Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

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SUPPLEMENTAL/COMPLÉMENTAIRE
CMD: 12-M23.B
Date signed/Signé le : 2012-04-25

CNSC Action Plan: Lessons Learned from the Fukushima Nuclear Accident

Plan d'action de la CCSN : Leçons apprises sur l'incident nucléaire de Fukushima

Public Meeting
scheduled for:
May 3, 2012

Réunion publique
Prévue pour le :
03 mai 2012

Information regarding:

Actions required by the CNSC to address the recommendations of the CNSC Fukushima Task Force, External Advisory Review Committee and comments from the public and stakeholders

Information relative aux :

Mesures requises de la part de la CCSN pour donner suite aux recommandations du Groupe de travail de la CCSN sur Fukushima et du Comité consultatif externe ainsi qu'aux commentaires reçus du public et des parties intéressées.

Submitted by:
CNSC staff

Soumise par :
Le personnel de la CCSN

Canada

Summary

The purpose of this supplemental CMD is to seek Commission acceptance of the *CNSC Action Plan*.

Résumé

Le présent CMD supplémentaire a pour objet d'obtenir l'acceptation de la Commission du Plan d'action de la CCSN.

Signed/signé le
2012-04-25

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Executive Summary

On March 11, 2011, a magnitude 9.0 earthquake, followed by a devastating tsunami, struck Japan. The combined impact of the earthquake and tsunami on the Fukushima Daiichi nuclear power plant caused a severe nuclear accident. In response to these events, the Canadian Nuclear Safety Commission (CNSC) issued an order requesting Class I nuclear facilities, under subsection 12(2) of the *General Nuclear Safety and Control Regulations*, to re-examine the safety cases of their nuclear power plants. In April 2011, the CNSC established the CNSC Fukushima Task Force to review licensees' responses to the request.

The EAC concluded that the process followed by the CNSC in responding to the Fukushima crisis was appropriate and identified nine recommendations. CNSC Management accepted these EAC recommendations. CNSC staff modified the draft *CNSC Staff Action Plan*, where applicable, to reflect the EAC's views and those received from the public and stakeholders during the three rounds of public consultations. The revised plan is now called the *CNSC Action Plan.*

This Commission member document (CMD) presents the *CNSC Action Plan*, which includes the measures encompassing the EAC recommendations. These measures will be implemented in a phased approach in the short-term, medium-term and long-term timeframe. Progress will be reported to the Commission in August of each year as part of the *CNSC Staff Integrated Safety Assessment of Canadian Nuclear Power Plants* and other CNSC annual industry reports that include non-NPP nuclear facilities.

1.0 Overview

On March 11, 2011, a magnitude 9.0 earthquake, followed by a devastating tsunami, struck Japan. The combined impact of the earthquake and tsunami on the Fukushima Daiichi nuclear power plant caused a severe nuclear accident. In response to these events, the Canadian Nuclear Safety Commission (CNSC) issued an order requesting Class I nuclear facilities, under subsection 12(2) of the *General Nuclear Safety and Control Regulations*, to re-examine the safety cases of their nuclear power plants (NPPs). In April 2011, the CNSC established the CNSC Fukushima Task Force (Task Force) to review licensees' responses to the request.

On September 30, 2011, the Task Force completed its review and presented its findings and recommendations in the *CNSC Fukushima Task Force Report*[1] (Task Force Report). The Task Force made 13 recommendations to further enhance the safety of nuclear power plants in Canada with emphasis on:

- the capability of Canadian nuclear power plants to withstand conditions similar to those that triggered the Fukushima nuclear accident
- emergency preparedness and response in Canada
- the effectiveness of the CNSC regulatory framework
- international collaboration

The CNSC subsequently embarked on a series of consultations with the public and stakeholders, seeking their input so as to provide added awareness of the nuclear accident and to share the measures being planned by the CNSC to address the lessons learned from its safety reviews. These include:

- October 28, 2011: Round 1 consultation on the *Task Force Report* and accompanying *CNSC Management Response*
- December 21, 2011: Round 2 consultation on the draft *CNSC Staff Action Plan on the CNSC Fukushima Task Force Recommendations* and the comments received during round 1
- March 2, 2012: Round 3 consultation on the *CNSC Staff Action Plan on the CNSC Fukushima Task Force Recommendations* and comments received during round 2
- May 3, 2012: Presentation of the final *CNSC Action Plan* to the Commission for approval

On August 5, 2011, the President of the CNSC established an external advisory committee (EAC) to assess the organization's processes and responses in light of the lessons learned from the Fukushima nuclear incident. The recommendations from the EAC were considered together with all comments received during the three rounds of consultation. Where applicable, these recommendations were adopted into the final *CNSC Action Plan on the Lessons Learned from the Fukushima Nuclear Accident* (CNSC Action Plan).

2.0 External Advisory Committee Report

On April 12, 2012, the external advisory committee submitted its report[2] to the President of the CNSC, Dr. Michael Binder. In the report, the EAC drew some general conclusions and made nine recommendations.

[1] nuclearsafety.gc.ca/pubs_catalogue/uploads/October-2011-CNSC-Fukushima-Task-Force-Report_e.pdf
[2] nuclearsafety.gc.ca/eng/pdfs/japan-earthquake/April-2012-Final-Report-of-the-EAC_CNSC-Response-to-the-Japanese-Nuclear-Event_e.pdf

2.1 Conclusions of the EAC Report

The EAC concluded that the process followed by the CNSC in responding to the Fukushima Daiichi nuclear event was appropriate. Notably, the CNSC had immediately activated its emergency operations centre and established contacts with a wide array of stakeholders, both domestically and internationally. Furthermore, the CNSC made it a priority to obtain and make publicly available science-based information regarding the event through regular updates.

Within one week, the CNSC set a process in motion for examining the situation regarding Canadian facilities and for determining whether any measures were required to protect against issues that were identified from lessons being learned from Japan. This process included a flexible, open and transparent process with three opportunities for public input in the development of the *CNSC Action Plan* to strengthen defence-in-depth in Canadian nuclear power plants, enhance emergency preparedness and response in Canada and improve the CNSC regulatory framework and processes.

2.2 EAC Recommendations

2.3 Planned Implementation of EAC Recommendations

The EAC recommendations have been reviewed and addressed in the following three categories:

- communication and public education (EAC recommendation 8)
- application of Fukushima lessons learned to non-NPP facilities (EAC recommendation 5)
- *CNSC Action Plan* (EAC recommendations 1, 2, 3, 4, 6, 7 and 9, which pertain to NPPs)

The recommendations in the first two categories are addressed below, since the EAC has recommendations that were not covered by the original *CNSC Action Plan*.

The other EAC recommendations were included under the appropriate section of the *CNSC Action Plan* (section 3 of this CMD).

Communication and Public Education

EAC Recommendation 8 – The EAC recommends that the CNSC develop a comprehensive communication and education strategy that includes the use of various tools including social media and expands partnerships and relationships with various science media organizations that have the ability to inform the public on nuclear safety.

CNSC staff has already taken the following concrete steps towards enhancing communications with stakeholders, strengthening readiness, and improving co-operation and ties with organizations involved in the dissemination of information related to nuclear safety.

Social media – Social media tools have been added or are in the process of being added (RSS feed and "share this page" tool for over 200 platforms are already in place, CNSC launched its Facebook page February 2012, a CNSC Youtube channel will be launched before fall 2012, Twitter is currently under consideration).

Web enhancements – The CNSC is committed to developing new content in plain language to better cover all safety-significant aspects of the operation of nuclear facilities on an ongoing basis, including measures in place to deal with nuclear emergencies. The CNSC has also already initiated regular updates on current topics of interest to the general public and stakeholders, including on subjects specific to the *CNSC Action Plan* and emergency preparedness. A revamp of the Web site is planned for January 2013, to improve navigation.

