



The role of HOF in Unexpected and Extreme Situations: Contribution of the CSNI Working Group on Human & Organisational Factors (WGHOF)

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Content

- Ø The Working Group on Human and Organisational Factors in the NEA/CSNI
- Ø New task Action post-Fukushima
- Ø Conclusion



NEA structure



Steering Committee for Nuclear Energy

Committee on the Safety of Nuclear Installations

CSNI

CSNI Programme Review Group (CSNI PRG)

> Working Group on Risk Assessment (WGRISK)

Working Group on Analysis and Management of Accidents (WGAMA)

Working Group on Integrity of Components and Structures (IAGE)

- Subgroup on the Integrity of Metal Components and Structures
- Subgroup on the Ageing of Concrete Structures
- Subgroup on the Seismic Behaviour of Components and Structures

Working Group on Human and Organisational Factors (WGHOF)

Working Group on Fuel Safety (WGFS)

Working Group on Fuel Cycle Safety (WGFCS)

Task Group on Defence in Depth of Electrical Systems and Grid Interactions Follow-up (DIDELSYS-2)

Task Group on Sump Clogging (SC)

Committee on Nuclear **Regulatory Activities CNRA**

Senior-level Task Group on Impacts of the Fukushima Accident

Working Group on Inspection Practices (WGIP)

Working Group on Public Communication of Nuclear Regulatory Organisations (WGPC)

Working Group on Operating Experience (WGOE)

Working Group on the Regulation of New Reactors (WGRNR)

> Working Party on Decommissioning and

- Decommissioning Cost
- Task Group on Radiological Characterisation and Decommissioning (TG-RCD)

Radioactive Waste Management Committee **RWMC**

RWMC Regulators' Forum (RWMC-RF)

Integration Group for the Safety Case (IGSC)

Working Group on the Characterisation, the Understanding and the Performance of Argillaceous Rocks as Repository Host Formations (CLAY CLUB)

Expert Group on Preservation of Records, Knowledge and Memory across Generations (RK&M)

> Forum on Stakeholder Confidence (FSC)

Dismantling (WPDD)

Estimation Group (DCEG)

Committee on Radiation rotection and Public Health

Expert Group on Radiological Protection Aspects of the Fukushima Accident (EGRPF)

Expert Group on the Implications of ICRP Recommendations (EGIR)

Expert Group on Occupational Exposure (EGOE) Expert Group on Best Available Techniques (EGBAT)

> Working Party on Nuclear **Emergency Matters** (WPNEM)

Expert Group on the Implementation of International Recommendations for Emergency Situations (EGIRES)

Nuclear Science Committee

NSC

Expert Group on Integral Experiments for Minor Actinide Management

Working Party on International Nuclear Data Evaluation Co-operation (WPEC)

- High Priority Request List for Nuclear Data
- Meeting Nuclear Data Needs for Advanced Reactor
- Methods and Issues for the Combined Use of Integral **Experiments and Covariance Data**
- Co-ordinated Evaluation of 239Pu in the Resonance Region
- Scattering Angular Distribution in the Fast Energy Range
- Evaluation of Experimental Data in the Resolved
- Resonance Region

Working Party on Scientific Issues of the Fuel Cycle (WPFC)

- Heavy Liquid Metal Technologies
- Chemical Partitioning
- Advanced Fuel Cycle Scenarios
- Innovative Structural Materials
- Innovative Fuels
- Benchmarking of Thermal-hydraulic Loop Models for Lead-alloy-cooled Advanced Nuclear Energy Systems

Working Party on Multi-scale Modelling of Fuels and Structural Materials for Nuclear Systems (WPMM)

- Validation and Benchmarks of Methods
- Multi-scale Modelling Methods
- Structural Materials Modelling
- Multi-scale Modelling of Fuels
- Primary Radiation Damage

Working Party on Nuclear Criticality Safety (WPNCS)

- Advanced Monte Carlo Techniques
- Criticality Safety Benchmarks
- Burn-up Credit
- Criticality Excursions
- Assay Data of Spent Nuclear Fuel
- Uncertainty Analyses for Criticality Safety Assessment

Working Party on Scientific Issues of Reactor Systems (WPRS)

- Reactor Physics and Advanced Nuclear Systems
- Uncertainty Analysis in Modelling
- Reactor Fuel Performance
- Radiation Transport and Shielding

Executive Group of the NSC

> (Data Bank Management Committee)

The Scientific

Co-ordination

Group of the Joint

Evaluated Fission

and Fusion (JEFF)

Data Project

Fuel Cycle NDC

Committee for Technical

and Economic Studies

on Nuclear Energy

Development and the

High-level Group on the Security of Supply of Medical Radioisotopes

Joint NEA/IAEA Group on Uranium (UG)

Working Party on Nuclear Energy Economics (WPNE)

Ad hoc Expert Group on the Economics of the Back End of the Nuclear Fuel Cycle

Ad hoc Expert Group on the Economics of Longterm Operation of Nuclear Power Plants

Ad hoc Expert Group on Managing Environmental and Health Impacts of Uranium Mining

Nuclear Law Committee



WGHOF Mission



Mission of WGHOF

 To improve the understanding and treatment of human and organisational factors within the nuclear industry in order to support the continued safety performance of nuclear installations and improve the effectiveness of regulatory practices in member countries.

