



W A N O

Evaluation of Nuclear Safety Culture During the Pre-Operational Phase

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WANO-World Association of Nuclear Operators

- Formed in 1989 following accident at Chernobyl
- Has members in more than 30 countries operating 440 nuclear units around the world
- WANO and IAEA signed Memorandum of Understanding in September 2012 to reflect increased cooperation after the Fukushima accident.



WANO's Mission

- To maximise the safety and reliability of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information and emulation of best practices.



WANO Organization



- London Office
- ★ Regional Centers
- ▲ Hong Kong pre-startup review office



Safety Culture definition

- Safety Culture is an organization's values and behaviors—modelled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority.”
- WANO definition is well-aligned with IAEA
- Three basic themes....



3 themes from Safety Culture definition

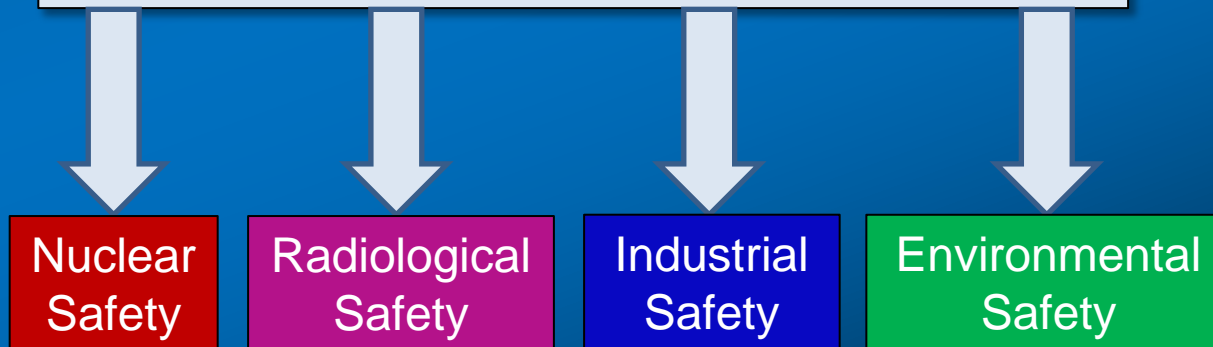
“Safety culture applies to every employee in the nuclear organization.”



3 themes from Safety Culture definition

“The focus is on nuclear safety, although the same principles apply to radiological safety, industrial safety and environmental safety.”

8 Principles for a Strong Nuclear Safety Culture



3 themes from Safety Culture definition

“Nuclear safety is the first value adopted at a nuclear station and is never abandoned.”



WANO Safety Culture Principles

1. Everyone is personally responsible for nuclear safety.
2. Leaders demonstrate commitment to safety.
3. Trust permeates the organization.
4. Decision-making reflects safety first.
5. Nuclear technology is recognized as special and unique.
6. A questioning attitude is cultivated.
7. Organizational learning is embraced.
8. Nuclear safety undergoes constant examination.



Conduct of WANO Pre-Startup Reviews

- Typically 14 team members conducting a two-week review at the site
- Functional areas of the review include operations, maintenance, engineering, chemistry, radiation protection, industrial safety, emergency preparedness, fire protection, operating experience, training, and organizational effectiveness (which includes nuclear safety culture).
- Includes review of operations crew performance in the simulator and a review of station response to selected SOERs (Significant Operating Experience Reports)
- Team input on each of the 8 Principles is documented



Principle #1

Everyone is personally responsible for nuclear safety.

- All personnel understand the importance of adhering to nuclear safety standards
- Employees follow procedures
- Employees are prepared to operate the plant to the highest standards
- The organisation demonstrates a healthy accountability for shortfalls in standards
- Shortfalls are identified and dispositioned through the corrective action programme.



Principle #2

Leaders demonstrate a commitment to safety.

- Rewards and goals do not emphasise schedule adherence over safety.
- Managers and supervisors provide appropriate oversight and coaching; management leadership and reinforcement of standards is visible in the field
- Leaders are personally involved in high-quality training. This is especially for a newly-established workforce that may have limited nuclear experience.
- Selection and evaluation of managers and supervisors considers their ability to reinforce a strong nuclear safety culture.



Principle #3

Trust permeates the organization.

- Personnel can raise nuclear safety concerns without fear of retribution.
- There is a free flow of timely and accurate information at all levels of the organisation
- Complete and accurate information is provided to oversight, audit, and regulatory organisations.



Principle #4

Decision-making reflects safety first.

- Emphasis on “prudent” choices (those consistent with a healthy nuclear safety culture) rather than “allowable” choices (based on limitations in schedule or budget)
- Senior leaders support and reinforce conservative decisions and require a rigorous approach to problem-solving.
- Operators are vested with the necessary authority to ensure decision-making reflects safety first.



Principle #5

Nuclear technology is recognized as special and unique

- The special characteristics of nuclear technology are taken into account in all decisions and actions. For example, all workers should understand foreign material exclusion is particularly important to protect fission product barriers.
- Plant activities are governed by comprehensive, high-quality procedures and processes
- Equipment is properly maintained; equipment turned over to operations is maintained consistent with the high standards required of an operating plant.
- There is a clear transition from a construction culture to an operating culture



Principle #6

A questioning attitude is cultivated.

- Personnel do not proceed in the face of uncertainty and are not penalised for stopping an activity if they are unsure of the consequences of their actions.
- Workers realise their inappropriate actions during construction and testing contribute to latent problems that will become evident after the plant is on line, potentially impacting safe and reliable operation.
- Workers are encouraged to identify conditions or behaviours that have the potential to degrade operating and design margins and are assured anomalies will be investigated thoroughly and properly.