Education – The CNSC has educational initiatives underway such as an Educational Resources section which has been added to our Web site. Phase 2 is underway and targets senior students. CNSC On-Line is a new web-based educational resource tool created to explain the nuclear fuel lifecycle and nuclear safety in plain language to Canadians. This interactive tool includes graphics and illustrations. The CNSC has also recently developed "CNSC 101 Information Sessions", which are held for stakeholders in communities across the country to present information to and answer questions from Canadians on how the nuclear industry is regulated. In addition, the CNSC is a partner in the Canada Science and Technology Museum's Energy Exhibit.

Crisis Web site – As a result of the Fukushima event, the CNSC realized the importance of a "crisis Web site" and is expediting its development for Fall 2012. The architecture has been approved and the CNSC is currently in the process of creating content to populate it. The site will be ready to be launched in the event of a major nuclear emergency.

Media training – More specialists / subject matter experts will be trained throughout fiscal 2012–13. The emphasis of training to be delivered is on crisis communications.

Co-operation with science-based partners – The CNSC has worked with the Science Media Centre of Canada in the past, including during the Fukushima event. We will proactively engage the Centre and continue to provide recommendations on our trained subject matter experts. We will continue to explore the possibility of developing partnerships with other educational science-based institutions.

International co-operation – CNSC Communications representatives will meet with international peers and make presentations at international forums to exchange best practices and lessons learned from the Fukushima crisis. Discussions at the NEA's Crisis Communications Workshop in Madrid, Spain in May 2012 and at the IAEA International Experts' Meeting on Enhancing Transparency and Communication Effectiveness in the event of a Nuclear or Radiological Emergency in Vienna in June 2012 will focus on crisis communications and emergency preparedness.

Application of Fukushima Lessons Learned to non-NPP Facilities

EAC Recommendation 5 - The EAC recommends that the CNSC clarify its position on the 12(2) orders with respect to the non-NPPs.

CNSC staff accepts the recommendation that the position for facilities other than NPPs could be clarified. The CNSC Fukushima Task Force was mandated to focus on NPPs for two reasons. Firstly, the accident was at an NPP and therefore the early lessons learned were most relevant to NPPs. Secondly, NPPs, unlike almost all other nuclear facilities, require cooling for a significant period after shutdown to maintain nuclear safety. This adds a level of complexity to accident management and emergency response at an NPP, which does not exist at other facilities. Given this complexity, CNSC staff applied a risk-informed approach and focused their reviews on NPPs.

However, the 12(2) order was also issued to all other major facilities licensees. The review of the submissions received in response did not reveal the need for any immediate regulatory measures. The loss of power or shutdown cooling was not identified as a potential issue. For most facilities, the review focused on potential improvements to emergency response to deal with extreme events, recognizing that some facilities, such as uranium mines, which are remotely located, have always had to plan to deal with a full range of emergencies. Given that the emergency response situation is facility specific, CNSC staff choose to deal with these facilities under normal regulatory oversight. No additional scenarios were identified by Fukushima reviews that would lead to significant releases of radioactive material to the environment.

The one exception is the NRU reactor at CRL which is operated by AECL. Since the NRU reactor was in the process of re-licensing in 2011, the response from AECL on Fukushima was incorporated into the CNSC staff licence renewal reviews. The appropriate Fukushima-related actions were added to the licence and NRU improvement plan in October 2011. These changes cover the relevant parts of Task Force recommendations 1 to 6. This was an important part of the public hearings on the licence renewal in June and October 2011, and CNSC staff will be updating progress on implementation on an annual basis to the Commission.

The impact of Fukushima on other facilities has been discussed routinely with the Commission at licence renewals (e.g., Cameco's Blind River and Port Hope facilities) and update reports to the Commission (e.g., Cameco's mines and mills) since March 2011. Where necessary, follow-up actions to Fukushima lessons learned have been included in licences and licence condition handbooks.

Where the Task Force recommended changes to the regulatory framework, all proposed changes are being reviewed to determine to see if they are applicable beyond NPPs. For example, **Action 7.1** to amend the *Class I Nuclear Facilities Regulations* to require NPP licensees to submit offsite emergency plans is being considered for all Class I facilities, not just NPPs.

CNSC staff will provide the Commission and the public a more holistic view of the status of the Fukushima lessons learned for non-NPPs, starting with the 2011 Performance Report for Fuel Cycle Facilities.

CNSC Staff provided an overview of the Fukushima lessons learned for fuel cycle facilities in the *2011 Performance Report* and will be providing a progress report on the implementation of the *CNSC Action Plan* to the Commission in October 2012.

3.0 CNSC Action Plan

CNSC staff modified the draft *CNSC Staff Action Plan,* where applicable, to reflect the EAC's views and those received from the public and stakeholders during the three rounds of public consultations. The revised plan is now called the *CNSC Action Plan.*

The *CNSC Action Plan* is to be accepted by the Commission.

Development of the CNSC Action Plan

The *CNSC Action Plan* is based on the findings and recommendations of the Task Force which led to the development of specific actions on licensees and the CNSC to strengthen defence-in-depth, enhance emergency response, improve the regulatory framework and enhance international collaboration.

The independent review conducted by the EAC complemented the findings of the Task Force, particularly in areas of shared responsibilities with other government departments or international regulators. The EAC recommendations have been mapped to the associated CNSC Task Force recommendations and are included in the *CNSC Action Plan.*

The *CNSC Action Plan* includes 33 actions needed to address the Task Force Report recommendations. These are grouped in the following four categories:

Part 1 – Strengthening reactor defence-in-depth
Part 2 – Enhancing emergency response
Part 3 – Improving regulatory framework and processes
Part 4 – Enhancing international collaboration

In addition, for added clarity, the CNSC Task Force Recommendations were assigned titles as shown in the table below.

Consistent with the CNSC Management Response, the *CNSC Action Plan* will be implemented in a phased approach in the short-term, medium-term and long-term timeframe as shown in the table.

Task Force Recommendations	Implementation timeline		
	Short term (Dec 2012)	Medium term (Dec 2013)	Long term (Dec 2015)
Strengthening Reactor Defence-in-depth			
1. Verify Robustness of NPP designs	✓	✓	✓
2. Assessment of Site-Specific External Hazards		✓	
3. Enhance Modelling Capabilities		✓	
Enhancing Emergency Response			
4. Assess Emergency Plans (Onsite)	✓		
5. Update Emergency Facilities and Equipment	✓		
6. Offsite Emergency Plans and Programs		✓	
Improving the Regulatory Framework and Processes			
7. *Class I Nuclear Facilities Regulations* Amendments		✓	
8. *Radiation Protection Regulations* Amendments		✓	
9. Update Regulatory Document Framework	✓	✓	
10. Amend Power Reactor Operating Licences (PROLs)	✓		
11. Implementation of Periodic Safety Reviews (PSRs)	✓		
Enhancing International Cooperation			
12. Enhance Collaboration with CANDU Owner Countries	✓		
13. Enhance International Cooperation	✓		

For each Task Force Recommendation, the structure of the information provided in the *CNSC Action Plan* is as follows:

- Task Force Recommendation
- Associated EAC Recommendation(s)
- Actions arising from the recommendations[3]
    - Action Items (specific deliverables with timelines) needed to meet the Action
- Implementation details for the overall recommendations

[3] Actions arising from the recommendations also take into consideration the comments received from the public and stakeholders.

Part 1 – Strengthening reactor defence-in-depth

The CNSC Task Force confirmed that Canadian NPPs are safe and have a robust design that relies on multiple layers of defence. The design ensures that there will be no impact on the public from external events that are regarded as credible. The design also offers protection against more severe external events that are much less likely to occur. Nevertheless, the CNSC Task Force recommended strengthening each layer of defence built into the Canadian NPP design and licensing philosophy.

Human and organizational performance (HOP) is integral to all design, analysis and procedural activities and supports all levels of defence-in-depth. The CNSC has in place, as part of the design-basis operation, a comprehensive HOP program that assesses elements such as safety culture, minimum shift complement and fitness for service. CNSC staff will examine HOP in beyond-design-basis scenarios and accident management.

