

IAEA INTERNATIONAL CONFERENCE ON HUMAN AND ORGANISATIONAL ASPECTS OF
ASURING NUCLEAR SAFETY
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INSTITUTIONAL STRENGTH IN DEPTH

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- Fundamental Lesson from Fukushima
- Need for robust Nuclear Safety System
- Strength in Depth Principles
- A model for a Robust Nuclear Safety system
- Systems and Interactions
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Lessons from Fukushima

- Immense amount of work undertaken
- Mainly targeted at engineering lessons or HF associated with them

But ...

- Root cause institutional/cultural
- Regulator not independent
- Not a culture of welcoming challenge, continuous improvement, etc
- Important to seek and apply technical lessons and enhance international standards but not sufficient to ensure robust implementation



Fundamental Lesson

- Can have rigorous and comprehensive safety standards and other tools to deliver high standards of safety **but**
- Vital that **nuclear safety system** ensures that relevant institutions diligently apply these standards and tools



*Need a **robust nuclear safety system** to ensure safety standards applied in all circumstances, nuclear facilities and adequate in all conditions*

Robust National Nuclear Safety System

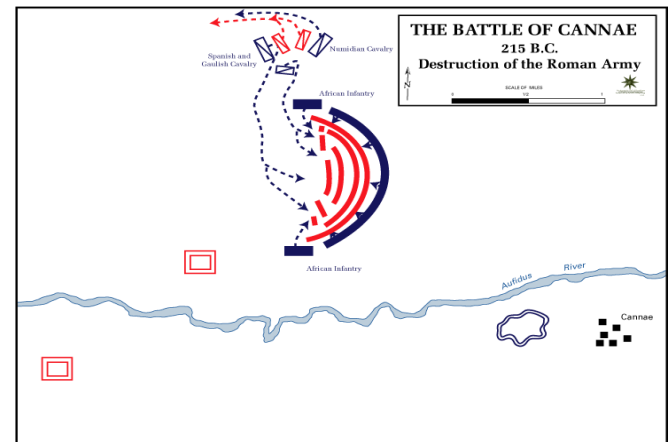
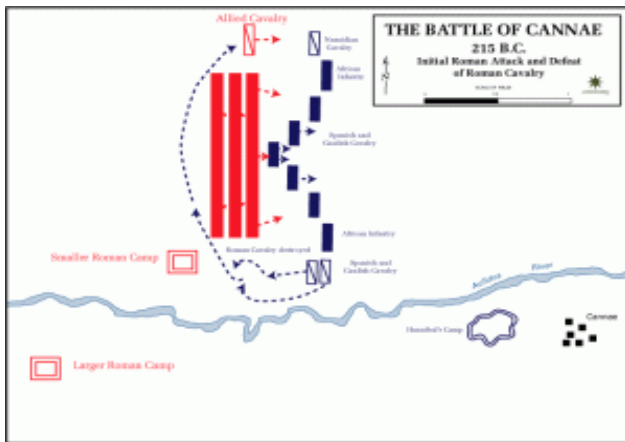
- Who involved? – all those who can influence its safety outcome
- Designers, vendors, constructors, operators, suppliers, regulators, national and international bodies, workers, governments, public, NGOs, other nuclear stakeholders
- Robustness – not vulnerable to any individual failure or combination of failure of attention to nuclear safety or to a common failure

How to design, model, assess and improve 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)
- Strong Deep Foundations – **Leadership and Culture**

Strength in Depth Philosophy – what do we mean?

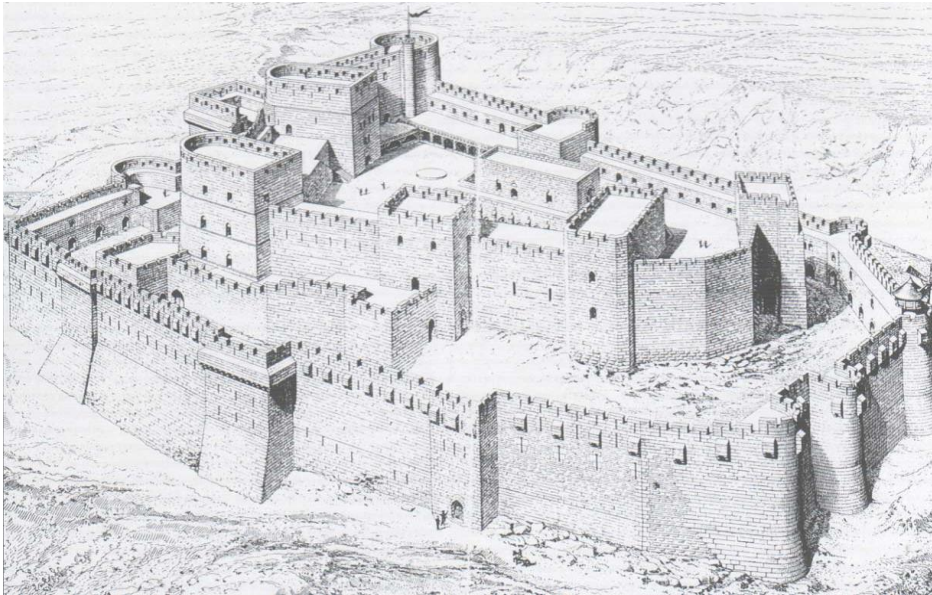
Classically, it's about military strategies to defeat a much stronger enemy:



Having diverse means not putting all your forces in one block. But also about giving ground to weaken and engulf your enemy with your strongest forces.

