Conference on Human and Organisational Factors in Nuclear Safety Culture



NATIONAL NUCLEAR REGULATOR

For the protection of persons, property and the environment against nuclear damage.

Leadership for Safety in Practice: Perspectives from a Nuclear Regulator

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THE NNR

- The National Nuclear Regulator was established by the National Nuclear Regulator Act (Act No 47 of 1999).
- Regulating wide range of nuclear facilities and activities since the 1950's (NORM > NPP)
- NNR Executive reports to a Board of Directors that have been appointed by the Minister of Energy;
- Small nuclear regulator with 160 staff;
- Also, regulated recent projects such as the PBMR





Facilities under Regulation











What is HOF





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Human Performance

- "Human error means that something has been done that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits"
- In short, human error is a deviation from intention, expectation or desirability





Human Performance and Safety

Aircraft Accidents











Human Performance and Nuclear Safety





Nuclear Safety Culture and Leadership

- Nuclear Safety culture "is the organization's values and behaviors modeled by its leaders and internalized by its members – that serve to make nuclear safety the <u>over-riding priority</u>" - (INPO 2004)
- Strong leadership is key to establishing, fostering and maintaining a healthy safety culture as well as a systematic approach to inculcate and maintain a strong safety culture
- Carefully designed and well-implemented management systems are therefore essential to establishing, fostering and maintaining a healthy safety culture
- The design, development and the implementation of the management system should ensure that Leadership and Accountability for safety is clear, Safety is learning driven, a clearly recognised value and integrated in all activities (Safety culture Characteristics and Attributes)





Nuclear Safety

- Nuclear technology and human activities involving radioactive material can contribute to the well-being of people but, as with other industrial activities, present risk.
- The risks may be borne by the site personnel, by people living near the site and by the whole of society. The environment may also suffer harm if radioactive materials are released, particularly under accident conditions.
- Consequently, it is necessary to limit the risks to which people and the environment are subjected to for all prevailing and reasonable foreseeable circumstances.
- First priority must be to prevent accidents from happening as far as reasonably practicable commensurate with the safety goals (1st two levels of DiD concept)



Nuclear Safety – (Prevention of Accidents)

- Prevention of accidents is primarily achieved through sound and conservative:
 - Siting;
 - Design;
 - Manufacturing;
 - Construction;
 - Operation
 - Maintenance



 "nuclear safety" defined to mean the achievement of proper operating conditions, prevention of nuclear incidents and nuclear accidents or mitigation of consequences of nuclear incidents and nuclear accidents for the protection of workers, the public and the environment against harmful effects of ionizing radiation ial





Role of the Regulator

- Regulators have a critical role in ensuring the stringent monitoring and implementation of measures to eliminate or minimise human errors during the entire value chain and lifecycle of a nuclear facility thereby preventing accidents
- This is achieved amongst others through:
 - Setting standards for the siting, design, manufacturing, construction, operation and decommissioning
 - Setting standards addressing organisational systems, nuclear safety culture and human factors
 - Ensuring that lessons learnt from operating experience (OE) and nuclear and radiological accidents are considered in the entire life cycle of new facilities and the operation of existing facilities
- Regulatory oversight during the entire lifecycle of a facility, including manufacturing and construction, as well as tests and commissioning activities is also paramount to ensure safety





NNR Approach







NNR Approach

- NNR have oversight relating to safety by (cont.):
 - Ensure compliance to these conditions through inspections and enforcement actions
- Regulatory oversight over siting, design, manufacturing construction and operation:
 - Eg, Manufacturing (PP0012: Manufacturing of Components for nuclear installations)
 - It is important that the constructed plant must be consistent with the safety case.
 - This is accomplished by considering various aspects, from the broad aspect of accountability of organizations involved in the supply chain, to the raw materials being used as well as to the diligence, competence and care of the respective workers (safety culture).