Furthermore, CNSC staff will review regulatory documents to ensure that they adequately address all potential external hazards, including tornadoes. Any identified changes will be addressed through the existing regulatory document preparation process.

Certain design enhancements for severe accident management – such as containment performance to prevent unfiltered releases of radioactive products, control capabilities for hydrogen and other combustible gases, and adequacy and survivability of equipment and instrumentation – will be evaluated and implemented wherever practicable. Some have already been implemented. The following sections describe those actions that are needed to strengthen each layer of defence-in-depth.

Recommendation 1 – Verify the Robustness of NPP designs

Task Force Recommendation

Licensees should systematically verify the effectiveness of, and supplement where appropriate, the existing plant design capabilities in beyond-design-basis accident and severe accident conditions, including:

a) overpressure response of the main systems and components **(Actions 1.1, 1.2)**
b) containment performance to prevent unfiltered releases of radioactive products **(Action 1.3)**
c) control capabilities for hydrogen and other combustible gases:
    i) accelerate installation of the hydrogen management capability and sampling provisions **(Action 1.4)**
    ii) include spent fuel bays and any other areas where hydrogen accumulation cannot be precluded **(Action 1.5)**
d) make-up capabilities for the steam generators, primary heat transport system and connected systems, moderator, shield tank and spent fuel bays **(Actions 1.6, 1.7, 1.8, 1.9)**
e) design requirements for the self-sufficiency of a plant site such as availability and survivability of equipment and instrumentation following a sustained loss of power and capacity to remove heat from a reactor **(Action 1.10)**
f) control facilities for personnel involved in management of the accident **(Action 1.9)**
g) emergency mitigating equipment and resources that could be stored offsite and brought onsite if needed **(Action 1.11)**

EAC Recommendation 6
The EAC recommends that the CNSC examine the area of human and organizational factors to achieve a more complete understanding of lessons learned from the Fukushima crisis. **(This recommendation has been applied to actions 1.3, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11.)**

CNSC Staff Actions

1.1 Action:
Licensees should submit additional evidence (e.g., test results) that provide confidence in the bleed condenser / degasser condenser relief capacity.

Action Item(s)[4]:
- **1.1.1** An updated evaluation of the capability of bleed condenser / degasser condenser relief valves providing additional evidence that the valves have sufficient capacity.
- **1.1.2** If required, a plan and schedule either for confirmatory testing of installation or provision for additional relief capacity.

Applicable to: All sites

Timeline: Completion by end of December 2012.

1.2 Action:
Licensees should re-examine the capability of the shield tank / calandria vault relief to discharge steam produced in a severe accident. The benefits of sustainability of shield tank heat sink during accident conditions should also be re-examined.

Action Item(s):
- **1.2.1** An assessment of the capability of shield tank / calandria vault relief.
- **1.2.2** If relief capacity is inadequate, an assessment of the benefit available from adequate relief capacity and the practicability of providing additional relief.
- **1.2.3** If additional relief is beneficial and practicable, a plan and schedule for provision of additional relief.

Applicable to: All sites

Timeline: Completion by end of December 2013.

1.3 Action:
Licensees should evaluate the means to prevent the failure of the containment systems and, to the extent practicable, unfiltered releases of radioactive products in beyond-design-basis accidents including severe accidents. If unfiltered releases of radioactive products in beyond-design-basis accidents including severe accidents cannot be precluded, then additional mitigation should be provided. This assessment should consider elements of HOP under accident conditions.

[4] Action Item(s) denote site-specific Fukushima Action Items (FAIs) listed at Appendix D of CMD 12-M23.

Action Item(s):

1.3.1 Assessments of adequacy of the existing means to protect containment integrity and prevent uncontrolled release in beyond-design-basis accidents including severe accidents.

1.3.2 Where the existing means to protect containment integrity and prevent uncontrolled releases of radioactive products in beyond-design-basis accidents including severe accidents are found inadequate, a plan and schedule for design enhancements to control long-term radiological releases and, to the extent practicable, unfiltered releases.

Applicable to: All sites

Timeline: Completion by end of December 2015.

1.4 Action:

Licensees should complete the installation of passive autocatalytic recombiners (PARs) as quickly as possible.

Action Item(s):

1.4.1 A plan and schedule for the installation of PARs as quickly as possible.

Applicable to: All sites

Timeline: Completion by end of December 2012.

1.5 Action:

If draining of the irradiated fuel bay (IFB) following a beyond-design-basis event cannot be precluded, the need for hydrogen mitigation should be evaluated.

Action Item(s):

1.5.1 An evaluation of the potential for hydrogen generation in the IFB area and the need for hydrogen mitigation.

Applicable to: All sites

Timeline: Completion by end of December 2013.

1.6 Action:

Licensees should evaluate the structural integrity of the IFB at temperatures in excess of the design temperature limit. If structural failure cannot be precluded, then additional mitigation (e.g., high-capacity make-up or sprays) should be provided. Consequences of the loss of shielding should be evaluated. This assessment should consider elements of HOP under accident conditions.

Action Item(s):

1.6.1 An evaluation of the structural response of the IFB structure to temperatures in excess of the design temperature, including an assessment of the maximum credible leak rate following any predicted structural damage.

1.6.2 A plan and schedule for deployment of any additional mitigating measures shown to be necessary by the evaluation of structural integrity.

Applicable to: All sites

Timeline: Completion by end of December 2013.

1.7 Action:
Licensees should evaluate means to provide coolant make-up to the primary heat transport system, steam generators, moderator, shield tank / calandria vault, spent fuel pools and dousing tank where applicable. Means include:

1. Coolant makeup to prevent severe core damage.
2. If severe core damage cannot be precluded, then the make-up coolant should be used in severe accident management guidelines (SAMG) to mitigate the severe accident.

This assessment should consider elements of HOP under accident conditions.

Action Item(s):
1.7.1 A plan and schedule for optimizing existing provisions and putting in place additional coolant make-up provisions and supporting analyses.

Applicable to: All sites

Timeline: Completion by end of December 2013.

1.8 Action:
Licensees should provide a reasonable level of confidence that the means (e.g., equipment and instrumentation) necessary for severe accident management and essential to the execution of SAMGs will perform their function in the severe accident environment for the duration for which they are needed. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
1.8.1 A detailed plan and schedule for performing assessments of equipment and instrumentation survivability, and a plan and schedule for equipment upgrade where appropriate based on the assessment.

Applicable to: All sites

Timeline: Completion by end of December 2013

1.9 Action:
Licensees should ensure the habitability of control facilities under conditions arising from beyond-design-basis and severe accidents. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
1.9.1 An evaluation of the habitability of control facilities under conditions arising from beyond-design-basis and severe accidents and, where applicable, detailed plan and schedule for control facilities upgrades.

Applicable to: All sites

Timeline: Completion by end of December 2014.

1.10 Action:
Licensees should investigate means of extending the availability of power for key instrumentation and control (I&C) needed in accident management actions following a loss of all AC power. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
1.10.1 An evaluation of the requirements and capabilities for electrical power for key instrumentation and control. The evaluation should identify practicable upgrades that would extend the availability of key I&C, if needed.
1.10.2 A plan and schedule for deployment of identified upgrades. A target of eight hours without the need for offsite support should be used.

Applicable to: All sites

Timeline: Completion by end of December 2012.

1.11 Action:
Licensees should procure, as quickly as possible, emergency equipment and other resources that could be either stored onsite or stored offsite and brought onsite to mitigate a severe accident. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
1.11.1 A plan and schedule for procurement.

Applicable to: All sites

Timeline: Completion by end of December 2012.

Planned Implementation of Recommendation 1

The measures outlined in these actions are addressed by licensees through site-specific action items that were opened for each site on February 17, 2012. These are described in **Appendix A** to this CMD 12-M23.B.

The expression “closed” used in the Appendix is an interim indicator to show that the action may not apply to that specific site, or that the licensee has already submitted the information requested by CNSC Staff.

Final closure is dependant on the outcome of CNSC staff assessment and the Commission acceptance of the *CNSC Action Plan*.

