

Learning from Experience to Improve Nuclear Safety – A Perspective from the UK

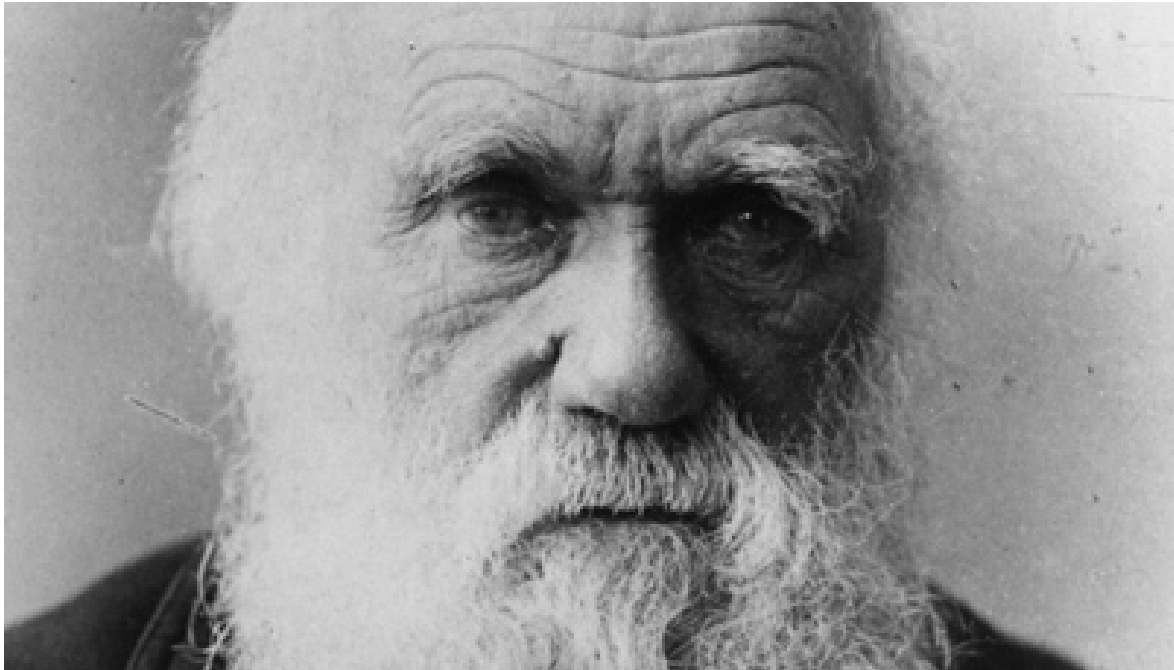
By

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A Philosophy



Darwin

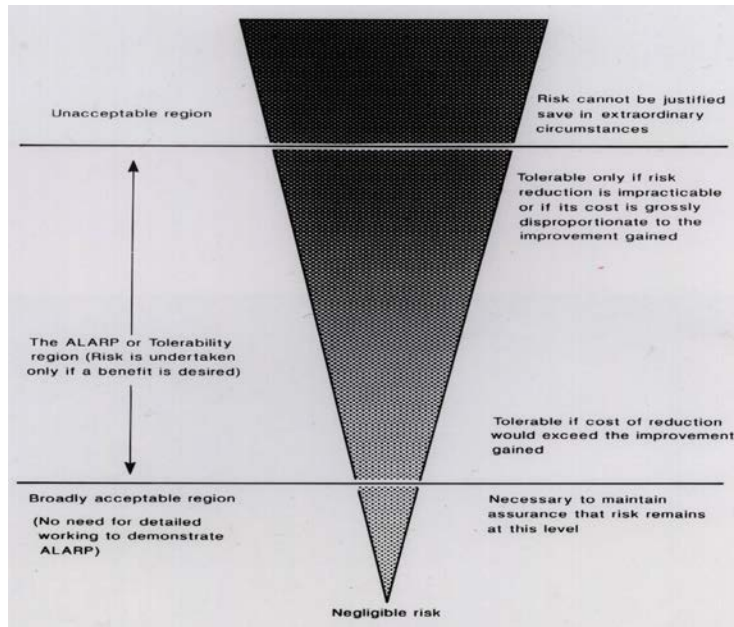
Those who respond to their changing environment and learn grow and prosper.
Those who do not wither and die out.

