NEA Plans for Strengthening International Implementation of the Application of DiD Philosophies in Nuclear Power Countries

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IAEA Conference on Topical Issues in Nuclear Installation Safety:
Defence in Depth Advances and Challenges for Nuclear Installation Safety
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Outline of Presentation

- The OECD/NEA three DiD related tasks post Fukushima Daiichi Accident.
- Combined work member countries consider NEA should carry forward to enhance understanding and implementation of DiD.
- Summary of tasks and NEA International Programme of Activities.

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NEA DiD related Activities Post Fukushima Accident

NEA established three streams of work related to DiD immediately post Fukushima accident and subsequently in the months that followed:

a) Fukushima Senior Task Group and its subsequent Lessons Learnt Report.

b) A joint CNRA/CSNI workshop on “Challenges and Enhancements to Defence in Depth (DiD) in light of the Fukushima Daiichi Accident” on 5 June 2013.

c) A reassessment of accident management issues.

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The Fukushima Senior Task Group [1/2]

- Examine generic implications and lessons learnt from the event.
- Identify areas where in-depth evaluations would be of benefit at the international level.
- Define the activities that could be undertaken by new task groups of the CNRA or the NEA Committee on the Safety of Nuclear Installations (CSNI) in order to address gaps that were not addressed within the scope of an existing groups.
- Role of programme/oversight official and co-ordinator for the CNRA overall co-ordination of the NEA integrated response from CNRA, CSNI and CRPPH.
- Coordination was essential as all three standing committees had separate work streams which had overlaps.
- Coordination facilitated an effective and efficient exchange of information and response.

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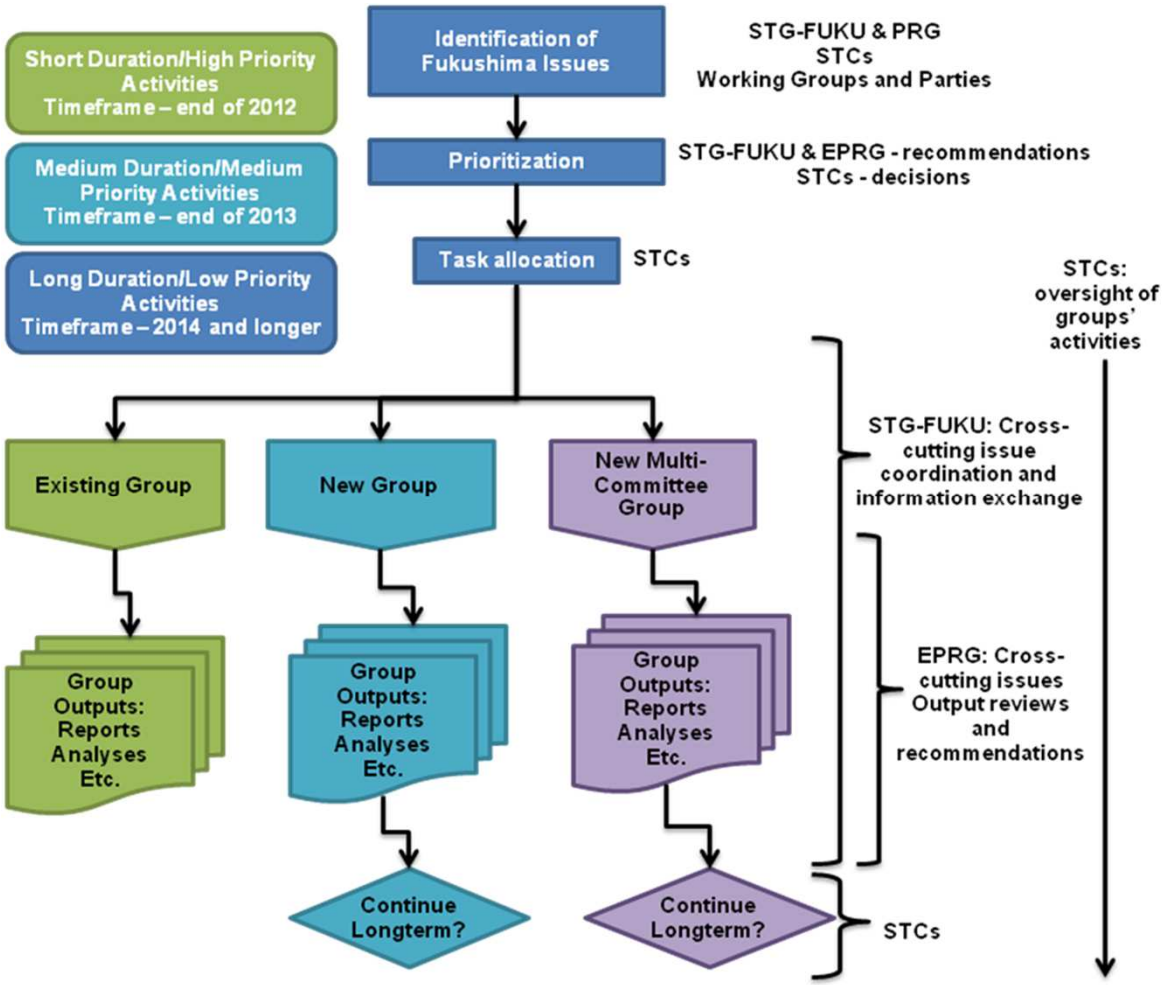
The Fukushima Senior Task Group [2/2]