Recommendation 2 – Assessment of Site-Specific External Hazards

Task Force Recommendation

Licensees should conduct more comprehensive assessments of site-specific external hazards to demonstrate that:

a) considerations of magnitudes of design-basis and beyond-design-basis external hazards are consistent with current best international practices **(Action 2.1)**
b) consequences of events triggered by external hazards are within applicable limits **(Action 2.2)**

Such assessments should be updated periodically to reflect gained knowledge and modern requirements.

EAC Recommendation 6
The EAC recommends that the CNSC examine the area of human and organizational factors to achieve a more complete understanding of lessons learned from the Fukushima crisis. **(This recommendation has been applied to action 2.1.)**

EAC Recommendation 7
The EAC recommends that the CNSC clarify its plans to address tornado hazards. **(This recommendation has been applied to action 2.1.)**

CNSC Staff Actions

2.1 Action:
Licensees should complete the review of the basis for external events against modern state-of-the-art practices for evaluating external events magnitudes and relevant design capacity for these events, including but not limited to: earthquake, floods, tornadoes and fire. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
Through implementation of the current S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*:

2.1.1 Re-evaluate, using modern calculations and state-of-the-art methods, the site-specific magnitudes of each external event to which the plant may be susceptible.
2.1.2 Evaluate if the current site-specific design protection for each external event assessed in 1 above is sufficient. If gaps are identified a corrective plan should be proposed.

Applicable to: All sites

Timeline: Completion by end of December 2013.

2.2 Action:
Implementation of RD-310, *Safety Analysis for Nuclear Power Plants*, is already in progress and being tracked by the CNSC/Industry Safety Analysis Improvement Initiative working group.

Action Item(s):
2.2.1 No new requirement since it is already being implemented.

Applicable to: All sites

Timeline: Completion by end of December 2013.

Planned Implementation of Recommendation 2

The measures outlined in these actions are addressed by licensees through site-specific action items that were opened for each site on February 17, 2012. These are described in **Appendix A** to this CMD 12-M23.B.

Recommendation 3 – Enhance Modelling Capabilities

Task Force Recommendation

Licensees should enhance their modelling capabilities and conduct systematic analyses of beyond-design-basis accidents to include analyses of **(Actions 3.1, 3.2)**:

a) multi-unit events
b) accidents triggered by extreme external events
c) spent fuel bay accidents

The analyses should include estimation of releases, into the atmosphere and water, of fission products, aerosols and combustible gases.

EAC Recommendation 6

The EAC recommends that the CNSC examine the area of human and organizational factors to achieve a more complete understanding of lessons learned from the Fukushima crisis. **(This recommendation has been applied to actions 3.1, 3.2.)**

CNSC Staff Actions

3.1 Action:

1. Licensees should develop/finalize and fully implement severe accident management guidelines (SAMGs) at each station.
2. Licensees should expand the scope of SAMGs to include multi-unit and IFB events.
3. Licensees should demonstrate effectiveness of SAMGs. Licensees should validate and/or refine SAMGs to demonstrate their adequacy in the light of lessons drawn from the Fukushima Daiichi nuclear accident.

This assessment should consider elements of HOP under accident conditions.

Action Item(s):

3.1.1 Where SAMGs have not been developed/finalized or fully implemented, provide plans and schedules for completion.

3.1.2 For multi-unit stations, provide plans and schedules for the inclusion of multi-unit events in SAMGs.

3.1.3 For all stations, provide plans and schedules for the inclusion of IFB events in station operating documentation where appropriate.

3.1.4 Demonstrate the effectiveness of SAMGs via table-top exercises and drills.

Applicable to: All sites

Timeline**:** Completion by end of December 2013.

3.2 Action:
Licensees of multi-unit NPPs should develop improved modelling of multi-unit plans in severe accident conditions or demonstrate that the current simple modelling assumptions are adequate. This assessment should consider elements of HOP under accident conditions.

Action Item(s):

3.2.1 An evaluation of the adequacy of existing modelling of severe accidents in multi-unit stations. The evaluation should provide a functional specification of any necessary improved models.

3.2.2 A plan and schedule for the development of improved modelling, including any necessary experimental support.

Applicable to: All sites (multi-unit accident conditions are not applicable to Point Lepreau and Gentilly-2)

Timeline: Completion by end of December 2012.

Planned Implementation of Recommendation 3

The measures outlined in these actions are addressed by licensees through site-specific action items that were opened for each site on February 17, 2012. These are described in **Appendix A** to this CMD 12-M23.B.

Part 2 – Enhancing emergency response

The CNSC Task Force also confirmed that the current status of emergency preparedness and response measures in Canada, both the onsite and offsite preparedness and response, remain adequate. Nevertheless, the Task Force identified further improvements to be achieved through streamlining emergency preparedness between onsite and offsite authorities. These improvements should consider HOP which is integral to design, analysis and procedural activities and supports all levels of defence-in-depth, including accident management.

These improvements are described in the actions outlined below. Commission consideration will be sought for all measures required to strengthen interaction with provincial and federal emergency planning authorities and where legislation may be needed. The CNSC has no regulatory mandate to interact in these areas; nevertheless, the CNSC is committed to facilitating discussions and liaising with appropriate regulatory authorities to address the concerns expressed by the Task Force.

Recommendation 4 – Assess Emergency Plans (Onsite)

Task Force Recommendation

Licensees should assess emergency plans to ensure emergency response organizations will be capable of responding effectively in a severe event and/or multi-unit accident, and conduct sufficiently challenging emergency exercises based on them. **(Actions 4.1, 4.2)**

EAC Recommendation 6

The EAC recommends that the CNSC examine the area of human and organizational factors to achieve a more complete understanding of lessons learned from the Fukushima crisis. **(This recommendation has been applied to action 4.1, 4.2.)**

CNSC Staff Actions

4.1 Action:

Licensees should evaluate and revise their emergency plans in regard to multi-unit accidents and severe external events. This activity should include an assessment of their minimum complement requirements to ensure their emergency response organizations will be capable of responding effectively to multi-unit accidents or to severe natural disasters. This assessment should consider elements of HOP under accident conditions.

Action Item(s):

4.1.1 An evaluation of the adequacy of existing emergency plans and programs.

4.1.2 A plan and schedule to address any gaps identified in the evaluation.

Applicable to: All stations (multi-unit accident conditions are not applicable to Point Lepreau and Gentilly-2)

Timeline: Completion by end of December 2012.

4.2 Action:

Licensees should review their drill and exercise programs to ensure that they are sufficiently challenging to test the performance of the emergency response organization under severe events and/or multi-unit accident conditions. This assessment should consider elements of HOP under accident conditions.

Action Item(s):

4.2.1 A plan and schedule for the development of improved exercise program.

Applicable to: All stations (multi-unit accident conditions are not applicable to Point Lepreau and Gentilly-2)

Timeline: Completion by end of December 2012.

Planned Implementation of Recommendation 4

The measures outlined in the actions are addressed by licensees through site-specific action items that were opened for each site on February 17, 2012. These are described in **Appendix A** to this CMD 12-M23.B.

Recommendation 5 – Update Emergency Facilities and Equipment

Task Force Recommendation

Licensees should review and update their emergency facilities and equipment, in particular:

a) ensure operability of primary and backup emergency facilities and of all emergency response equipment that require electrical power and water **(Action 5.1)**
b) formalize all arrangements and agreements for external support and document these in the applicable emergency plans and procedures **(Action 5.2)**
c) verify or develop tools to provide offsite authorities with an estimate of the amount of radioactive material that may be released and the dose consequences, including the installation of automated real-time station boundary radiation monitoring systems with appropriate backup power **(Actions 5.3, 5.4)**

EAC Recommendation 6

The EAC recommends that the CNSC examine the area of human and organizational factors to achieve a more complete understanding of lessons learned from the Fukushima crisis. **(This recommendation has been applied to action 5.1, 5.2.)**

CNSC Staff Actions

5.1 Action:

Licensees should review primary and alternate emergency facilities, and all emergency response equipment that requires electrical power to operate (e.g., electronic dosimeters, two-way radios), to make sure that appropriate backup power sources exist. The requirements and limitations should be documented in the applicable emergency plans and procedures. This assessment should consider elements of HOP under accident conditions.

