Enhancing safety culture in nuclear power plants

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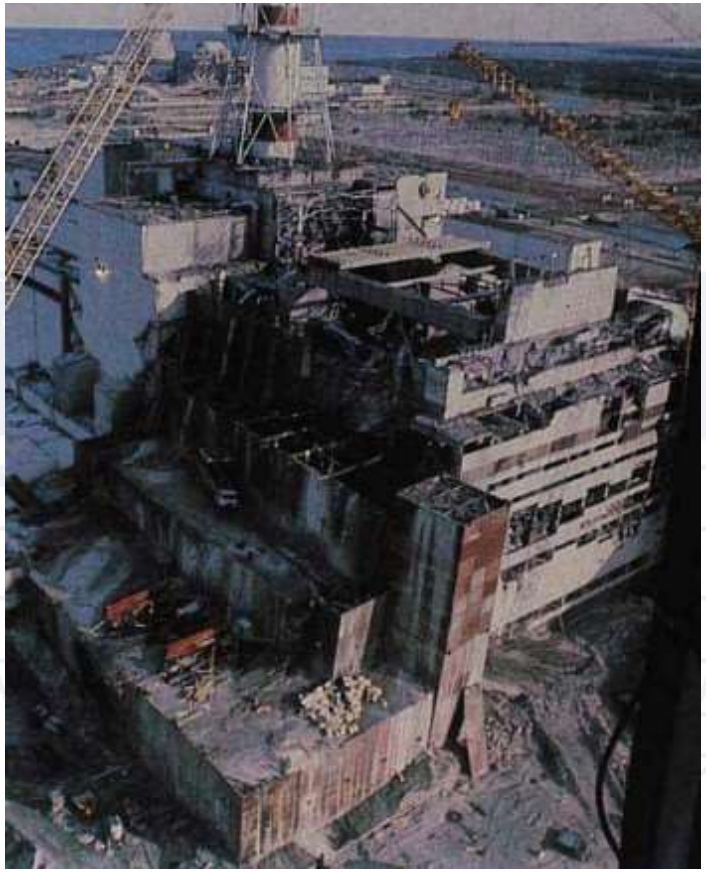
Chernobyl -26 April 1986

This disaster was a result of a test performed with safety features disabled, despite the conservative opinion of experienced operators. The analysis attributed the accident to deficiencies of management, supervision, and **safety culture**.



After the accident, the World Association of Nuclear Operations (WANO) was created to promote international collaboration to prevent a similar accident in the future.

Five years later, in 1991 the IAEA Independent Nuclear Safety Advisory Group published INSAG 4 and the concept of safety culture was defined for the nuclear community because of its relationship to the accident.

Fukushima Daiichi - 11 March 2011

- The possibility of internal and external events with severe consequences was underestimated.
- Lack of recognition of the importance of Emergency Preparedness to cope with extreme conditions.

Safety Culture?

Results of the analysis of the accident:

1. Poor questioning attitude
2. Lack of conservatism in the decisions
3. Lack of learning from experience
4. Isolationism.
5. Lack of Nuclear Oversight
6. Complacency

Safety Culture!

The Davis-Besse Event (2002)

In March 2002 a **degradation** of the material of the **reactor pressure vessel head** was discovered being caused by primary water **stress corrosion cracking** of the control rod drive mechanisms and **boric acid corrosion**.

Ultrasonic tests discovered **cracking** in vessel head penetration nozzles and a **17 cm corrosion hole** in the carbon steel of the **reactor head**. An accident was prevented only due to a **0.5 cm stainless steel** inner liner which had not corroded.

The plant remained shut down for **2 years** after the incident.

The Davis-Besse Event (2002)

Davis-Besse NPP. Photo by US Nuclear Regulatory Commission.

Davis-Besse was one of the best performing plants in the U.S.!

- *"Over time, the plant appeared to become **complacent**. In many areas, a minimum **compliance standard** existed in management and thus throughout the Davis-Besse organisation. The plant did not use **internal and external operating experience** effectively, and in many areas became **isolated** from the industry."*