Strength in Depth – what do we mean?

Used in castle design for centuries also with attention to siting:



- Independent layers
- Within each several defensive weapons
 - Bow and arrows
 - Spears
 - Clubs
 - Swords
 - Stones
 - Boiling oil
- But success depends on the defenders
- Their culture
- Their organisation
- Their **leadership**

Strength in Depth Principles

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

3 Main Independent Layers In A Robust Nuclear Safety System

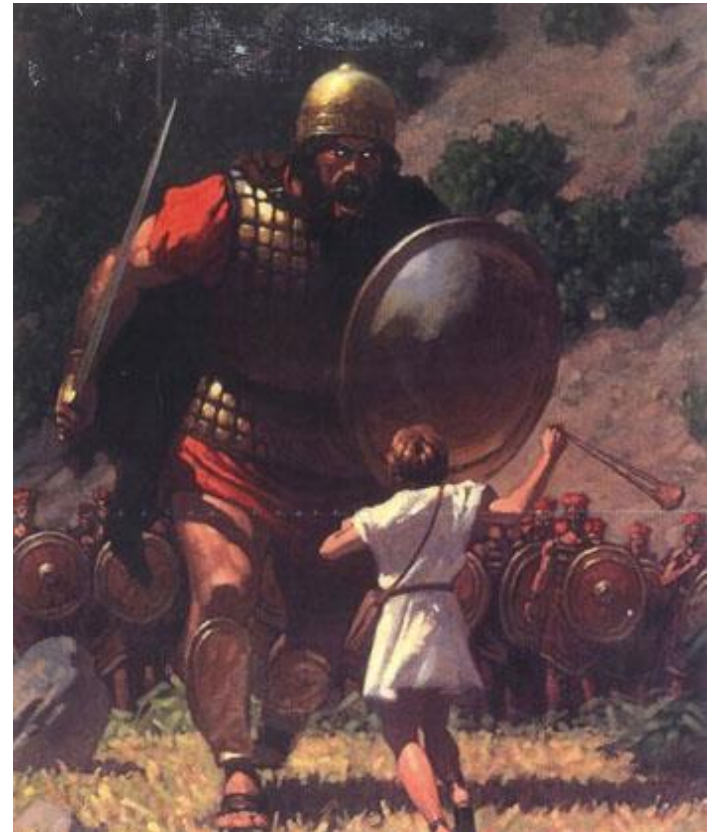


**Foundation Stone:
Leadership and Culture**

What do I mean by strong?

Inner strength not brute strength:

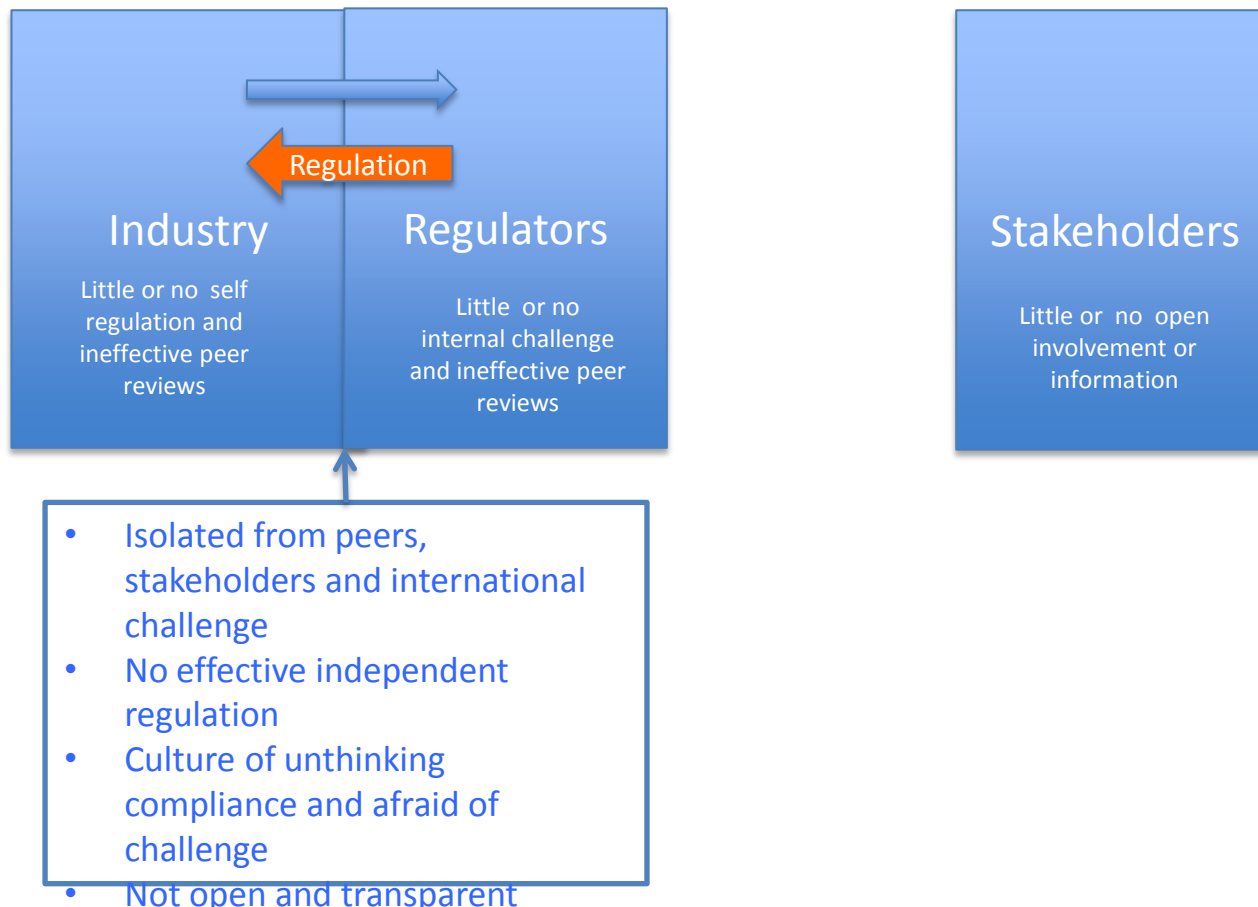
- Strong enough to listen and absorb others' ideas
- Strong enough to not be afraid of challenge
- Strong enough to welcome new ideas and learn from others
- Strong enough to tell it as it is
- Strong enough to recognise when you got it wrong and show that you are learning from it



