommissioning. The experts recommended that IAEA should develop guidance for regulatory oversight of human factors programmes.
- The experts commented on the tendency of the nuclear industry to focus only from learning from failures. It was strongly recommended that the focus should be broadened to also facilitate learning from successes. For example, when analysing "near miss" events, the success factors for why the near-miss did not escalate should be examined as well as the root causes of the event. It was suggested that IAEA should promote and encourage this approach.
- Some experts stated that more attention should be given to ensure that effective feedback on event reporting is provided. This will influence and improve the event reporting culture. The experience with the analysis of events from other industries should be used such as aviation.

3) Evaluation of Human and Organizational Performance

a. Evaluation tools

- The experts considered that the use of structured tools to assess and enhance human and organizational performance should be promoted. There is a need to elaborate guidelines for developing self-assessment of human performance using a matrix approach and involving HOF specialists. Employees should be encouraged to take part in self-assessment exercises.
- Drills and exercises can help to identify valuable lessons for human and organizational performance including identifying training needs and equipment issues.
- Methods of analysis of human and organizational performance should include post-accident analysis, pre-accident risk assessment and the use of 'event trees'.

b. Use of Operating Experience

- Experts at the IEM discussed the difficulties in undertaking investigations of the HOF root causes of accidents. There was considerable discussion on the approach to gathering reliable information on HOF root causes, particularly as working level HOF errors often have their root cause in decisions made at the leadership level. The need for a systematic analysis of HOF associated with accidents was emphasized, along with the importance of using an appropriate system for coding accidents to facilitate their analyses and to extract data and general trends. It was considered that nuclear event investigations are often not sufficiently focused on identifying the latent root causes related to HOF and leadership. As a result, it is important that human performance engineering or HOF specialists should be included in the event investigation teams.
- Existing initiatives include the IAEA International Reporting System for Operating Experience (IRS) database on organizational causal factors and the European Commission Human Factor Analysis and Classification System.

4) **Establishing a HOF Strategy**

a. General

- A national approach in responding to lessons learned from Fukushima accident should be promoted as a good practice. For example, this include legal agreement support interventions for the "incident" site for long-term response.
- The experts emphasized the importance of the embarking countries taking into account HOF aspects from a very early stage. They recognized the importance of the support provided by the IAEA for this purpose. The experts considered that the vendor-countries also have a very important role in supporting the embarking countries.
- Utilization of the results from relevant research should be used when developing HOF strategies and implementation of technical and organizational improvements.

b. Integration of HOF in the Design Process

- The experts discussed the importance of integrating HOF into the design process. The man-machine interaction and anticipation of the future work situations should be prepared by the designer in cooperation with the operators taking full account of HOF aspects.
- Analysis of the potential HOF influence on specific design aspects and of the level of risk involved must be carried out in advance and should allow to implement a graded approach.
- To better convey information, the preparation of simple instructions (less time consuming) for consideration of HF in design should be promoted.
- Early engagement and communication between regulators and licence applicants during the new build phase, particularly for HOF requirements is very important.

c. Promotion of Adaptive Behaviour in case of Emergency

- During the discussions on HOF issues associated with emergencies, some Member States reported on a move from rule based procedures to knowledge based guides to better manage severe accident. These were considered to allow for a higher degree of flexibility and efficiency.
- Staff support in the case of an accident should include: prioritization matrix (if shortage of staff), training flexibility and emotional support.
- Some experts highlighted the need for the deployment of support equipment in case of emergency to be made as simple as possible to avoid relying on highly specialised staff and rather being able to employ immediately available human resource. In addition easily comprehensible guidance on the prioritization of decisions, with appropriate authority, to support decisions in SAM situations should be developed

Topics for Further Investigation

- IAEA should develop guidance for the regulatory oversight of licensees' human factors programme.

- IAEA should review the current guidance on HOF aspects in IAEA safety standards in light of the Fukushima accident.
- IAEA should review and update guidance on management of organizational changes, including emergency organizations in light of the Fukushima accident.
- IAEA should provide training and support to regulatory bodies for conducting self-assessment and for the regulatory oversight of licensees' safety culture.
- IAEA should promote and encourage the analysis of the successful handling of near misses and events.
- In the case of events, HOF specialists should be integrated into multi-disciplinary teams from the initial phase of analysis
- Both regulatory bodies and operating organizations should have sufficient competence in HOF area.
- Experience from other high-risk industries such as aviation and chemical should be utilized.