

Institutional Strength in Depth

Dr. Richard A. Meserve
Executive Adviser
Nuclear Risk Research Center

1

Nuclear Power in Japan

- Nuclear Power is of Strategic Significance
 - Japan has few indigenous energy resources
 - Replacement fossil fuel is expensive and vulnerable
 - Japan needs carbon-free generation
 - Important for Japan to remain strong
- But Japan cannot rely on nuclear power unless it meets highest standards for safety.
 - Japanese people demand no less.
 - Safety is primary obligation for all those who construct and operate nuclear power plants

2

IAEA Comprehensive Report on Fukushima Accident

- “Before the accident, there was a basic assumption in Japan that the design of nuclear power plants and the safety measures that had been put in place were sufficiently robust”
- “Because of the basic assumption that nuclear power plants in Japan were safe, there was a tendency for organizations and their staff not to challenge the level of safety. The . . . basic assumption among the stakeholders . . . resulted in a situation where safety improvements were not introduced promptly.”
- “A systemic approach to safety needs to consider the interactions between human, organizational and technical factors. This approach needs to be taken through the entire life cycle of nuclear installations.”

3

Systemic Approach to Build a Robust Nuclear Safety System?

- Apply **Strength in Depth** philosophy to provide robust framework
- Cover **all** who impact on nuclear safety
- Keep simple
- Base on strong components & **effective interactions** (no effective system if no interactions)
- Recognize strong and deep foundations – **Leadership and Culture are critical.**

4

Elements of a Positive Safety Culture

- Leaders demonstrate commitment to safety in behaviors and decisions
- Issues impacting safety are promptly identified, analyzed, and addressed
- All individuals take personal responsibility for safety
- Engage in continuous learning to improve safety
- Personnel are free to raise safety concerns without retaliation
- Communications focus on safety
- Trust and respect each other
- Individuals avoid complacency and maintain a questioning attitude

5

Properties of Institutional Strength in Depth

- MULTIPLE LAYERS
- INDEPENDENCE OF LAYERS
- LAYERS BUILT USING:
 - DIVERSITY
 - REDUNDANCY
 - SEPARATION OF FUNCTION
- NO SINGLE POINT FAILURE OR COMMON CAUSE FAILURE
- ROBUST DEEP FOUNDATIONS – CULTURE & LEADERSHIP

6

Elements of Strength in Depth



7

What does “strong” mean?

Inner strength does not refer to brute strength:

- Strong enough to listen and absorb others' ideas
- Strong enough to face challenges
- Strong enough to welcome new ideas and learn from others
- Strong enough to tell it as it is
- Strong enough to recognise when you have things wrong, to learn, and to correct errors.

8

1. Components of a Strong Nuclear Industry Sub-System

*Layer 1.1 Licensee/Operator level	Layer 1.2 Peer Pressure at State/Region Industry level	Layer 1.3 Peer pressure/ review at International Industry level	Layer 1.4 Review at International Institutional level
Suitably qualified and experienced staff who effect safety Technical/Design/operational capability including sub-contractors and TSOs	National/regional industrial high level fora/associations.	WANO/INPO/JANSI Missions and Requirements	IAEA OSART Missions
Strong management systems with multiple checks and balances	Other organisations involved in emergency preparedness and response	Bilateral/Multilateral Organizations e.g. BWR and PWR Owners' Groups	
Company Nuclear Safety Committee with external members			
Company board that holds the Executive to account			
Vibrant safety culture led from the top with all encouraged to point out potential deficiencies or concerns			
Independent Nuclear Safety Assessment Review and Inspection (assurance function internal to the company independent of the executive chain of command)			

Nuclear Leadership/Culture/Values

** The licensee is the lead for this level of the Industry Sub-System. The licensee has the prime and enduring legal responsibility for the safety of the facility. This sub-system can be split further to include designer, vendor, constructor, etc.*

9

2. Components of a Strong Regulatory Sub System

Layer 2.1 Regulatory Authority	Layer 2.2 Special Outside Technical Advice	Layer 2.3 International Peer Pressure	Layer 2.4 International Peer Reviews
World class technical/regulatory capability and competencies, including assessment, licensing, inspection, enforcement and influencing. The inherent technical capabilities are sometimes augmented by TSOs.	Standing Panel of experts (may be national or international) Special Expert Topic Groups on such topics as <ul style="list-style-type: none"> • Natural hazards (including seismic hazards) • Aircraft Crash • PRA • Human Interventions • Digital I&C 	NEA CNRA & CSNI committees and working groups. IAEA Convention on Nuclear Safety	IAEA IRRS missions
Organizational Structure with internal standards, assurance, OEF, policy, strategy, decision review arrangements, etc.		WENRA – reference levels, reviews, groups, stress tests	
Regulatory safety culture with openness and transparency as core values		INRA – top regulators	
Formal accountability to internal governing body – Board, Commission, etc.		IAEA Safety Standard meetings.	

Nuclear Leadership/Culture/Values

10

3. Components of the Strong Stakeholder Sub-System

Layer 3.1	Layer 3.2	Layer 3.3	Layer 3.4	Layer 3.5	Layer 3.6	Layer 3.7
Public	National Government/ Parliament	Local Government	Neighbors, Including Local Committees and the International Community	Media	NGOs, Special Interest Groups	Shareholders
Industry and Regulatory Routine Supply of Information						
Accountability to Public through Parliament						
Special Reports on Matters of Interest						
Responsiveness to Requests for Information						
Routine and Special Meetings						
<p style="text-align: center;">Openness & Transparency, Accountability, Assurance – Industry/Regulator Leadership, Culture and Capability</p>						

11

Aspects of Strength in Depth

- Each subsystem is independent of the others, but each should be open and transparent to the other subsystems. There should be effective communications within and between the various subsystems
- For the system to work optimally, all the subsystems and all layers and components of layers have to be strong and operate effectively.
- The establishment of a vibrant safety culture is a prime responsibility of the leaders in both industry and the regulator.
- Both industry and the regulator must have openness, transparency and accountability to stakeholders as deep-rooted value. In this way, trust and confidence by the stakeholders can be earned.

12

Summary

- Just addressing the technical lessons from Fukushima is not sufficient
- Fundamental Lesson of Fukushima – There is a need for a systemic approach to safety.
- An effective systemic approach should be built on Strength in Depth principles
- Institutional Strength in Depth has 3 main Independent layers: Strong Industry, Strong Regulator, Strong Stakeholders
- Industry Sub-System is multi-layered, but prime responsibility rests with licensee/operator
- The Interfaces are crucial.
- Foundation stone is strong nuclear leadership and a robust safety culture