David and Goliath
Skills, Strategy & Inner Strength for
Success

A Fragile Nuclear Safety System

A system susceptible to single point or common mode failure with a single weak barrier based on internal group think, and limited or no interfaces.



Components of a Robust Nuclear Safety System

1. Components of a Strong Nuclear Industry Layer

Sub-layer 1.1 Licensee/Operator resources, organization and cultural level	Sub-layer 1.2 Peer Pressure at State/Region Industry level	Sub-layer 1.3 Peer pressure/ review at International Industry level	Sub-layer 1.4 Review at International Institutional level
Suitably qualified and experienced staff who effect safety Technical/Design/operational capability	National/regional industrial high level fora/associations.	WANO Missions and Requirements	IAEA OSART Missions
Vibrant safety culture with all employees at all levels encouraged to point out potential deficiencies			
Nuclear Safety Assessment review and Inspection internal to the company independent of the executive chain of command		Bilateral/Multilater al Organisations e.g. CANDU Owners Group	
Company Nuclear Safety Committee with membership from outside			

Nuclear Leadership/Culture

2. Components of a Strong Regulatory Layer

Sub-layer 2.1 Regulatory Authority	Sub-layer 2.2 Special Outside Technical Advice	Sub-layer 2.3 International Peer Pressure	Sub-layer 2.4 International Peer Reviews
World Class Technical/Regulatory Capability	<p>e.g. Standing Panel of experts nominated by stakeholders</p> <p>e.g. Special Expert Topic Groups on such topics as</p> <ul style="list-style-type: none"> - Fukushima - Aircraft Crash 	NEA CNRA & CSNI committees and working groups	IAEA IRRS missions
Organisational Structure with internal standards, assurance, OEF, policy, strategy, decision review arrangements, etc.		e.g. WENRA – reference levels, reviews, groups	ENSREG Reviews
		INRA – top regulators	
Accountability to Governing Body – Board, Commission, etc.		IAEA Safety Standard meetings, etc.	

Nuclear Leadership/Culture

3. Components of the Strong Stakeholder Layer

3.1 Public	3.2 Worker s	3.3 Parlia ment	3.4 Nation al & Local Gov.	3.5 Neighb ours	3.6 Media	3.7 NGOs
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Industry and Regulatory Routine Supply of Information