Continuous Improvement

– A Basic Philosophy for Nuclear Safety

UK – Embedded in Legal Requirements:

Reduce Risks So Far As Is
Reasonably Practical



Nuclear Site Licence Conditions

- Learning from Events
- Periodic Safety Reviews

The Essential Role of NEA

- Over 50 years of promoting learning from each other
- Especially:
 - through the collection and recording of nuclear events worldwide, both from incidents and good practices
 - Regulators getting together and discussing/debating topical issues, working to promote mutual understanding and learning
 - Sharing research and data, working together on projects, extending knowledge and understanding

Post TEPCO Fukushima Dai-ichi Learning to Enhance Nuclear Safety in the UK

Post Fukushima Learning in the UK

- Immediate technical review of whether UK NPPs should be shut down, industry & regulator – no need
- Immediate action to understand the circumstances and potential impact: Independent HMCI Scientific Advice to PM – no need to evacuate UK citizens
- Mid May 2011 - Independent HMCI Interim Report on Lessons for the UK Nuclear Industry (NPPs)
- October 2011 - Independent HMCI Final Report on Lessons for the UK Nuclear Industry (All nuclear facilities)
- January 2012 – Stress Tests on UK NPPs reported
- May 2012 – Stress Tests on other UK nuclear facilities published

HMCI Interim Report on Lessons for UK Nuclear Industry

Key Messages:

- Confident no fundamental weakness in UK nuclear facilities or systems
- No matter how high the standards, the quest for improvement must never stop
- Vital to learn lessons and take action
- Underlying it all is a need for a vibrant and active safety culture

HMCI Interim Report: General Recommendations

International:

- Improve dissemination of information
- UK support review and implementation of international safety standards

UK:

- Lessons for contingency planning
- Review UK nuclear emergency arrangements and associated technical methods
- Examine planning control adequacy for developments near nuclear installations
- Enhance Openness and Transparency, including by legislative means during ONR statutory corporation creation



Recommendations for the Regulator

- Review Safety Assessment Principles
- Consider exercising long term accidents
- Review ONRs response to severe accidents
- Expand oversight of research



Main Recommendations for Industry

- Review dependency on off-site supplies - enhance self sufficiency
- Review flooding studies
- Ensure adequate safety cases for new sites with multi reactors
- Ensure adequacy of spent fuel management strategies
- Review plant layout
- Ensure adequacy of the design of new spent fuel ponds



Main Recommendations for Industry

For Severe Accidents:

- Ensure all plant needed for accident response are protected and capable of operating
- Review training for severe accident management
- Establish the robustness of the UK electrical grid
- Review the need for long term diverse supplies
- Review contingency plans for pond water make up
- Review venting routes
- Review provision of control and communications



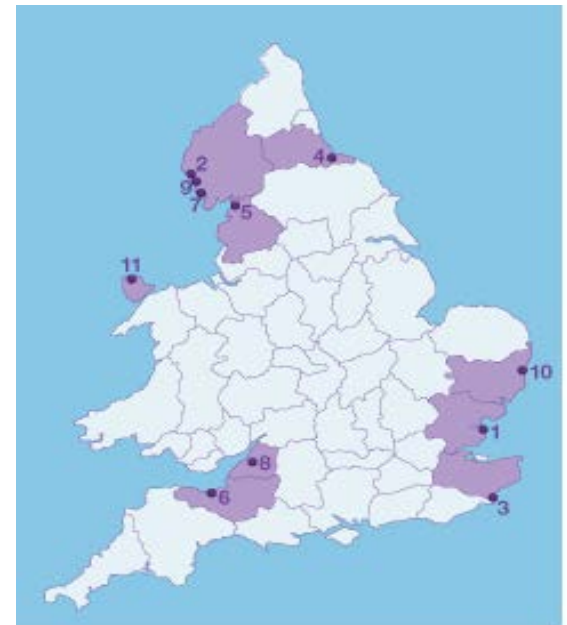
Main Recommendations for Industry

- Need for hardened emergency response capability



Prospects for UK Nuclear Industry

- Still energy security and supply issues and climate change agenda
- Still a vast and expanding need to decommission and deal with radioactive waste
- Unique position?
 - Lessons identified and action taken: recovered position post Fukushima
 - Public opinion
 - Parliamentary Continued Wide Support
 - Government policy
 - GDA & site licensing on track



Prospects for UK Nuclear Industry

But ...