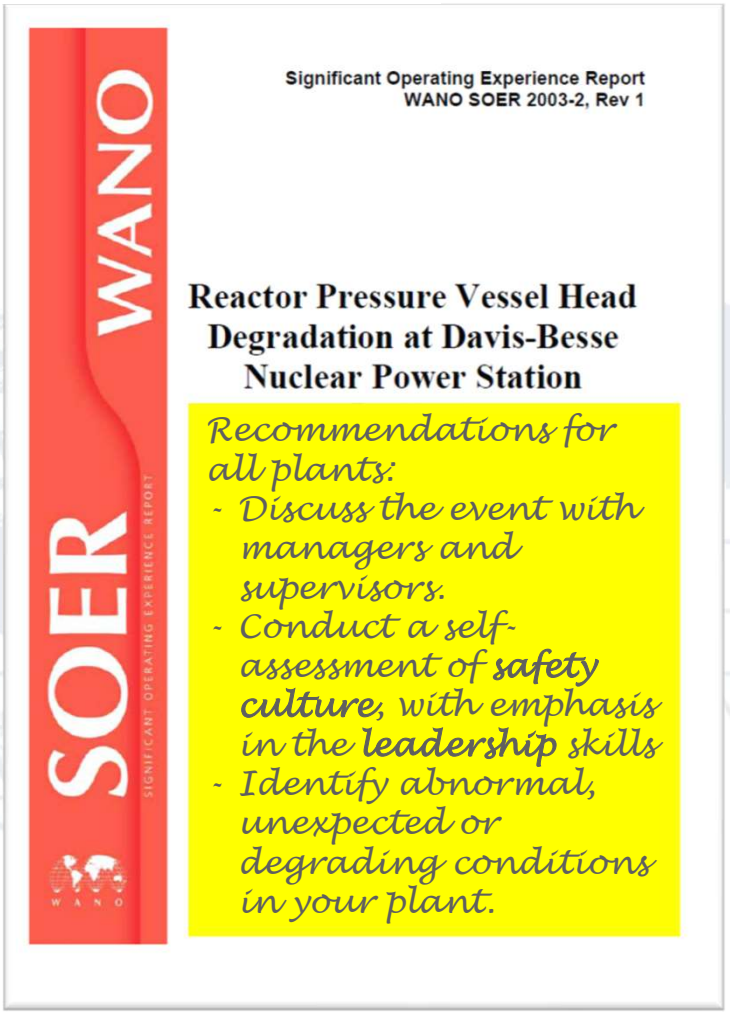
- *"There was a **lack of sensitivity to nuclear safety**, and the focus was to **justify existing conditions**".* The overall conclusion was that *"**Management** ineffectively implemented processes and thus **failed to detect and address plant problems** as opportunities arose".*

The Davis-Besse Event (2002)

Root Causes*:

- Shift in the focus at all levels of the organisation from implementing high standards to justifying minimum standards
- Excessive focus on meeting short-term production goals
- Lack of management oversight
- Symptom-based problem-solving
- Justification of plant problems
- Isolationism
- Ineffective use of operating experience
- Workers not raising questions about abnormal conditions

Safety Culture as the main problem



* Root cause analysis by WANO SOER 2003.2

So, why Safety Culture and not simply Safety Management?

- Because the Culture of the organisation will determine **how** it will **respond** to the **safety challenges**.
- Because Safety Culture weaknesses have been identified as a **main contributor in all major nuclear (and non-nuclear) accidents** (TMI, Chernobyl, Fukushima,…).
- Because, **without proper safety leadership**, the organisation tends to **accept risks** as it gains experience.
- Because nuclear accidents are **very unlikely** but with **huge impact**.
- Because (nuclear) technology is not intrinsically safe: **humans and organisations make it safe**.
- Because **complacency** and **overconfidence** are the worst challenges to safety.

Culture changes…

- By natural evolution
- By contact with other cultures
- When confronted with Crises
- With technology changes
- With **Change Management**
- By good **Leadership**

Common issues and recommendations observed in nuclear power plants

(from the speaker experience as team leader in safety culture assessments)

The following slides contain some common **issues** identified in Safety Culture Assessments conducted by WANO* in several Nuclear Power Plants, as well as **recommendations** that have been given to the plants to address the issues.

* World Association of Nuclear Operations

Group photo: Safety Culture Assessment Mission in the Beloyarsk Nuclear Power Plant (Russia)

Common issues and recommendations - Human performance:

Issue	Recommendations
• Unclear or absence of expectations for human error reduction tools	• Establish and communicate a set of human error reduction tools. • Training
• Lack of peer-to-peer challenge	• Presence of management in the field, leading by example. • Management to welcome challenge.
• Human error reduction tools not used	• Use of Task Observation and Coaching to reinforce the use of the established human error reduction tools.

Some Human Error Reduction Tools:

Pre-job Briefing	Three-Way Communication	Independent verification
Post-job debrief	STAR (Stop-Think-Act-Review)	Procedure Use and Adherence
Phonetic alphabet	Peer check	Place-keeping ...

Common issues and recommendations - Learning from experience:

Issue	Recommendations
• Poor reporting culture	• Easy process to report, even anonymous. • Communication. • Use of Task Observation and Coaching to reinforce the need to report low level events and near-misses.
• Isolationism	• Benchmarking • Use of external operating experience • Active participation in international exchange forums
• Insufficient use of low level events and near-misses	• Establish objectives for reporting and analysis • Communication • Reinforce reporting
• Poor analysis of events	• Define expectations for method and depth of analysis by event category • Training

Common issues and recommendations - Operational decision-making:

Issue	Recommendations
• Absence of an ODM process	• Develop a process for Operational Decision-Making based on six principles: 1. Recognize and report degrading conditions & safety margins 2. Clearly define roles and responsibilities 3. Clearly define the problem and the potential consequences 4. Assess short- & long-term risks and potential combined effects of different options 5. Develop an implementation plan, compensatory measures & back-up plan 6. Periodically review of decisions & the operational decision-making process.
• ODM process not used when or how it should have been used.	• Provide training to the management team on the application of an Operational Decision-Making process.

Common issues and recommendations - Management presence in the field:

Issue	Recommendations

• Management not present in the field
  • Poor safety behaviours
  • Expectations not followed
  • Events
  • ...
	• Conduct manager-in-the-field training for all levels of management.
	• Implement a task observation program involving all managers and supervisors.
	• Focus on reinforcing high standards and emphasizing a coaching/questioning approach to giving feedback.

Leadership in Safety Culture

Remember:

- Leaders play an important role in building and maintaining a healthy Safety Culture.

- But can also easily spoil it!

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