Routine Reports on Activities and Decisions

Special Reports on Matters of Interest

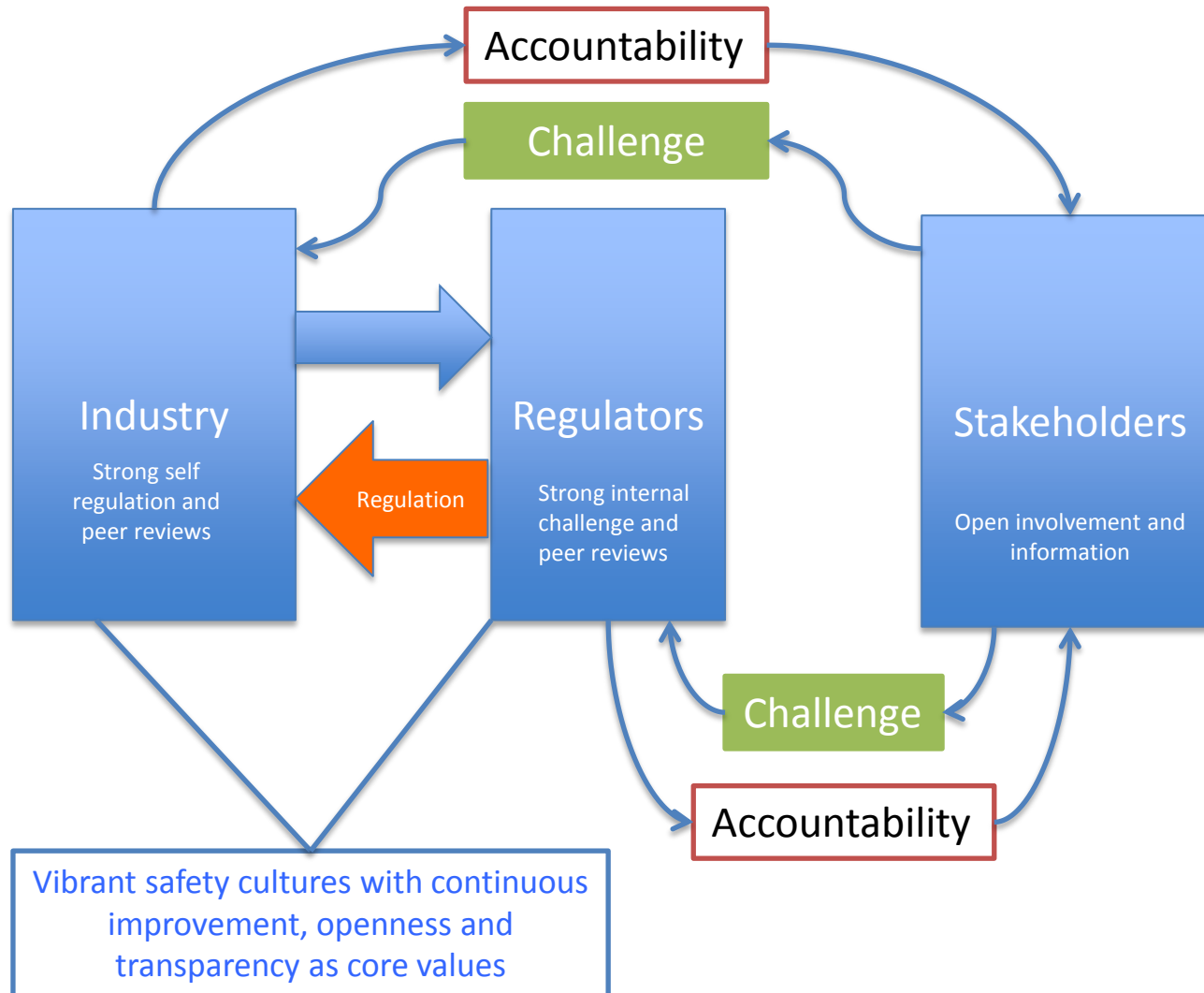
Responsiveness to Requests for Information

Routine and Special Meetings

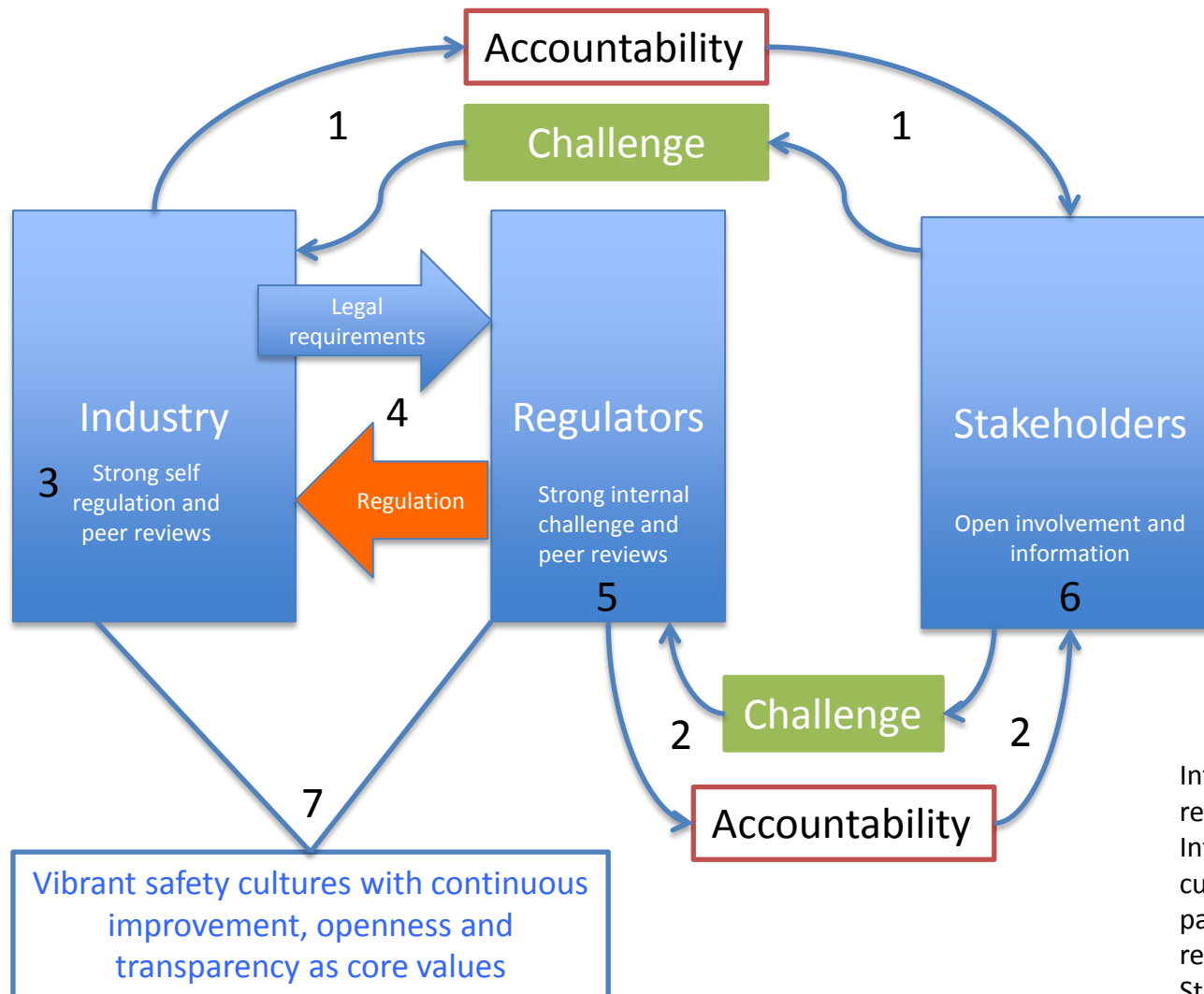
**Openness & Transparency, Accountability, Responsiveness
– Industry/Regulator Leadership, Culture**