Action Item(s):

5.1.1 An evaluation of the adequacy of backup power for emergency facilities and equipment.

5.1.2 A plan and schedule to address any gaps identified.

Applicable to: All sites

Timeline: Completion by end of December 2012.

5.2 Action:
Licensees should formalize all arrangements and agreements for external support and should document these in the applicable emergency plans and procedures. This assessment should consider elements of HOP under accident conditions.

Action Item(s):
5.2.1 Identify the external support and resources that may be required during an emergency.
5.2.2 Identify the external support and resource agreements that have been formalized and documented.
5.2.3 Confirm if any undocumented arrangements can be formalized.

Applicable to: All sites

Timeline: Completed by end of December 2012.

5.3 Action:
Licensees should install automated real-time station boundary radiation monitoring systems with appropriate backup power and communications systems.

Action Item(s):
5.3.1 Provide a project plan and installation schedule.

Applicable to: All sites

Timeline: Completion by end of December 2012.

5.4 Action:
Licensees should develop source term estimation capability including dose modelling tools.

Action Item(s):
5.4.1 Provide source term and dose modelling tools specific to each NPP.

Applicable to: Hydro-Québec and NB Power

Timeline: Completed by end of December 2012.

Planned Implementation of Recommendation 5

The measures outlined in these actions are addressed by licensees through site-specific action items that were opened for each site on February 17, 2012. These are described in **Appendix A** to this CMD 12-M23.B.

Recommendation 6 – Offsite Emergency Plans and Programs

Task Force Recommendation

Federal and provincial nuclear emergency planning authorities should undertake a review of their plans and supporting programs, such as **(Action 6.1)**:

a) ensuring plan revision activities are expedited and making regular full-scale exercises a priority
b) establishing a formal, transparent, national-level oversight process for offsite nuclear emergency plans, programs and performance
c) reviewing the planning basis of offsite arrangements in view of multi-unit accident scenarios
d) reviewing arrangements for protective action including resolving the issues pertaining to public alerting, validating the effectiveness of potassium iodide (KI) pill-stocking and distribution strategies and verifying, or developing the capability for predicting, offsite effects.

EAC Recommendation 3

The EAC recommends that the CNSC work with other government departments to ensure better coordination and redefinition of departmental roles and responsibilities should a nuclear accident occur in Canada, the United States or overseas. **(This recommendation has been applied to action 6.1.)**

EAC Recommendation 4

The EAC recommends that the CNSC meet with its partner organizations and licensees to establish the frequency and extent of multi-level emergency exercises. **(This recommendation has been applied to action 6.1.)**

EAC Recommendation 9

The EAC recommends that, as the Canadian nuclear safety regulator, the CNSC should play an active role in ensuring that emergency planning exercises with the United States are conducted regularly. **(This recommendation has been applied to action 6.1.)**

CNSC Staff Actions

6.1 Action:

CNSC staff will meet with provincial and federal nuclear emergency planning authorities to ensure understanding of recommendations and findings.

Action Item(s):

6.1.1 CNSC staff will participate in activities led by respective provincial and federal authorities and initiate adequate CNSC regulatory framework or oversight measures to address recommendations.

Applicable to: All sites and federal and provincial emergency planning authorities

Timeline: Completion by end of December 2013.

Planned Implementation of Recommendation 6

Meetings with key federal organizations are being planned before July 2012, and federal/provincial workshops are to be conducted by the end of December 2012. In addition to these workshops, the frequency and extent of multi-level emergency exercises will be discussed in the upcoming meeting of Emergency Management Committee chaired by Public Safety at the Deputy Minister, Assistant Deputy Minister and Director General levels.

The measures outlined in the actions above are addressed by CNSC staff through site-specific action and are described in **Appendix B** to this CMD 12-M23.B.

Part 3 – Improving regulatory framework and processes

The CNSC Task Force reviewed the CNSC regulatory framework and processes and confirmed that the Canadian regulatory framework is strong and comprehensive. Nevertheless, the Task Force identified further improvements to existing regulations and supporting regulatory documents and to the licensing basis to strengthen the oversight of existing programs and of programs currently being considered for potential new nuclear power plants. These are described in each of the actions outlined below.

Recommendation 7 – *Class I Nuclear Facilities Regulations* Amendments

Task Force Recommendation

The CNSC should initiate a formal process to amend the *Class I Nuclear Facilities Regulations* to require NPP licensees to submit offsite emergency plans with an application to construct or operate a nuclear power plant. **(Actions 7.1, 7.2)**

CNSC Staff Action

7.1 Action:
The CNSC will initiate a project to amend the *Class I Nuclear Facilities Regulations* to require submission of applicable provincial and municipal offsite emergency plans along with evidence to support how the licensees are meeting the requirements of those plans to the CNSC as part of the licence application or licence renewal process.

Action Item(s):

7.1.1 The CNSC will prepare proposed amendments to the *Class I Nuclear Facilities Regulations* for consultation in *Canada Gazette Part I* and submit to the Commission for approval to proceed.

7.1.2 The CNSC will review results of consultation and prepare final amendments to the *Class I Nuclear Facilities Regulations* and propose them to the Commission for enactment.

Applicable to: CNSC staff

Timeline: Completed by December 2013.

Planned Implementation of Recommendation 7

The measures outlined in these actions will be addressed by CNSC staff following the established Government of Canada process for regulatory amendments. The proposed amendments will be posted in *Canada Gazette Part I* for formal consultation after which CNSC staff will request that the Commission make the amendments.

Recommendation 8 – *Radiation Protection Regulations* Amendments

Task Force Recommendation

The CNSC should amend the *Radiation Protection Regulations* to be more consistent with current international guidance and to describe in greater detail the regulatory requirements needed to address radiological hazards during the various phases of an emergency. **(Action 8.1)**

CNSC Staff Action

8.1 Action:

The CNSC will initiate a project to amend the *Radiation Protection Regulations* to introduce additional clarity on emergency dose limits for workers and to establish return-to-work criteria.

Action Item(s):

8.1.1 The CNSC will prepare and consult on a discussion paper on potential amendments to the *Radiation Protection Regulations* which will include proposed amendments to the emergency provisions in the regulations.

8.1.2 The CNSC will prepare proposed amendments to the *Radiation Protection Regulations* for consultation in the *Canada Gazette Part I* and submit them to the Commission for approval to proceed.

8.1.3 The CNSC will review results of consultation and prepare final amendments to the *Radiation Protection Regulations* and propose them to the Commission for enactment.

Applicable to: CNSC staff

Timeline: Completed by end of December 2013.

Planned Implementation of Recommendation 8

The measures outlined in these actions will be addressed by CNSC staff following the established Government of Canada process for regulatory amendments. The proposed amendments will be posted in *Canada Gazette Part I* for formal consultation after which CNSC staff will request that the Commission make the amendments.

Recommendation 9 – Update Regulatory Document Framework

Task Force Recommendation

The CNSC should update the regulatory document framework through:

a) updating selected design-basis and beyond-design-basis requirements and expectations, including those for **(Action 9.1)**:
   i) external hazards and the associated methodologies for assessment of magnitudes
   ii) probabilistic safety goals
   iii) complementary design features for both severe accident prevention and mitigation
   iv) passive safety features
   v) fuel transfer and storage
   vi) design features that would facilitate accident management

b) developing a dedicated regulatory document on accident management **(Action 9.2)**

c) strengthening the suite of emergency preparedness regulatory documents **(Action 9.3)**
d) reviewing applicable Canadian Standards Association standards **(Action 9.4)**

EAC Recommendation 7
The EAC recommends that the CNSC clarify its plans to address tornado hazards. **(Action 9.1)**

CNSC Staff Actions

9.1 Action:
The CNSC will initiate projects to amend applicable regulatory documents in order to incorporate the findings of the CNSC Task Force for both existing and new nuclear power plants.