Principle #7

Organisational learning is embraced.

- Construction and operating experience is sought out and applied during construction and commissioning.
- A process is in place to obtain operating experience from the industry and to properly evaluate applicable items and establish effective corrective actions.
- Internal experience is also valued and acted upon to prevent repeat events
- Latent organisational weaknesses are identified and resolved to mitigate future events.



Principle #8

Nuclear safety undergoes constant examination.

- Independent oversight is valued; sufficient and timely actions are taken to resolve identified concerns.
- Senior executives are periodically briefed on the results of oversight activities.
- Safety culture assessments are conducted and used as a basis for improvement, even in the pre-operational phase.
- A transition plan is in place to ensure the oversight organisation is fully prepared to provide intrusive oversight of operating standards well before the first fuel load.



Emerging Trends

- A review of WANO pre-startup reviews conducted so far reveals several emerging trends and common areas for improvement....



Emerging Trend #1

Insufficient emphasis on operator team-skills.

- Focus is placed on the individual skills necessary to pass the license examination.
- Normal, abnormal, and emergency procedures are not adequately implemented
- Shortfalls exist in crew communications and use of human error reduction techniques.
- Shift managers step out of their oversight role.
- No conservative decision-making process in place.
- *(Reflects attributes of Principle 7: Organisational learning is embraced and*

Principle 4: Decision-making reflects safety first.)



Emerging Trend #2

Weaknesses in safety system status control.

- Lack of a rigorous process to ensure the status of safety systems is maintained after turnover and that all system requirements are met prior to mode changes.
- Workers do not have an understanding of what could go wrong if they do not follow the process or procedure
- An over-reliance on contract operators during the testing phase deprives station operators of valuable learning opportunities and experience.
- *(Reflects attributes of Principle 5: Nuclear technology is recognised as special and unique.)*



Emerging Trend #3

Not learning from operating / construction experience.

- Most sites have not captured lessons learned from lower-level events to identify developing station problems or causes before they contribute to an event.
- Lack of timely evaluation of some significant operating experience and the late realisation of necessary actions have contributed to weaknesses in safety system status control, operational decision-making, and identification of hazards
- *(Reflects attributes of Principle 7: Organisational learning is embraced.)*



Emerging Trend #4

Ineffective use of training

- Some control room simulators do not adequately model abnormal or emergency conditions or do not accurately reflect actual control room configuration.
- Training provides insufficient emphasis on error prevention techniques, communication, procedure use, and questioning attitude.
- Training and qualification may be satisfactory for the crews assigned to the first operating unit but were not sufficient for the staff on subsequent units.
- *(Reflects attributes of Principle 5: Nuclear technology is recognised as special and unique and Principle 7: Organisational learning is embraced.)*



Emerging Trend #5

Status of fire protection systems.

- Some sites had no methods in place to ensure the proper status of fire protection systems prior to core loading or subsequent reactor mode changes.
- The required status of fire protection active features (such as fire detection, fire pumps, valves, and dampers) or passive features (such as fire doors, pipe and cable penetrations, or cable coatings) could not be verified by approved and consistent methods.
- *(Reflects attributes of Principle 5: Nuclear technology is recognised as special and unique.)*



Emerging Trend #6

Emergency preparedness meets minimum requirements

- Actions in emergency preparedness are focused on passing the required regulatory exercises before startup, without sufficient emphasis on mitigating the consequences of an accident.
- At many pre-startup sites, less than one half of the organisation has ever participated in an emergency response drill; those who have drill experience have often been exposed to the same drill scenario in each occurrence.
- *(Reflects attributes of Principle 7: Organisational learning is embraced and Principle 2: Leaders demonstrate a commitment to safety.)*



Emerging Trend #7

Senior managers not placing emphasis on safety culture

- Management has not emphasised the establishment of a healthy reporting culture.
- Management standards and expectations are not effectively communicated to the workforce; understanding and implementation of standards is often not assessed.
- Processes are put in place without adequate recognition of the limited nuclear experience of the workforce and the necessary training and communication required
- *(Reflects attributes of Principle 2: Leaders demonstrate a commitment to safety and Principle 8: Nuclear safety undergoes constant examination.)*



Emerging Trend #8

Turn-key nature of projects contributes to deficiencies

- Insufficient oversight and involvement by station managers; weaknesses in system turnover, particularly in readiness of procedures and proper closeout of open items
- Installed systems in turn-key projects are not adequately protected from the harsh construction environment, resulting in dirt and debris in critical systems.
- Station chemistry personnel are often not adequately integrated into startup activities to ensure proper system flushes and cleanliness inspections.
- *(Reflects attributes of Principle 8: Nuclear safety undergoes constant examination and Principle 5: Nuclear technology is recognised as special and unique.)*



Conclusion

WANO pre-startup reviews are required at all new nuclear power plants.

These reviews cover all areas related to effective startup and operation of the new unit, and several emerging trends have been identified based on the conduct of numerous pre-startup reviews. Aspects of nuclear safety culture are applicable to many areas of the pre-startup review and are assessed to ensure the foundation for a healthy safety culture is in place.



Conclusion

As stated in the WANO Principles for a Strong Nuclear Safety Culture, “nuclear safety is the first value adopted by a nuclear station and is never abandoned.”



Thank You!

Are there any questions?