Vital Interfaces of a Robust Nuclear Safety System

A Robust Nuclear Safety System – Importance of Interactions

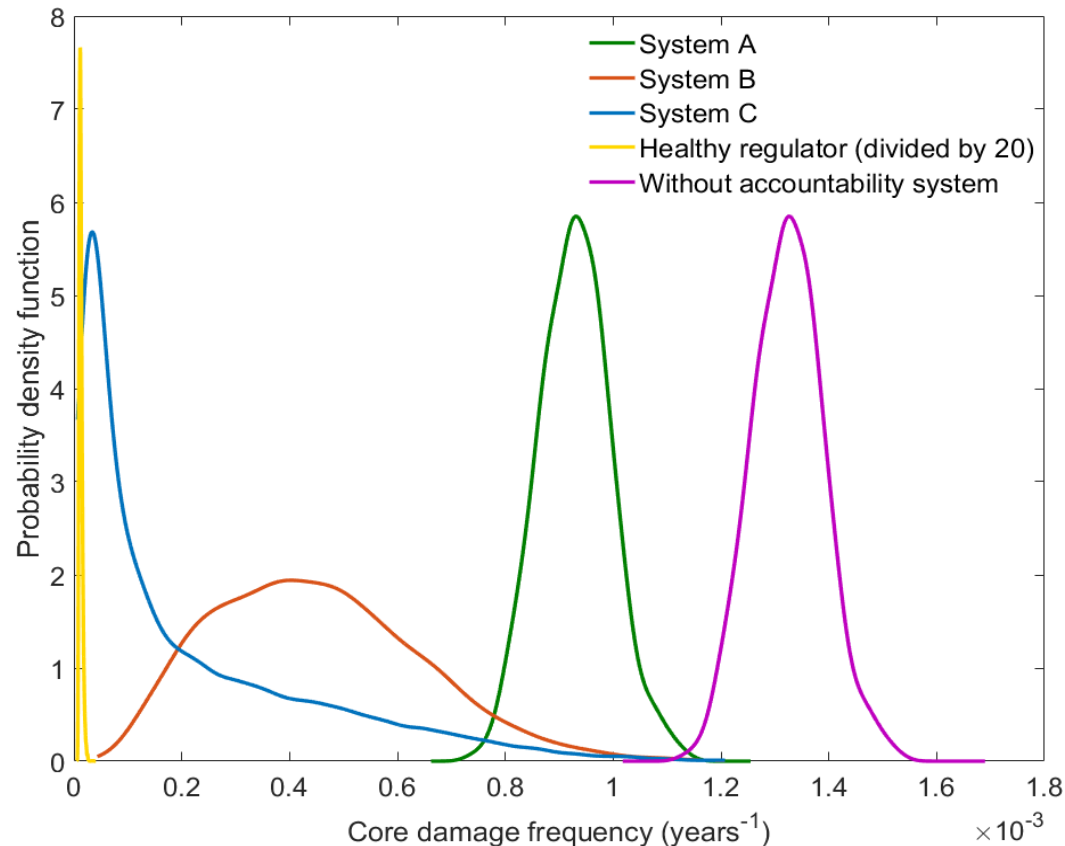


Reviews of Nuclear Safety Systems



Interfaces (1, 2, 4) are not really subject to peer reviews. Internal arrangements and cultures (3, 5, 7) are only partially subject to peer review. Stakeholders (6) are not covered by peer reviews.

Can We Use Safety Assessment Techniques to Assess the Nuclear Institutional Systems? – Example: a Vital Interfaces