Action Item(s):

9.1.1 The CNSC will adapt the proposed GD-310, *Guidance on Safety Analysis for Nuclear Power Plants*, prior to publishing it, to address the findings of the CNSC Task Force review findings.

9.1.2 The CNSC will prepare revisions to RD-337, *Requirements and Guidance for Design of New NPPs* and, following a public consultation period, submit them to the Commission for approval to publish.

9.1.3 The CNSC will prepare targeted amendments to specific regulatory documents and, following a public consultation period, submit them to the Commission for approval to publish. These include:

- RD-346, *Site Evaluation for New Nuclear Power Plants*
- S-294, *Probabilistic Safety Assessments for Nuclear Power Plants*
- S-296, *Environmental Protection Policies, Programs, and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills*
- RD-310, *Safety Analysis for Nuclear Power Plants*
- G-306, *Severe Accident Management Programs for Nuclear Reactors*

Applicable to: CNSC staff

Timeline: Completed by end of December 2013.

9.2 Action:
The CNSC will initiate a project to develop a dedicated regulatory document on accident management.

Action Item(s):

9.2.1 The CNSC will prepare a draft document on accident management and, following a period of public consultation, submit it to the Commission for approval to publish.

Applicable to: CNSC staff

Timeline: Completed by end of December 2013.

9.3 Action:
The CNSC will initiate a project to develop a dedicated regulatory document on emergency management.

Action Item(s)**:**

9.3.1 The CNSC will prepare a draft regulatory document on emergency management, reviewing and incorporating existing information in G-225, *Emergency Planning at Class I Nuclear Facilities and Uranium Mines and Mills*, and RD-353, *Testing the Implementation of Emergency Measures* and, following a period of public consultation, submit them to the Commission for approval to publish.

Applicable to: CNSC staff

Timeline: Completed by end of December 2013.

9.4 Action:

The CNSC will support the review of Canadian Standards Association (CSA) Standards to take into account the lessons from the Fukushima Daiichi nuclear accident through its participation in the CSA Nuclear Strategic Steering Committee (NSSC).

Action Item(s):

9.4.1 The CNSC will request the CSA to provide, within the proposed timeline:

1. identification of the issues that need to be addressed in the next review cycles for its Standards.

2. action and work plans to address the identified needs.

Applicable to: CNSC staff

Timeline**:** Completed by end of December 2013.

Planned Implementation of Recommendation 9

The measures outlined in these actions are addressed by CNSC staff following the rigorous process that the CNSC has in place for all regulatory document development. This includes formal public consultation and, as appropriate, Commission approval of any new or revised regulatory requirements.

CNSC staff will review regulatory documents to ensure that they adequately address all potential external hazards, including tornadoes. Any identified changes will be addressed through the existing regulatory document preparation process.

Recommendation 10 – Amend Power Reactor Operating Licences

Task Force Recommendation

The CNSC should amend all power reactor operating licences (PROLs) to include specific licence conditions, requiring implementation of accident management provisions, severe accident management and public information. **(Actions 10.1, 10.2)**

10.1 Action:
Require licensees to have programs for accident management, severe accident management and public communication.

Action Item(s):

10.1.1 A Commission member document (CMD) will be produced for the February 2012 Commission meeting, requesting approval of a new PROL template that will include new licence conditions. The following wording is proposed:

"The licensee shall develop and implement operational guidance and adequate capabilities to deal with abnormal situations, emergencies, and accidents, including severe accidents and, where applicable, multi-unit events."

A licence condition will also be proposed, requiring licensees to implement and maintain a public information program that includes a proactive disclosure protocol. Once RD/GD-99.3, *Public Information and Disclosure*, has been approved for publication (refer to Action 10.2 below for details).

Sections will be added to the NPP Licence Condition Handbook (LCH) template to clarify the compliance verification criteria for the new licence conditions.

10.1.2 The amendments to the existing PROLs will be added to comply with the updated template.

Applicable to: CNSC staff

Timeline:
Item 1: Completion by February 1, 2012.
Item 2: Completion by end of December 2014.

10.2 Action:
The CNSC will continue to develop RD/GD-99.3, *Public Information and Disclosure*, and submit it to the Commission for approval.

Action Item(s):

10.2.1 The CNSC will submit the updated draft RD/GD-99.3 to the Commission for approval to publish at the February 2012 Commission meeting.

10.2.2 The amendments to existing PROLs will be consistent with the implementation timeline set out in Action 10.1.

Applicable to: CNSC staff

Timeline: Completion by end of February 2012.

Planned Implementation of Recommendation 10

Updated licence conditions will be proposed by CNSC staff and submitted to the Commission for approval upon licence amendment or renewal.

RD/GD-99.3 was published in April 2012 and amendments to PROLs will be implemented, subject to Commission approval.

Recommendation 11– Implementation of Periodic Safety Reviews

Task Force Recommendation

The CNSC should further enhance the regulatory oversight of nuclear power plants through the implementation of a periodic safety review process. **(Action 11.1)**

CNSC Staff Action

11.1 Action:
The CNSC will consider the development of a regulatory framework for the implementation of the periodic safety review process.

Action Item(s):

11.1.1 A CMD seeking endorsement to proceed with the development of regulatory requirements for conducting periodic safety reviews by licensees is to be submitted for consideration by the Commission in Fall 2012 at a public Commission meeting.

11.1.2 Amendments to existing PROLs are anticipated to be completed by the end of December 2015 or as set out by the Commission.

Applicable to: CNSC staff

Timeline:
Item 1: Completion by end of December 2012.
Item 2: Completion by end of December 2015.

Planned Implementation of Recommendation 11

CNSC staff are developing an implementation strategy for periodic safety review at existing NPPs. Staff will present a CMD for endorsement by the Commission prior to proceeding with specific licensing actions.

Part 4 – Enhancing International Collaboration

Enhance Transparency of Integrated Regulatory Review Service Missions

As recommended by the EAC, the CNSC will continue to play a strong role in encouraging IAEA member states to seek more frequent IRRS reviews and follow-up missions and be more open and transparent in sharing the outcome of these missions with stakeholders.

The CNSC intends to continue seeking support from IAEA member states to strengthen the effectiveness of the IRRS Mission. These discussions, together with a number of effectiveness proposals to be tabled by Contracting Parties to the Convention on Nuclear Safety (CNS) at the 2nd Extraordinary Meeting of the CNS, in August 2012, will promote Canada's views to strengthen the Convention on Nuclear Safety. These include enhanced openness and transparency, a more rigorous reporting of IRRS Mission findings and follow-up actions in national reports to the triennial review meetings. The proposals will also seek to have triennial review meeting reports to the IEAE Director General convey more detailed information related to major safety lapses or unresolved safety issues identified during the peer-review process, and to have this information communicated to the Board of Governors of the IAEA to ensure they have an opportunity to review and address these lapses directly with the affected parties.

Consistent with the recommendation of the CNSC Task Force to enhance international collaboration (recommendations 12 and 13), the CNSC will also be pursuing discussions with CANDU senior regulators, the first of which took place at a meeting in April 2012 to prepare for the CNS 2nd Extraordinary Meeting. This will provide the CNSC with the opportunity to seek a greater consensus for its proposals.

Foster Greater International Cooperation in Seeking WANO Transparency

As recommended by the EAC, the CNSC will continue to work with other international regulators in convincing WANO members to share the results of their peer-review process to promote nuclear safety in all nations with nuclear power plants.