(Management System)

- NNR safety standards requires:
 - Integrated Management System requiring both quality and safety management systems to be implemented in organisations involved in the lifecycle of the installation performing activities important to safety (RD-0034)
 - This involves the implementation by policies and procedures and an Safety Culture Plan





(Safety Culture)

- The safety standards requires amongst others:
 - The management system of an applicant for, or holder of, a nuclear authorisation shall integrate safety culture arrangements in the organisations management system, including setting goals, policies and standards as well as strategies, plans and objectives so that their collective impact on nuclear safety is understood and managed.
 - The operator is **primarily** responsible for safety
- Guidance on the implementation of these standards states amongst others:
 - Persons and/or organisations performing quality and safety management function should be in a position to **report** to the management at such a level that the required assurance and oversight function is ensured. – This address the independence of the operators oversight/inspectorate function
 - Senior management is responsible for developing the values and behavioural expectations for the organisation, and should be responsible for modelling these through their words and activities – This address the leadership responsibility





(Human Factors)

- NNR standards further require that:
 - The design and operation of nuclear facilities shall take into account human factors and shall support good performance and good practices to prevent human and organisational failures
- Guidance on the implementation of these standards states:
 - Human factors should be systematically considered at all stages of the life cycle of the nuclear facility or activity. These considerations include the **allocation of functions** to humans and technology, the identification and **analysis of tasks** important to nuclear safety (including human error potential), the design of the **work environment**, **user interface design**, **training** and procedures





(Human Factors)

• Guidance on the implementation of these standards states (cont.):

Human and organisational failures should be prevented in the design and operation of nuclear facilities by ensuring that:

- *a) Sound ergonomic principles* are followed in the design of equipment and the development of operating procedures;
- b) Appropriate *equipment*, safety *systems* and *procedural* requirements are provided and other necessary provisions are made to
 - *i. reduce, as far as practicable, the possibility that human error or inadvertent action could give rise to accidents or other incidents leading to the exposure of any person;*
 - *ii. provide means for detecting human errors and for correcting them or compensating for them; and*
 - *iii. facilitate protective actions and corrective actions in the event of failures of safety systems or failures of protective measures.*



Safety Culture and Leadership within the NNR

- Carefully designed and well-implemented management systems are essential to keep people safe and protect the environment.
- Management systems include the necessary organizational structures, resources, accountabilities, policies and procedures to effectively manage risks and continually improve operations.
- Promote regulatory self-assessment of leadership and management for safety and safety culture. (It is important for the regulator to treat self-assessment information with care in order to build trust and encourage high quality self assessments which look at potentially sensitive underlying organisational and cultural issues).
- Implement approaches for continued development of competence in leadership, sharing of approaches and management for safety and safety culture through staff exchange programs between regulators as well as continued training and coaching of staff in areas such as root cause analysis, influencing skills and lifecycle specific considerations.





Concluding remarks

- Human error and performance are two sides of the same coin
- Human errors could have a major impact (both positive and negative)on:
 - The condition of plant
 - Financial resources
 - Morale of employees
 - Quality of Supply to Customers
 - Health and Safety, which implies injury or death
- In nuclear facilities the results of human error could have catastrophic consequences and must therefore be eliminated
- We need to recognise that nuclear safety is an encompassing term and that all parties involved in the value chain could potentially impact nuclear safety





Concluding remarks

- The NNR has put in place regulatory standards that requires the development and the implementation of the management system to ensure:
 - Leadership for safety,
 - Safety is **learning** driven, a **clearly recognised value** and **integrated** in all activities;
 - Accountability of the **operator** and **organizations** involved in the supply chain;
- The NNR has also put in place oversight processes to monitor and inspect activities throughout the lifecycle of nuclear facilities and to ensure and enforce compliance with authorised conditions.
- The NNR also has in place ways to inculcate and continuously improve and monitor safety culture not only for operators it regulates, but also amongst its own staff members.





Thank-You for Your Attention