- Must be seen to continue addressing lessons with full vigour and utmost commitment
- Must expand openness and transparency
- Must continue to develop and embed a vibrant nuclear safety culture, especially in supply industry
- Must deliver commitments and actions for enhancement

NEA
Committee on Nuclear Regulator Activities
(CNRA):

Special Task Group - Fukushima

CNRA Special Task Group - Fukushima

CNRA Senior-level Task Group (STG-FUKU) established on the Impacts of the Fukushima Daiichi NPS Accident

- STG-FUKU has held five formal meetings & many other informal interactions
- First meeting was held 4 – 6 May 2011
 - Shortly after the accident & acute crisis phase.
 - Sharing information on the accident
 - Exchanging information on Member countries initial actions
- Fifth meeting was held 26-28 February 2013
 - Final report to CNRA
 - Embedding future work into main stream CNRA activities.
- A status report of STG-FUKU's activities and results to CNRA in June 2013
 - Considered and approved for publication.

STG-FUKU

- Provided advice to CNRA/NEA on:
 - Member countries immediate, medium and longer term responses
 - Key safety issues for consideration
 - Regulatory priorities for scientific and technical tasks
 - Identified and requested new scientific and technical tasks for CSNI
 - Re-assessment of Accident Management issues (TGAM)
 - Development of a thorough understanding of the accident progression (CSNI)
 - Review of pre-cursor events (WGOE)
 - The CNRA Task Group on Accident Management (TGAM)
 - Nuclear Site Selection and Preparation (WGRNR)
 - Crisis Communication (WGPC)
 - Re-assessment of concept of Defence in Depth and its implementation.

Enhancement of Defence in Depth

OECD/NEA International Conference on
Global Nuclear Safety Enhancement, Tokyo
Japan, 8 April 2014

Defence in Depth levels

Level of defence in depth	Plant Status	Objective	Essential Means
Level 1	Normal Operation	Prevention of abnormal operation and failures by design	Conservative design, construction, maintenance and operation in accordance with appropriate safety margins, engineering practices and quality levels
Level 2	Operational Occurrences	Control of abnormal operation and detection of failures	Control, limiting and protection systems and other surveillance features
Level 3	Accidents	Control of accidents within the design basis	Engineered safety features and accident procedures
Level 4	Beyond Design Base Accidents	Control of severe plant conditions in which the design basis may be exceeded, including the prevention of fault progression and mitigation of the consequences of severe accidents	Additional measures and procedures to prevent or mitigate fault progression and for on-site emergency management
Level 5	Significant off site release of radioactivity	Mitigation of radiological consequences of significant releases of radioactive materials	Accident management and off-site emergency response

Workshop on Challenges and Enhancements to Defence in Depth in light of the Fukushima Dai-ichi Accident

One-day workshop jointly organised by the CNRA and the CSNI and held in Paris on 5 June 2013.

➤ Participation

- All NEA member countries were invited to participate.
- Senior regulators, senior industry representatives, international organisations

➤ Main Conclusions:

- DiD Concept remains valid, but strengthening maybe needed
- Implementation needs further work, in particular regarding external hazards
- Additional guidance to harmonize implementation
- Improvement focus not just to prevent accidents but also to mitigate the consequences
- CNRA to discuss in December 2013 the conclusions from the DiD workshop and decide on future NEA tasks – developing special publication

Main issues – Effective DiD Implementation (1/2)

- Implementation of DiD - especially on external and rare events. Combination of external events. Human made events. Boundaries for external events.
- Ability to quantify the risk posed by external events. Tools and guidance for PSA for external events
- Management of uncertainty in DiD. Establishing additional margins as well as appropriate flexibility. Managing the unknown/unexpected. Reducing uncertainties, via research.
- New technical challenges – digital I&C, SFP, recovery, multiple units site, long term scenarios, etc.
- DiD application to new reactors and fuel cycle facilities. Splitting DiD level 3 for new reactors (single vs multiple events)
- DiD training
- The human and organizational elements of DiD.