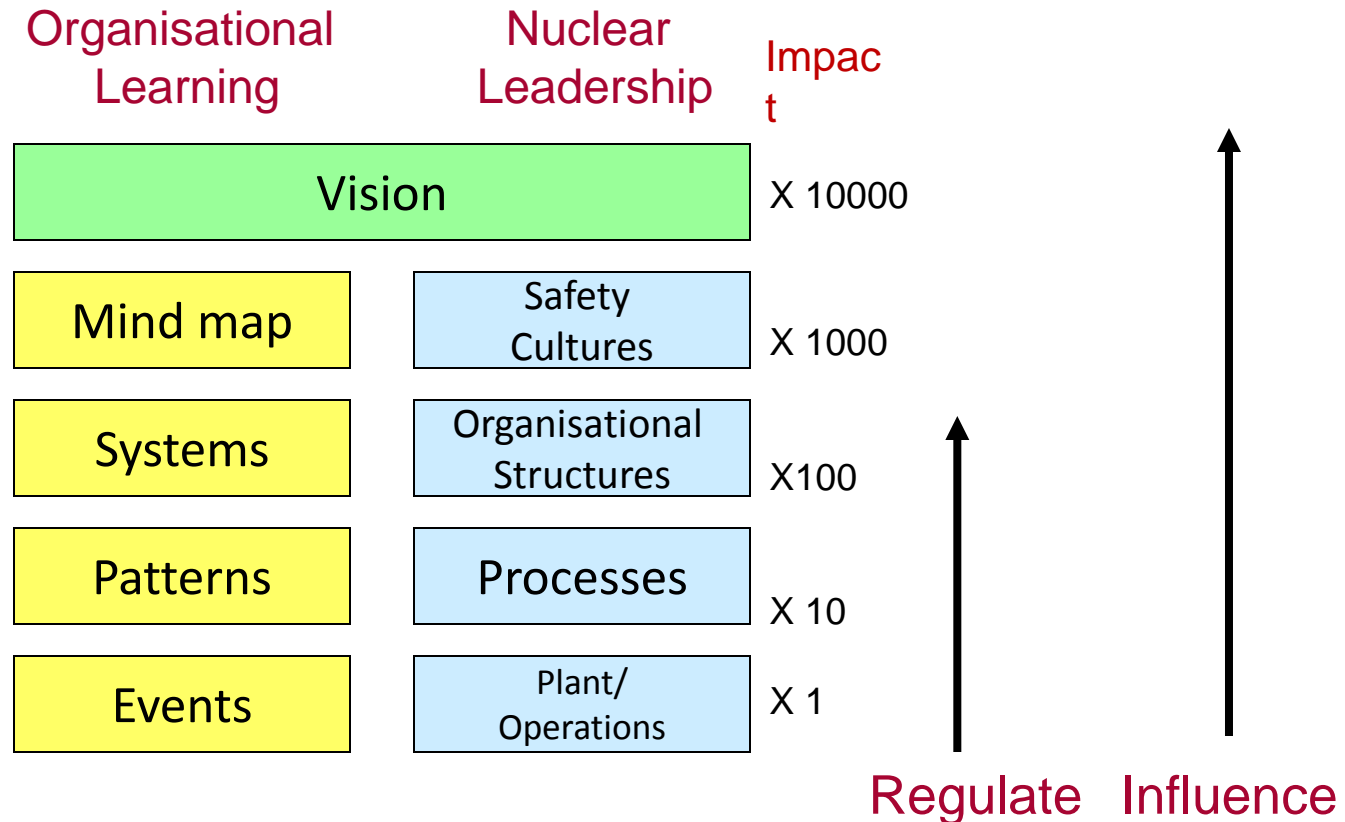


Nuclear Regulator Accountability – Impact of Different Systems
(work in progress by J.Lavarenne, Cambridge University)

The Foundation Stone for a Robust Nuclear Safety System

- Strong Nuclear Leadership and Safety Culture**

RNSS: Why is Nuclear Leadership so vital?



Can we develop Nuclear Leadership Ethical Principles and Values with Global Application?

- Strong Nuclear Leadership is key to developing, nurturing and ensuring nuclear institutions, culture and values
- Need common basis for Nuclear Leadership that has universal applicability – across societies, cultures, organisations

Nuclear Leadership – the Role

Setting the vision, nurturing the culture, and living the values to enable society to benefit from the peaceful use of nuclear energy while ensuring the protection of people, society and the environment

- Leading with humility
- Based on a strong set of **nuclear ethics and values**

What do we mean by Ethics and Values?

Ethics:

- Basis for deciding what's right or wrong
- On a society level
- Tends to constrain

Values:

- Fundamental belief
- Drives Individual Behavior
- Tends to Motivate

**Some Nuclear Ethical Principles and
Values to build and sustain a Strong
and Successful Nuclear Safety
System?**

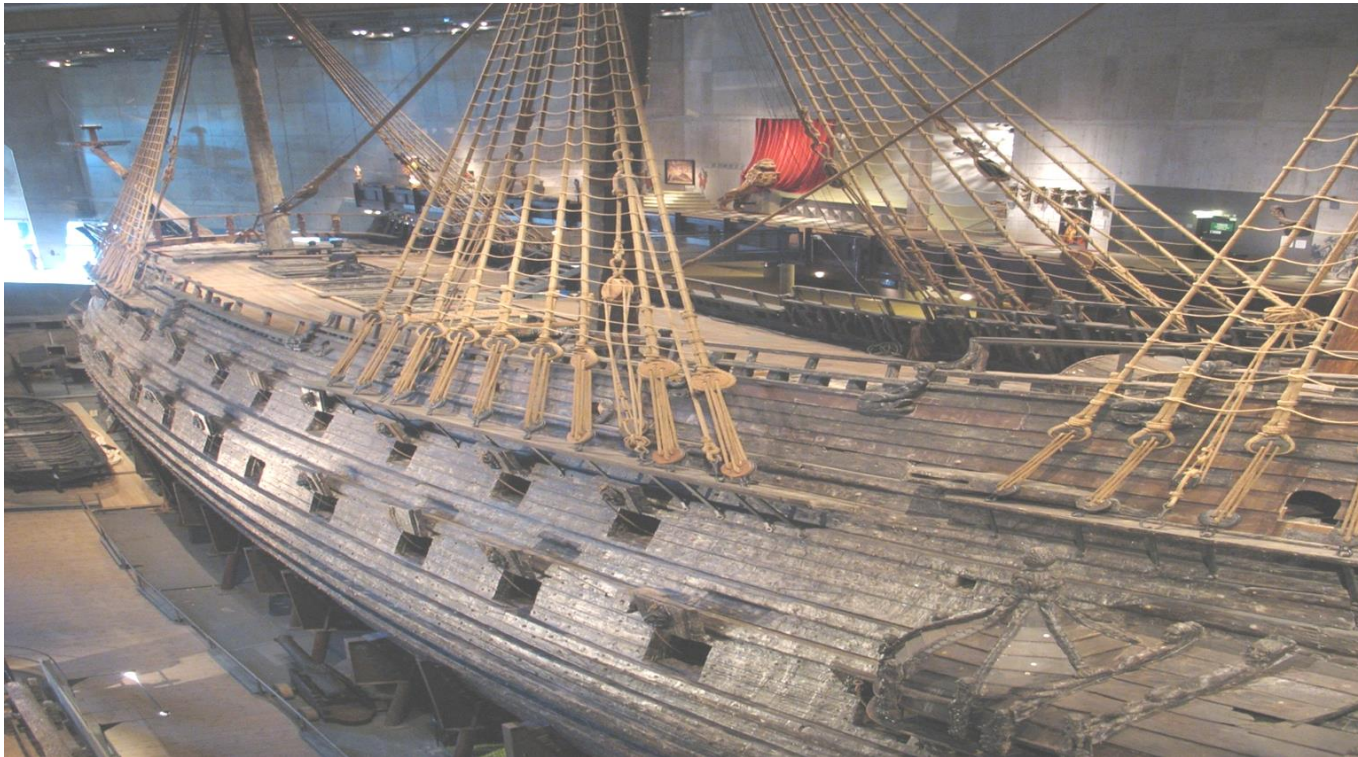
Nuclear Leadership – Ethical Principles?

1. Nuclear Leaders are **committed** to advancing the wellbeing of society
2. Nuclear leaders hold a privileged and trusted position in society and demonstrate that they are seeking to serve wider society and are **sensitive** to stakeholder concerns
3. Nuclear Leaders **champion** justice, integrity and continuous improvement
4. Nuclear Leaders see protecting people and society as **paramount** while working to secure other benefits

Some Nuclear Leadership Values?

Humility

Loss of Swedish **Vasa** Warship in 1628 in first 2km of maiden voyage – fear of telling the King that top heavy and need to delay



Welcoming Challenge and seeking to listen, learn and improve

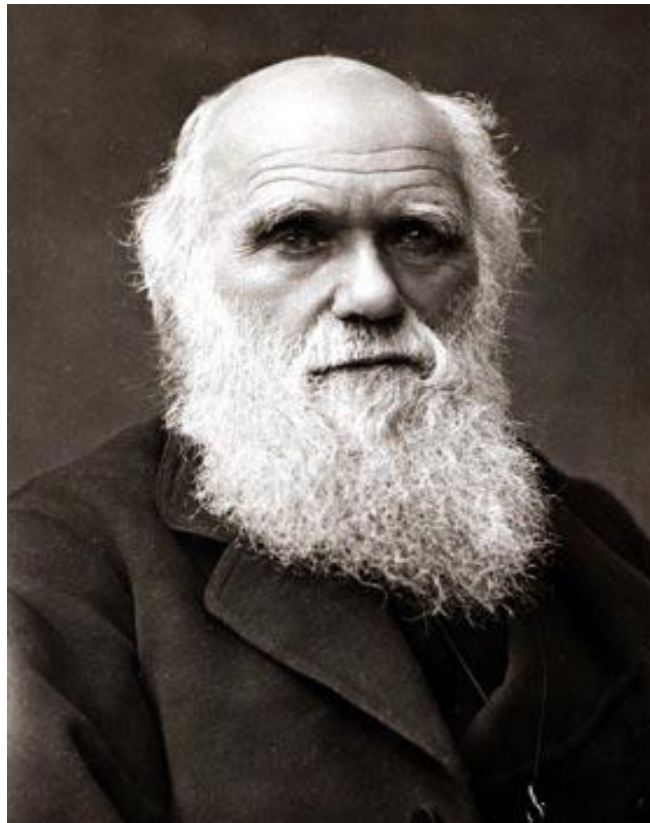
Inner Strength (not Brute Strength)