NEA Tri-Committee Coordination Process



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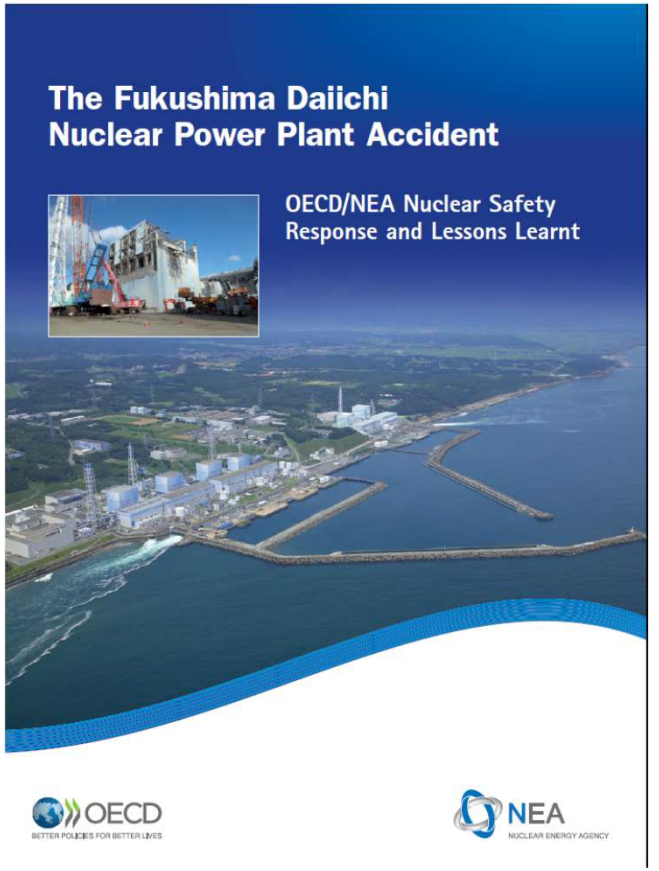
Fukushima review

NEA Report
The Fukushima Daiichi Nuclear Power Plant Accident OECD/NEA Nuclear Safety Response and Lessons Learnt



http://home.nea.fr/pub/2013/7161-fukushima2013.pdf

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Work Areas identified by Fukushima Review [1/2]

- Scoped and approved within WG using NEA CAPS system (Committee Activity Proposal Sheet)
- F-CAPS monitored
  - accident management and progression;
  - crisis or emergency communications;
  - evaluation of the methodologies for defining and assessing initiating internal and external events;
  - reassessment of operating experience (precursor events);
  - regulatory infrastructure;
  - radiological protection; and
  - decontamination and recovery.

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Work Areas identified by Fukushima Review [2/2]

Importantly,

- **Reassessment of DiD including the balance of deterministic and probabilistic approaches to regulatory decision making**.
- Work was identified for both regulators and those directly involved in the management of the safety of nuclear safety.

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New Task Group and Joint Research Projects

- Task Group on Accident Management (TGAM) to review accident management practices in light of the Fukushima Daiichi NPP accident. (DiD natural part of scope)
- ROBELSYS – ROBustness of ELectrical SYStems
- Joint Nuclear Safety Research Projects
  - Benchmark Study of the Accident at the Fukushima Daiichi Nuclear Power Plant (BSAF)
  - HYMERES Hydrogen Mitigation Experiments for Reactor Safety (HYMERES)
  - PKL3 (Findings from PKL2 and PKL are available)
  - ATLAS

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Fukushima Review

DiD Concept and implementation

- Need to strengthen the implementation of the concept of DiD that has been developed and refined over many years.
- NEA Steering Committee Debate on DiD.
- Although the concept of DiD is valid, issues have been raised regarding its implementation that need to be further reviewed and improved.
- One implication of the accident is that DiD and its implementation may have been applied and worked well against internal events, but it worked less well against external hazards.

