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NEA activities on safety research after the Fukushima Daiichi accident

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Outline

- Overview of the CSNI
- Examples of CSNI activities addressing Fukushima Daiichi lessons-learned
- Safety Research activities
- Conclusions

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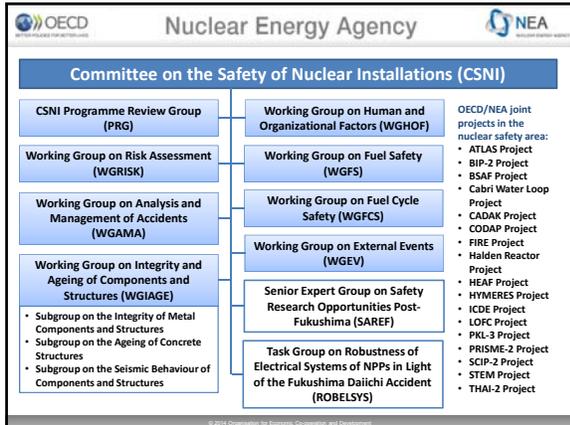



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CSNI Methods of Work

- Objective: Address potential safety issues common to many or all of the OECD/NEA member countries
 - Work tends to focus on operating reactors, but can also support new reactors
- Working Groups established for broad technical areas with ongoing work programmes
- Task Groups address short-term activities (~3 years)
- Cooperative research projects share resources on experimental or database activities of common interest

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- CSNI post Fukushima Activities**
- Following Fukushima, a number of high priority tasks were identified and undertaken:
 - *Technical Status Report on Filtered Containment Venting* (WGAMA - Analysis and Management of Accidents):
 - Summary of current practise and technical basis for venting
 - *Status Report on Hydrogen Risk Management and Related Computer Codes* (WGAMA):
 - Summary of technology for mitigating hydrogen and modelling hydrogen behaviour
 - *Workshop on Natural External Events including Earthquake* (WGRISK – Risk Assessment):
 - Current experience with using PSA for external events
 - *Workshop on the Robustness of Electrical Systems of NPPs in Light of the Fukushima Daiichi Accident* (Task Group):
 - Best practises for ensuring reliable electrical supply

- CSNI post Fukushima Activities**
- (cont.)
 - *Status Report on Spent Fuel Pool under Loss of Cooling Accident Conditions* (WGAMA and WGFS – Fuel Safety)
 - Current knowledge base of fuel pool response to threats
 - *Metallic Component Margins under High Seismic Loads* (WGIAGE – Integrity and Ageing of Components and Structures)
 - Assessment of margins for cooling systems in an earthquake
 - *Human Performance and Intervention under Extreme Conditions* (WGHOF – Human and Organisational Factors)
 - Best practises for supporting effective response to severe accidents
 - *International benchmarking project of fast-running software tools for the estimation of fission product releases during accidents at NPPs* (WGAMA)
 - Experience with applying tools to other reactor types

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CSNI post Fukushima Activities

- Senior Expert Group on Safety Research Opportunities Post-Fukushima:
 - Recommend information that should be obtained from Fukushima during the decommissioning/dismantlement process in order to further the knowledge base among members about severe accident progression.
- Working Group on External Events:
 - Fukushima, along with current PRAs, showed that a large part of the risk to a nuclear plant is from natural external events.
 - CSNI had few activities to look at how natural external events are handled among the various member countries, where major uncertainties remained, and what cooperation work could be done to address these uncertainties.
 - Initial focus is on severe weather events with high winds and a risk of flooding

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Concept of SAREF

Task 1: We will identify the needs for additional safety knowledge of common interest:

- Review/screen possible research topics,
- Interact with other groups (e.g. BSAF), if required.

Potential topic areas

- Source terms
- Seismic response
- Hydrogen behaviour
- Containment behaviour
- Chemistry effects of seawater
- Human factors
-

BSAF Project: Ongoing

Decommissioning activity at Fukushima

Task 2: We will identify what kind of data could be made available from Fukushima:

- Collect information from relevant Japanese organizations.

Task 3: We will identify possible safety research activities in the common region:

- Create proposals for each of them.

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Example of SAREF "Ranking Table"

Research Area	Safety Interest	Decomm. interest	Info. available from Fukushima	Challenges (cost, timing, dose, etc.)	Feasibility	Ongoing/planned research activities
FP release, Source term	HIGH Public dose assessment, EQ, Reducing uncertainty, in dose significant FPs - e.g. Te, Ru	HIGH Strategy for debris removal, sealing of leak paths, worker dose, etc.	AVAILABLE: On-site release data NEED: In-plant distribution and overall speciation	• Accessibility of deposition data, • Isotope decay making analysis uncertain	Difficult and not much info. in short term	Supporting info. from OECD joint projects, NUGENIA, nat'l programmes
Hydrogen behaviour	HIGH Hydrogen risk management, Identify the amount, leak path	HIGH Close relation to plant damage and debris removal process	AVAILABLE: Damage data of Unit 4 RB NEED: Damage data of Units 1/3	---	---	Several analytical activities ongoing in Japan
Mission time, Survivability (RCIC, cables, seals etc.)	HIGH Reconsideration of mission time for safety and reliability	---	---	---	---	---
Seismic response	MEDIUM Impact on plant equipment, structures	LOW May help to understand the possible impacts of seismic events during decomm.	---	---	---	Better data from other plants (not subject to accidents)
Human performance	HIGH	LOW	AVAILABLE: Fukushima event investigation reports in Japan	---	Difficult Unlikely to obtain additional info. from site	Data from Fukushima known Led by WGHDF

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Safety Research Projects (SRP)

- Collaborative research between OECD/NEA Member countries or associated members in compliance with the rules and regulations applicable to the OECD (see Article 5 of the Statute of the OECD/NEA)
- SRP Status
 - 10 Active Projects in progress
 - 5 Projects closing
 - 1 Project starting
 - 4 Ongoing Databases
 - Total 20 Active Workstreams
 - Potentially 4 project follow-ups
 - 26 Completed Projects

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Safety Research Projects related to Fukushima Daiichi accident

- **BSAF: Benchmark Study of the Accident at the Fukushima Daiichi Nuclear Power Station**
✓ Proposed by Japan.
- **HYMERES: Hydrogen Mitigation Experiments for Reactor Safety**
✓ Hosted by Switzerland and France.
- **ATLAS: Beyond-design-basis accidents**
✓ Hosted by the Republic of Korea.
- **PKL-3: Accident management for PWRs**
✓ Hosted by Germany.

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BSAF Project: Phase 1

- full-scope severe accident analysis for the first ~6 days to analyse the accident progression of the units 1 to 3;
- to improve the understanding of SA phenomena, through comparison of analytical results with measured plant data;
- to improve methods and models of the SA codes, by reducing uncertainties in SA analysis and validating the SA codes with measured plant data;
- to contribute to the planning of the future debris removal and decommissioning process.
- preliminary observations:
 - generally consistent results where uncertainties in safety system performance are less
 - Where safety systems may have been able to function, although impaired (e.g. cooling systems in Unit 3), predictions of the core damage state have more variation

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Conclusions

- The CSNI has a broad programme of work addressing knowledge gaps and safety research requirements of common interest, including lessons learnt from Fukushima Daiichi accident.
- Primary focus is operating reactors, with improvements and safety assessment tools being applicable also to new reactors
- Coordinated International Research Projects support both evolving good practice and underpinning experimental needs

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