David and Goliath
Skills, Strategy & Inner Strength for Success

Responsiveness

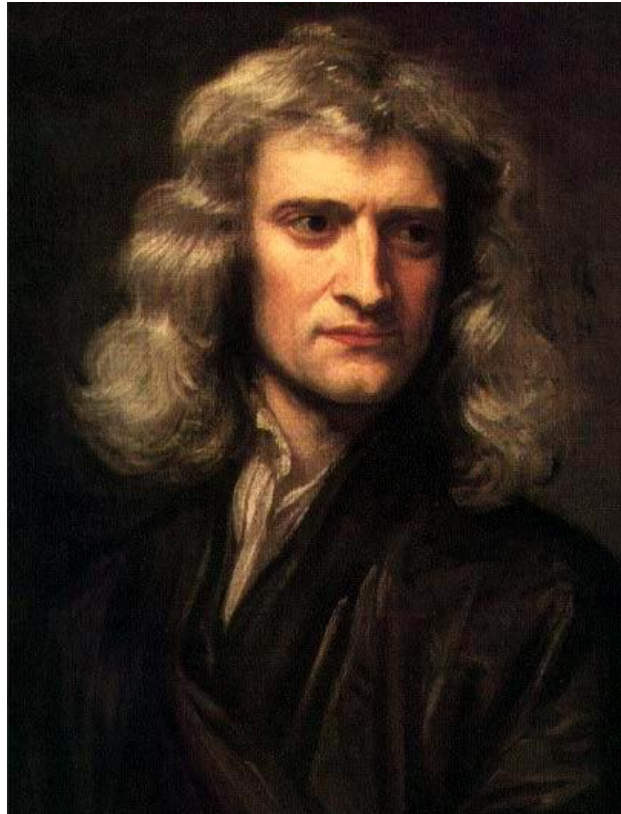
Charles Robert Darwin



Respond to changes in operating environment or die out

Objectivity

Isaac Newton



Decisions based on rationality, facts, knowledge and experience

Resilience

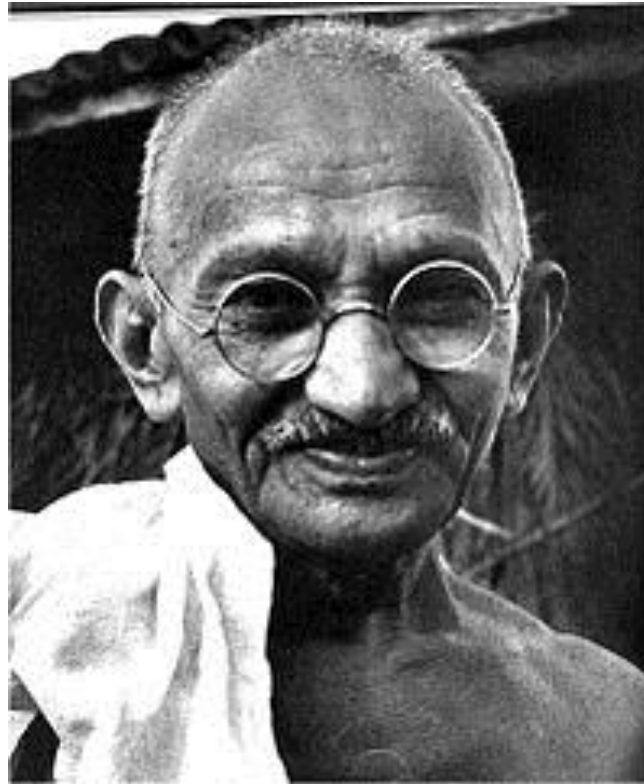
Aung Son Suu Kyi



To do the right thing despite all the obstacles

Integrity

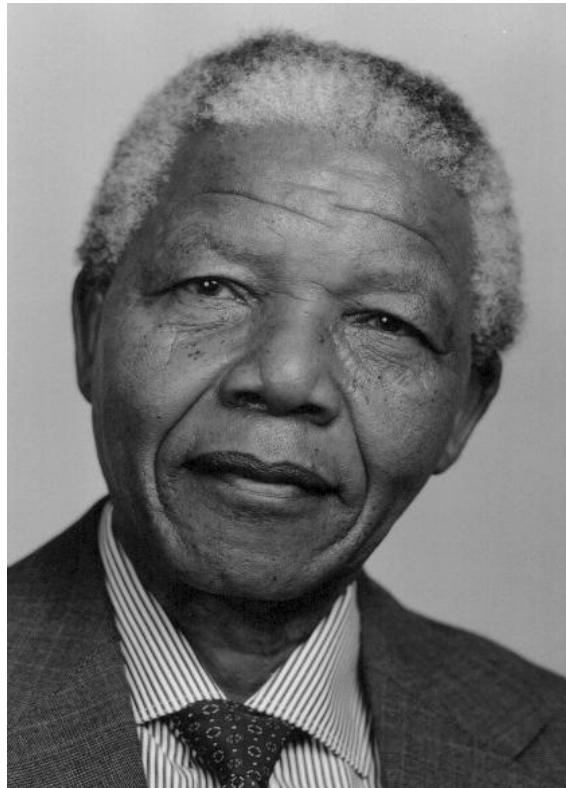
Mohandas Karamchand Gandhi



Truth and True to your word

Nuclear Leadership Values?

Nelson Mandela



Humility

Inner Strength

Responsiveness

Objectivity

Resilience

Integrity

Summary

- Fundamental Lesson of Fukushima – A Robust Nuclear Safety System (RNSS) is essential
- RNSS has to be built on Strength in Depth principles
- 3 main Independent layers: Strong Industry, Strong Regulator, Strong Stakeholders
- Crucial are the Interfaces and the Foundation Stone
- Foundation stone is strong nuclear leadership and robust safety culture
- Strong nuclear leaderships demands adherence to common nuclear ethics and values
- Need to take forward work as priority on Nuclear System Interfaces, nuclear ethics and values