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The joint CNRA/CSNI workshop on Challenges and Enhancements to Defence in Depth in light of the Fukushima Dai-ichi Accident on 5 June 2013

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Work Areas identified within the Joint Workshop [1/3]

- Exploring what the DiD safety goal concept “practically eliminate large and early offsite releases” means and how is it implemented.
- The importance of a strong safety culture and questioning attitude within both the operating and regulatory organisations.
- The need to establish regulatory boundaries for consideration of external hazards within the context of the design bases and the implementation of DiD.

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Work Areas identified within the Joint Workshop [2/3]

- Being prepared to address the unknown and unexpected scenarios using safety margins and DiD concepts.
- Common mode failures can breach all DiD barriers considering low probability high consequence events.
- Independence and margins in the implementation of DiD.
- Adequate margins within Levels to account for uncertainty and expand robustness.
- Need to revisit and improve long-term emergency preparedness with realism to improve efficient response and recovery.

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Work Areas identified within the Joint Workshop [3/3]

- Reinforcement of PSA for external hazards but consider the limitation of the methodology.
- New approaches for safety management of external hazards individually and in combination.
- Human interventions considering catastrophic external events effects on emergency response and recovery.
- Technical issues to be addressed (i.e., Digital I&C, multi-unit impacts, SFP, long term SBO, and loss of UHS, etc.).
- Detailed identification of additional safety research after Fukushima.

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Task Group on Accident Management

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Objectives and Activities

- **Objectives**
  - ✓ Identify measures to enhance regulations and regulatory guidance for operators' accident management activities.
  - ✓ Identify commendable regulatory practices that support enhanced onsite accident management response and decision-making.
- **Activities**
  - ✓ Act as a focal point for the timely and efficient exchange of information.
  - ✓ Identify commendable practices that are being implemented in the area of accident management.
  - ✓ Identify areas and issues, and associated priorities that would benefit from in-depth evaluation or research.
  - ✓ Identify short-term and long-term follow-on activities, and associated priorities for the Task Group.
  - ✓ Make recommendations for activities for current CNRA, CSNI, and CRPPH working groups.

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Status of Report

- Report is being produced to deliver the objectives.
- Three meetings have been held.
- Target is delivery of the report to the CNRA at its December 2013 meeting.
- Key outcome is a concept: Integrated Accident Management.

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Integrated Accident Management

Definition

- The enhancement of the original accident management into a comprehensive approach, combining existing good practices and new findings coming from post Fukushima studies.
- Refers to all arrangements needed to manage as efficiently as possible any accident affecting a nuclear power plant with potential release of radioactive material.
- Addresses accidents resulting from all kinds of initiators.
- Addresses all operating states of the reactor (operating or shutdown, of long or short duration), the kinetics and the duration of the accident.
- Integrates all available on-site and off-site resources, even if not preliminarily dedicated for accident management.

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Integrated Accident Management

Goals

- Contributes to the **DiD** approach to assure safety.
- Covers the whole spectrum of any accident affecting an NPP, but is focused on the **Beyond Design Basis Accidents** and applies to accident conditions more severe than a design basis accident, and may or may not involve nuclear fuel degradation.
- The objectives of IAM are to **Prevent the Escalation**, **Mitigate the Consequences**, and to achieve a **Long-Term Safe Stable State.**
- IAM includes both preventive and mitigative arrangements – first to prevent severe accidents – then to mitigate.
  - ✓ Priority to the preventive arrangements.
  - ✓ If significant fuel damage shift to mitigative arrangements.
  - ✓ Preventive arrangements – aim at preventing significant fuel degradation or damage,
  - ✓ Mitigative arrangements – aim at ensuring the integrity of the containment and the spent fuel pool building and minimizing radioactive releases into the environment.

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Report – Further Detailed Exploration

Report is providing further detail in what work is required and why in the following areas

- Guidelines and procedures related to accident response and the transition from short-term to long-term responses.
- Equipment, instrumentation, and infrastructure required to deal with accident management .
- Human and organisational issues including resource requirements and what is effective training for accident management in short- and long-term timeframes.

Further work has already been defined for NEA working groups within CSNI and CNRA

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Conclusions

- This presentation is a summary of those NEA international programme of activities to bring its members together in those areas they highlighted to deliver enhancement in the understanding and implementation of defence in depth.
- NEA has initiated significant on-going activities related to Defence in Depth that have been drawn out of its three main work streams.
- The research work stream is a fundamental building block of defence in depth concepts.
- Further investigations are required in some areas to either enhance existing work programmes or devise new ones.
- Overall further development is on-going to devise enhancements to existing work or identify clear new work programmes.

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Thank you for your attention

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