Main issues – Effective DiD Implementation (2/2)

- Level 5 of DiD (emergency planning and response) would benefit from guidance on effective implementation.
- Level 5 guidance on balancing radiation risks with other risks, regarding evacuation.
- Long term aspects of emergency response and post accident management.
- Interaction on-site and off-site emergency response – Level 5
- Emergency response coordination with national and international organisations.
- Crisis communication external to the country.

Main issues – Refining DiD Concept (1/2)

- Discussion of End Safety Goal to better include the prevention of social disruption (Societal and Economic consequences). Protection of the public in the broad sense.
- Strengthening the concept and application of “practical elimination” approach
- Independence of barriers between levels and margins within each level. Reasonably achievable. Practical approach
- Balance prevention and mitigation appropriately within DiD and in each level

Main issues – Refining DiD Concept (2/2)

- Accident should never be ruled out, so arrangements to deal with emergencies always needed
- Post accident management. Minimising social disruption when return to an area post accident is intended. Land use limitations
- Low frequency/high consequence events can breach all levels of DiD
- Cross cutting issues. Human and organisational issues. Safety culture impact on both licensee and regulatory authority.
- DiD applied to Nuclear System.

Defence in Depth levels

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Institutional defence in depth system

A. Strong Competent “self regulating” **Industry**

B. Strong **Regulator**

C. Strong Competent **Stakeholders**

- Each barrier is **Independent** and has **Sub-barriers** within it
- Industry and the Regulator have to:
 - have **openness, transparency and accountability** as a way of life
 - have an underpinning strong vibrant **safety culture and nuclear values**
 - **welcome challenge** with passion to improve

Barrier A

– Strong Competent Self Regulating Nuclear Industry

Components of the Nuclear Industry Barrier in a State or Region

I.1	I.2	I.3	I.4
Licensee	State/Region Industry Peer Pressure	International Industry Peer Pressure/Review	International Institutional Review
SQEP Technical/Design/operational capability	Safety Directors Forum, INPO, etc.	WANO Missions and Requirements	IAEA OSART Missions
Independent Nuclear Safety Assessment	Nuclear Industry Association, Nuclear Energy Institute, ANS	Bilateral/Multilateral Organisations e.g. CANDU Owners Group	
Nuclear Safety Committee			

Nuclear Leadership/Culture/Values

Barrier B

- Strong Independent Competent Nuclear Regulator

Components of a Strong Institution Regulatory Barrier

R.1	R.2	R.3	R.4
Regulatory Authority	Special Outside Technical Advice	International Peer Pressure	International Peer Reviews
World Class Technical/Regulatory Capability	E.g. Standing Panel of experts nominated by stakeholders – CNI Advisory Panel/ Groupe Permanent d' Experts	NEA CNRA & CSNI committees and working groups	IAEA IRRS missions
Organisational Structure with internal standards, assurance, OEF, policy, strategy, etc.	Special Expert Topic Groups <ul style="list-style-type: none"> - Fukushima - Aircraft Crash 	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/Values

Barrier C

- Strong Well Informed Competent Stakeholders

Components of the Strong Stakeholder Institutional Barrier

S.1	S.2	S.3	S.4	S.5	S.6	S.7
Workers	Public	Parliament	National & Local Gov.	Neighbours	Media	NGOs
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, Assurance – Industry/Regulator Culture and Capability						

Conclusions

Duty of Nuclear Professionals Worldwide:



To Work Together, Learn and Enhance Nuclear Safety



To better ensure the protection of People and Society to allow the benefits of the peaceful use of nuclear energy to be realised

NEA Continues to Act as a Prime Agent in this regard