International initiatives:

- In the Action Plan on Nuclear Safety, the IAEA Secretariat was asked to "strengthen cooperation with WANO by amending their Memorandum of Understanding to enhance information exchange on operating experience and on other relevant safety and engineering areas".
- The IAEA and WANO are increasing their mutual cooperation to maximize nuclear safety efforts around the globe.
- The two organizations are revising their Memorandum of Understanding in light of the lessons learned from the Fukushima accident, and will be stepping up their efforts to share expertise and knowledge between operators and governments.
- There will **be greater coordination between WANO peer reviews and IAEA Operational Safety Assessment Review Team (OSART) missions**, in which international experts assess the safety of individual nuclear power plants, and discussions are underway to examine further areas to improve information sharing.
- At present, WANO rules prohibit the sharing of information contained in their Significant Operating Experience Reports with the regulators because of confidentiality requirements. **The regulators fully understand and respect the integrity of the process**. However, ways

could be established to share certain information in a manner that protects confidentiality. For instance, information on general issues and trends in operational safety, as well as lessons learned, could be shared in summary form, without references to specific utilities or countries, **while maintaining the distinctive features of the program**.

The need for greater cooperation among international regulators was also recognized by the CNSC Task Force which recommended that the CNSC facilitate greater cooperation with international peers. The near term initiatives undertaken by the CNSC to collaborate more closely with senior regulators of CANDU owner countries in preparation for the 2nd Extraordinary Meeting of the CNS are consistent with actions outlined in the *CNSC Action Plan* and provide further opportunities for the CNSC to build consensus on proposed initiatives.

Recommendation 12 – Enhance Collaboration with CANDU Owner Countries

Task Force Recommendation

The CNSC should review memoranda of understanding with regulatory counterparts in countries with CANDU reactors to outline what support, if any, they would require from the CNSC during a nuclear emergency. **(Action 12.1)**

EAC Recommendation 1

The EAC recommends that the CNSC continue to work with regulators of other member states of the IAEA to ensure that the IRRS process is mandatory and transparent, and that the findings and recommendations are enforced. **(Action 12.1)**

EAC Recommendation 2

The EAC recommends that the CNSC work with its fellow regulators in convincing WANO members to share the results of their peer-review process to promote nuclear safety in all nations with nuclear power plants. **(Action 12.1)**

CNSC Staff Action

12.1 Action:
The CNSC is to initiate discussions with CANDU senior regulators to determine areas of interest where mutual support can be offered during a nuclear emergency.

Action Item(s):

12.1.1 The CNSC in collaboration with the IAEA and CANDU senior regulators proposes a meeting in April 2012 in Vienna, Austria, in advance of national report submissions for peer review in May 2012 to establish a common platform for harmonization of future improvements arising from the lessons learned from their independent safety reviews.

Applicable to: CNSC staff

Timeline: Completion by end of May 2012.

Planned Implementation of Recommendation 12

This is a shared responsibility with other CANDU regulators and was considered by the Task Force to foster greater international cooperation and nuclear safety.

Short-term initiatives outlined in recommendation 2 to foster greater international cooperation will also be used to facilitate discussions with Senior Regulators and the IAEA to strongly underline the need for WANO and regulators to work together. The meetings include:

- April 2012, CANDU Senior Regulators' Meeting in Vienna
- August 2012, 2nd Extraordinary Meeting of the CNS

Resolution of these concerns is not foreseen in the immediate future, but rather through careful and sensitive diplomatic undertakings to build consensus over a protracted period of time. The CNSC will continue to seek every opportunity to engage its peers in discussions that lead to greater nuclear safety worldwide.

Recommendation 13 – Enhance International Cooperation

Task Force Recommendation

The CNSC should enhance cooperation with other nuclear regulators in addressing the lessons learned from the Fukushima Daiichi nuclear accident and thus further strengthen the capability to respond efficiently to any nuclear emergency. **(Action 13.1)**

EAC Recommendation 1

The EAC recommends that the CNSC continue to work with regulators of other member states of the IAEA to ensure that the IRRS process is mandatory and transparent, and that the findings and recommendations are enforced. **(This recommendation has been applied to action 13.1.)**

EAC Recommendation 2

The EAC recommends that the CNSC work with its fellow regulators in convincing WANO members to share the results of their peer-review process to promote nuclear safety in all nations with nuclear power plants. **(This recommendation has been applied to action 13.1.)**

EAC Recommendation 3

The EAC recommends that the CNSC work with other government departments to ensure better coordination and redefinition of departmental roles and responsibilities should a nuclear accident occur in Canada, the United States or overseas. **(This recommendation has been applied to action 13.1.)**

EAC Recommendation 9

The EAC recommends that, as the Canadian nuclear safety regulator, the CNSC should play an active role in ensuring that emergency planning exercises with the United States are conducted regularly. **(This recommendation has been applied to action 13.1.)**

CNSC Staff Action

13.1 Action:
Canada, as a signatory to the Convention on Nuclear Safety, is required to participate in triennial review meetings of the Convention and any extraordinary meeting that may be agreed to by contracting parties. The CNSC on behalf of Canada is responsible for coordinating the preparation and submission of the national reports for peer review and the participation of Canadian delegates at the review or extraordinary meetings. The CNSC in collaboration with industry and government stakeholders is to prepare a national report for peer review by contracting parties and to participate at the 2nd Extraordinary Meeting of the Convention on Nuclear Safety on the sharing of lessons learned and actions taken by contracting parties in response to the Fukushima Daiichi nuclear accident.

Action Item(s):

13.1.1 A national report on lessons learned from the Fukushima Daiichi nuclear accident consistent with the requirements established by contracting parties at the 5th Review Meeting in April 2011. The national report is to be submitted to the IAEA Secretariat in May 2012 for peer review by the Convention on Nuclear Safety states and discussed at an Extraordinary Meeting of the Convention in Vienna, Austria, August 27–30, 2012.

Applicable to: CNSC staff

Timeline: Completion by end of September 2012.

Planned Implementation of Recommendation 13

This is a shared responsibility with other international regulators and was considered by the Task Force to foster greater international cooperation and nuclear safety.

Short-term initiatives planned by the CNSC to foster greater international cooperation include:

- April 2012: INRA Meeting in Ottawa
- April 2012: CANDU Senior Regulator Meeting in Vienna
- August 2012: 2nd EM of the CNS
- September 2012: IAEA Board of Governors' Meeting and IAEA General Conference
- April 2014: 6th Review Meeting of the CNS

Resolution of the concerns related to openness and transparency of IAEA IRRS and WANO processes will be a challenging endeavour. It may not be achieved in the immediate future, as it requires significant consensus-building over a protracted period of time. In the interim, the CNSC will continue to seek every opportunity to engage its peers in discussions that lead to greater nuclear safety worldwide.

4.0 Conclusions

5.0 Recommendations

CNSC staff recommends that the Commission accept the *CNSC Action Plan* as presented.

CNSC staff seeks Commission support for the measures required to strengthen interaction with provincial and federal emergency planning authorities and where legislation may be needed. The CNSC is committed to playing a leadership role in facilitating discussions with appropriate regulatory authorities to address the concerns expressed by the Task Force and the EAC.

The *CNSC Action Plan* will be implemented in a phased approach in the short-term, medium-term and long-term timeframe. Progress will be reported to the Commission in August of each year as part of the *CNSC Staff Integrated Safety Assessment of Canadian Nuclear Power Plants* and other CNSC annual industry reports that include non-NPP nuclear facilities.