Composition of the group

- HOF experts (22 countries represented)
- Regulators, TSO, Researchers, Operators
- Representation of : Halden Project, IAEA, EU
- Meetings: twice a year



WGHOF activities



Scope of WGHOF activities

- Act as a forum for exchange of information and experience
- Identify and prioritise current and emergent HOF issues
- Identify HOF methodologies and practices
- Develop shared understanding and common positions
- Facilitate international convergence on safety HOF issues
- Sponsor specialists meetings, workshops and other means of fostering international collaboration with nuclear and other industries
- advancing the current state of knowledge on HOF related issues important to nuclear safety though studies and technical reviews
- **–** ...



WGHOF tasks and topics



WGHOF tasks

- A program and a task leader (CSNI approval)
- Surveys, workshops, meetings, ...
- Deliverables : task report, booklet (CSNI Topical Opinion paper)

Examples of topics addressed

- HOF in NPP modification
- Safety Management / Safety Culture
- HOF in Plant maintenance
- HOF in Root Cause Analysis of Events
- Research on HOF in new plant technology
- HRA developments and advancements in the field of nuclear risk assessment ...





Content

- Ø The Working Group on Human and Organisational Factors in the NEA/CSNI
- Ø Task on HOF in post-Fukushima
- \bigcirc
- Ø Conclusion



Action post-Fukushima in 2011



First step in 2011

- HOF issues discussed during WGHOF meetings
- Good contribution of all members, in particular Japanese member (JNES)
- Elaboration of a WGHOF "white paper" presented to CSNI in December 2011

A first WGHOF message

- Lessons to be learned in a reactive way on HOF during the accident phase, after the event occurred.
- But there are lessons to learn in a proactive way on decision making in design and modifications for improving plant robustness.



White paper – HOF areas concerned



A revised set of HOF areas has been identified:

- 1. Organisational decisions on design and modification
- 2. Organisational barriers to learn from operating experience
- 3. Emergency Preparedness
- 4. Operating procedures for beyond design bases events (big fires, flooding, earthquakes, etc.).
- 5. Human performance under extreme conditions (catastrophe, radiation, heat, flood, etc.)
- 6. Operators training and exercising for severe accidents situations
- 7. V&V of scenarios and emergency operating procedures for severe accidents
- 8. Availability of contractors for accidents mitigation. Intelligent customer to mitigate the accident
- 9. Emergency organisation. Coordination with offsite support organisations. Competing demands
- 10. HOF issues in clean-up, decontamination and remediation activities.
- 11. In a more long term perspective, HOF in dismantling of damaged installations

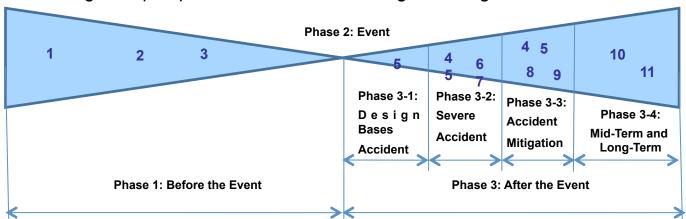


Figure: Bow-tie model



Action post-Fukushima in 2012



Second step in 2012

- HOF issues still discussed during WGHOF meetings
- A project of task (CAPS) elaborated and submitted to CSNI in June for approval

Messages from Fukushima accident

- Accident not triggered by "human error" from operators
- Positive role of the human operator to act even in a most demanding situation to maintain safety
- Need for HOF research and practice to take distance of the prevailing safety approach which takes the human as a risk factor and attempt to eliminate the human from the loop.



Another safety paradigm for HOF



Fukushima accident is an opportunity:

- -To show that HOF is not only dedicated to weaknesses and human errors analysis
- -To present HOF as contributing factors to the robustness of facilities

To formulate HOF issues **in a positive way** with the objective to improve the capability of human to act in a severe and unexpected situation :

- 1)How to support the human operator to respond as appropriately as possible in the on-line situation?
- 2)How to train and design normal work so that the capabilities to act appropriately in any situation, even in one that is unexpected, will develop continuously?
- 3)How to design plants so that the capability of human actions is not automated away?
- 4)What are the characteristics of such safety management and regulatory approaches that support the capabilities of the personnel to develop their capabilities and act in need?



