



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

Review of Japan 2011 Nuclear Event: Implications for Canadian Nuclear Power Plants



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Presentation Outline

🍁 What we have done to date

- How are we learning?

🍁 Initial lessons learned

- Domestic
- International

🍁 Path forward

CNSC Initial Response to Fukushima

Domestic:

- ✿ Activate Emergency Operations Centre and staff Nuclear Emergency Organization
- ✿ Create a Japan Executive Team (senior CNSC executives)
- ✿ 24-7 operation with Technical, External Liaison, Communications and Logistics teams
- ✿ Worked closely with other federal and provincial governments

Internationally:

- ✿ Established links with USA, UK, FRA regulators
 - Daily teleconferences
 - Information exchange and validation
- ✿ IAEA
 - CNSC access to IAEA secure emergency info web site
 - Canadian mission at IAEA in Vienna (VPERM)
- ✿ Two Canadian experts to Vienna to support IAEA
 - CNSC
 - AECL

How We Are Learning

- 🍁 12(2) Request to Industry
- 🍁 CNSC Task Force
- 🍁 External Review of Process

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CNSC's Request Under 12(2)

- ✦ Address CNSC's request for information as committed in the initial response to the 12(2) letter:
 - *“review initial lessons learned from the earthquake in Japan and re-examine the safety cases of nuclear power plants, in particular the underlying defence-in-depth concept, with focus on:*
 - *external hazards such as seismic, flooding, fire and extreme weather events;*
 - *measures for prevention and mitigation of severe accidents;*
 - *emergency preparedness; and*
 - *report on implementation plans for short-term and long-term measures to address any significant gaps”*
- ✦ Report on implementation plans should:
 - provide a plan and schedule for completion of short-term and long-term measures
 - identify measures that have already been put in place
 - identify any previously planned activities that have been accelerated as part of the lessons learned

CNSC's Request Under 12(2)

- Review initial lessons learned, with focus on:
 - External hazards such as seismic, flooding, fire and extreme weather events
 - Measures for prevention and mitigation of severe accidents
 - Emergency preparedness
- Report on implementation plans for short and long term to address any significant gaps

CNSC's Request Under 12(2): Licensees' Responses

🍁 Licensees' responses to date:

- provided requisite initial response, identifying proposed plans and schedule to meet CNSC's request
- concluded that overall safety case remains strong
 - but continue to identify potential improvements
- accelerated implementation, especially in severe accident management and emergency preparedness

CNSC's Task Force: Mandate

- ✿ Evaluate operational, technical and regulatory implications of the Japan 2011 events
- ✿ Focus on plant, spent-fuel pool and site behaviour, taking into account:
 - external hazards and common mode events that could impact Canadian NPPs
 - accident progression where different levels of protection are assumed failed
 - severe accident management
 - off-site emergency response
 - regulatory requirements

CNSC's Task Force: Outputs

- ❖ Identification of potential design and operational measures to minimize risk associated with severe accidents (likelihood and consequences)
- ❖ Priorities for implementation of risk control measures
- ❖ Recommendations for potential changes to CNSC's regulatory requirements

Risk Assessment

- ❖ An extended stress test
- ❖ Focus on consequences
- ❖ External events:
 - Will include man-made events
 - No random combinations: must be consequential or directly related
- ❖ DBAs/BDBAs/Severe Accidents:
 - Verify margins to core/severe core/containment damage
 - Cliff-edge effects and preventive measures

Risk Assessment: Severe Accident Scenarios

- ❖ Prolonged Loss of Heat Sinks:
 - loss of electrical power, service water, etc.
 - other consequential failures (e.g. LOCA)
- ❖ Progressive failure of back-up supplies, for example:
 - loss of electrical power (up to station blackout)
 - loss of service water
- ❖ Containment bypass
- ❖ Multi-unit events

Severe Accident Management (SAMG)

- ❖ Prompt completion of station-specific SAMGs:
 - Identify what equipment can be used for severe accident mitigation and where it is located
 - Identify what can and cannot be done (equipment survivability, capability, accessibility) based on experience and judgment
 - Develop Enabling Instructions, etc.
 - Consider multi-unit conditions, where necessary
- ❖ Consider Regulatory Guide G-306: *Severe Accident Management Programs for Nuclear Reactors*

Severe Accident Management (cont'd)

❖ Station-specific SAMGs:

- Assessment of station's instrumentation performance under severe accident conditions
- Safety analyses to validate selected strategies for severe accident management and support: SAMG entry criteria, Identification of challenges (e.g. to containment), Estimation of timing of challenges, Identification of system requirements to mitigate challenges, etc.
- Identification and evaluation of possible design modifications for accident mitigation
- Interface with Provincial and Municipal Emergency Management Organizations

Severe Accident Management (cont'd)

🍁 Off-Site Support for SAMGs:

- Provision of external supplies and mobile devices, including:
 - water, fuel, power, people
- Inter-utility cooperation and support

External Review

- 🍁 Review team members to be chosen from outside the nuclear industry
- 🍁 To review adequacy of CNSC's processes and confirm that they were followed
- 🍁 Not a technical review

Initial Lessons Learned - CANDU/Domestic

🍁 Some CANDU Specifics

- Venting
- Multi-unit events
- Implementation of hydrogen recombiners
- Completion of severe accident management guidelines

🍁 Emergency Management in Canada

- Exercising agency interfaces
- Communicating with stakeholders
 - The Internet Age
- Personnel
- Source term modelling

Initial Lessons Learned-International

International Events

- Domestic plans and international events
- Preparing for cross-boundary events

Generic Technical Observations

- Off-site support for SAMGs
- Inter-utility cooperation and support
- Formalizing support arrangements

Path Forward

- Completion of the task force report
- Validation of our findings:
 - External review panel
 - IRRS
 - CNS Extraordinary Review Meeting
- Implementation: short/medium/long term

Concluding Remarks

- 🍁 Detailed and in-depth program
- 🍁 Our licensees have completed all required short-term actions
- 🍁 Canadian facilities are safe
- 🍁 Potential improvements areas noted
- 🍁 Independent reviews
- 🍁 Canada looks forward to learning with our partners



**We Will Never
Compromise
Safety...**

...It's In Our DNA!



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