WGHOF task post-Fukushima



WGHOF Task (approved by CSNI in June 2012):

- Ø Human performance under extreme conditions
 - Ø to address issues around decision-making and problem-solving under very demanding conditions
 - Ø drawing in experience and previous studies from other high hazard industries
 - Ø report on human design/engineering principles important to support human intervention and performance under extreme conditions
- Outcome expected to provide basis for improvements and necessary research to account for HOF in design and use of measures for achieving highest level of human and organizational performance under extreme and unexpected conditions



WGHOF task post-Fukushima



- Ø Task Leader : GRS (Germany)
- Ø Contributors : Finland (VTT), USA (NRC), Japan (JNES), France (IRSN), Belgium (BelV), UK (ONR) and OECD/Halden project
- Ø Final report expected by end of 2014
- Ø One or two workshops organized in January and June 2014

Task Group

- Ø First meeting of the task group in February 2013
- Ø Hosted by GRS in Garching (Germany)
- Ø Nine participants from 9 countries



HOF key factors



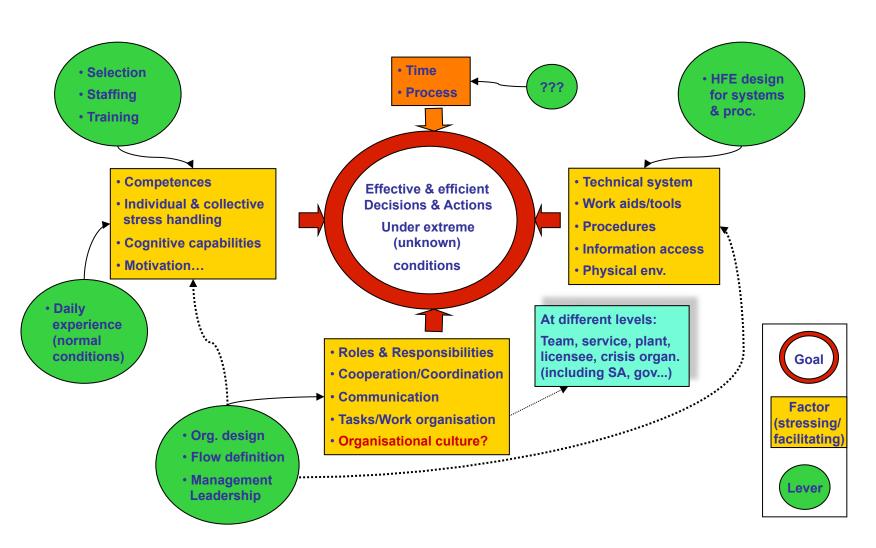
Three HOF areas are contributing to the possibility to prevent or mitigate severe consequences:

- Human capabilities (competencies including safety culture relevant attitudes, individual and collective stress handling).
- Human factors Engineering (HFE) aspects of the technical systems, work aids and tools, procedures, needed information and physical environment.
- Organizational aspects like roles and responsibilities, cooperation and coordination, communication, task and work flow, organizational culture.
 Different organizational levels should be considered.





Task Model: Key factors and relations





Workshop Outline (1)



- Objectives: To expand the amount of available information about key factor areas described by the model and to share information
- Expected participants
 - NEA members (regulator, TSO, research) and IAEA
 - Up to 4 invited key speakers from non-nuclear field
 - Licensees (e. g. EDF/France, ENBW/Germany…)
- First workshop hosted by ENSI/Switzerland (30 40 participants, end of January 2014, duration still to be defined)
- Workshop structure
 - Focus on presentations (invited experts, other participants)
 - Plenary and group discussion (still to be defined)



Workshop Outline (2)



- Expected key speakers
 - from aviation, research, chemical industry and if possible from military
 - NEA and WGHOF members support to fund them
 - provision of a list of potential experts/domains
- Development of a list of licensees to be specifically invited to the workshop (task group activity)
- Potential second workshop in May/June 2014 (depends on WS 1 results, still to be decided)

NEA Nuclear Energy Agency

Conclusion



– TMI :

- to protect from human errors
- HMI, automatisms, training, design, ...
- Tchernobyl :
 - to protect from organization failures
 - Safety culture, safety management, etc.

Fukushima :

- to support, to encourage, to reinforce human action as contributing to the robustness of installation
- Key factors ?? ...
- Still a lot of research and developments to do ...: decision under uncertainty, development of a shared representation of unexpected situation, capacity of innovation (use materials or equipments in a different ways they have been designed for, etc.)



Another possible task



- A question asked by CNRA
- On organisational culture and influences on safety
 - On the basis of the Fukushima accident
 - Cultural aspects in post-event response, but also in consideration of potential events before it happen ...
 - Role of cultural biases, traits, on safety culture at different levels, plant, organisation, country level ...
- A task to determine the state of understanding on cultural biases
- First step: WGHOF members to circulate information available on cultural studies and references, before next meeting





On behalf of WGHOF: Thank you for your attention