Appendix A – Action Items – Matrix of Applicability to Stations and Status

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
Recommendation 1								
1	AI 1.1 An updated evaluation of the capability of bleed condenser / degasser condenser relief valves providing additional evidence that the valves have sufficient capacity. December 2012.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	Open	Open	Open	Open
2	AI 1.1.2 If required, a plan and schedule either for confirmatory testing of installation or provision for additional relief capacity. December 2012.	tbd	tbd	tbd	tbd	tbd	tbd	tbd
3	AI 1.2.1 An assessment of the capability of shield tank / calandria vault relief. December 2013.	Closed	N/A	Open tcd 06/12	Open	Open	Closed (subject to acceptance)	Closed
4	AI 1.2.2 If relief capacity is inadequate, an assessment of the benefit available from adequate relief capacity and the practicability of providing additional relief. December 2013.	Closed	N/A	tbd	tbd	tbd	Closed (subject to acceptance)	N/A
5	AI 1.2.3 If additional relief is beneficial and practicable, a plan and schedule for provision of additional relief. December 2013.	Open	N/A	tbd	tbd	tbd	Open tcd Restart	N/A

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
6	AI 1.3.1 Assessments of adequacy of the existing means to protect containment integrity and prevent uncontrolled release in beyond-design-basis accidents including severe accidents. December 2015.	Closed	Open tcd Q4/13	Open tcd Q4/12	Open tcd 06/12	Open tcd 06/12	Closed (subject to acceptance)	N/A
7	AI 1.3.2 Where the existing means to protect containment integrity and prevent uncontrolled releases of radioactive products in beyond-design-basis accidents including severe accidents are found inadequate, a plan and schedule for design enhancements to control long term radiological releases and, to the extent practicable, unfiltered releases. December 2015.	Open tcd 2015	Open tcd Q4/14	Open tcd Q4/14	Open tcd 12/13	Open tcd 12/13	Open tcd Restart	N/A
8	AI 1.4.1 A plan and schedule for the installation of PARs as quickly as possible. December 2012.	Closed	Closed	Closed	Open tcd 03/12	Open tcd 02/12	Closed	Closed
9	AI 1.5.1 An evaluation of the potential for hydrogen generation in the IFB area and the need for hydrogen mitigation. December 2013.	Open tcd Q4/12	Open tcd Q4/13	Open tcd Q4/12	Open	Open	Open	Open
10	AI 1.6.1 An evaluation of the structural response of the IFB structure to temperatures in excess of the design temperature, including an assessment of the maximum credible leak rate following any predicted structural damage. December 2013.	Closed	Open tcd Q1/13	Open tcd Q4/12	Open tcd 12/13	Open tcd 12/13	Open tcd 12/13	Open

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
11	AI 1.6.2 A plan and schedule for deployment of any additional mitigating measures shown to be necessary by the evaluation of structural integrity. December 2013.	N/A	tbd	tbd	tbd	tbd	tbd	tbd
12	AI 1.7.1 A plan and schedule for optimizing existing provisions (to provide coolant makeup to PHTS, SGs, moderator, etc) and putting in place additional coolant make-up provisions, and supporting analyses. December 2013.	Open tcd Q1/13	Open tcd Q1/13	Open tcd Q1/13	Open tcd 12/13	Open tcd 12/13	Open tcd 12/13	Open
13	AI 1.8.1 A detailed plan and schedule for performing assessments of equipment survivability, and a plan and schedule for equipment upgrade where appropriate based on the assessment. December 2013.	Open tcd 12/13	Open tcd 12/13	Open tcd 12/13	Open tcd 12/13	Open tcd 12/13	Open tcd Restart	Open tcd 12/13
14	AI 1.9.1 An evaluation of the habitability of control facilities under conditions arising from beyond-design-basis and severe accidents. Where applicable, detailed plan and schedule for control facilities upgrades. December 2014.	Open tcd Q4/12	Open tcd Q4/13	Open tcd Q4/13	Open tcd 12/14	Open tcd 12/14	Open tcd 12/14	Open
15	AI 1.10.1 An evaluation of the requirements and capabilities for electrical power for key instrumentation and control. The evaluation should identify practicable upgrades that would extend the availability of key I&C, if needed. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
16	AI 1.10.2 A plan and schedule for deployment of identified upgrades. A target of 8 hours without the need for offsite support should be used. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12
17	AI 1.11.1 A plan and schedule for procurement (of emergency equipment and other resources that could be stored offsite). December 2012.	Closed (subject to acceptance)	Closed (subject to acceptance)	Closed (subject to acceptance)	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12
Recommendation 2								
18	AI 2.1.1 Re-evaluation, using modern calculations and state-of-the-art methods, of the site-specific magnitudes of each external event to which the plant may be susceptible. December 2013.	Closed	Open tcd Q4/13	Open tcd Q4/12	Open tcd 09/12	Open tcd 09/12	Closed (subject to acceptance)	Closed
19	AI 2.1.2 Evaluate if the current site specific design protection for each external event assessed in 1 above is sufficient. If gaps are identified a corrective plan should be proposed. December 2013.	Closed	Open tcd Q4/13	Open tcd Q4/12	Open tcd 2014	Open tcd 2014	Closed (subject to acceptance)	Open tcd 12/13
20	AI 2.2.1 Site-specific implementation plans for RD-310. December 2013.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open	Open	Open	Open tcd 12/13
Recommendation 3								
21	AI 3.1.1 Where SAMG has not been developed/finalized or fully implemented, provide plans and schedules for completion. December 2013.	Closed (subject to acceptance)	Closed (subject to acceptance)	Closed (subject to acceptance)	Complete (subject to acceptance)	Closed (subject to acceptance)	Open	Closed
22	AI 3.1.2 For multi-unit stations, provide plans and schedules for the inclusion of multi-unit events in	Open tcd Q4/13	Open tcd Q4/13	Open tcd Q4/13	Open tcd 12/13	Open tcd 12/13	N/A	N/A

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
	SAMGs. December 2013.							
23	AI 3.1.3 For all stations, plans and schedules for the inclusion of IFB events in station operating documentation where appropriate. December 2013.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	Open tcd 12/13	Open tcd 12/13	Open tcd Restart	Closed
24	AI 3.1.4 Demonstration of effectiveness of SAMGs via table-top exercise and drills. December 2013.	Open tcd Q4/13	Open tcd Q4/13	Open tcd Q4/13	Open tcd 12/13	Open tcd 12/13	Open tcd Restart	Closed
25	AI 3.2.1 An evaluation of the adequacy of existing modelling of severe accidents in multi-unit stations. The evaluation should provide a functional specification of any necessary improved models. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	N/A	N/A
26	AI 3.2.2 A plan and schedule for the development of improved modelling, including any necessary experimental support. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	N/A	N/A
Recommendation 4								
27	AI 4.1.1 An evaluation of the adequacy of existing emergency plans and programs. December 2012.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	Open tcd 09/12	Open tcd 09/12	Open tcd 12/12	Open tcd 12/12
28	AI 4.1.2 A plan and schedule to address any gaps identified in the evaluation. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd 03/13	Open tcd 03/13	Open tcd 12/12	Open tcd 12/12
29	AI 4.2.1 A plan and schedule for the development of improved exercise program. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd 10/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12
Recommendation 5								
30	AI 5.1.1 An evaluation of the adequacy of backup power for	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd 10/12	Open tcd 10/12	Open tcd 12/12	Open

Ser	Action Item	Darlington	Pickering A	Pickering B	Bruce A	Bruce B	Gentilly 2	Point Lepreau
	emergency facilities and equipment. December 2012.							
31	AI 5.1.2 A plan and schedule to address any gaps identified. December 2012.	Open tcd Q4/12	Open tcd Q4/12	Open tcd Q4/12	Open tcd 12/12	Open tcd 12/12	Open tcd 12/12	Open tcd 06/12
32	AI 5.2.1 Identify the external support and resources that may be required during an emergency. December 2012.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	Open tcd 12/12	Open tcd 12/12	Open tcd 12/12	N/A
33	AI 5.2.2 Identify the external support and resource agreements that have been formalized and documented. December 2012.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	Open tcd 12/12	Open tcd 12/12	Open tcd 12/12	N/A
34	AI 5.2.3 Confirm if any undocumented arrangements can be formalized. December 2012.	Open tcd 04/12	Open tcd 04/12	Open tcd 04/12	tbd	tbd	Open tcd 12/12	N/A
35	AI 5.3.1 Provide a project plan and installation schedule. December 2012.	Open tcd Q2/12	Open tcd Q2/12	Open tcd Q2/12	Open tcd 12/12	Open tcd 12/12	Open tcd 12/12	Open
36	AI 5.4.1 Develop source term and dose modelling tools specific to each NPP. December 2012.	N/A	N/A	N/A	N/A	N/A	Open tcd Restart	Open

Some AIs depend on the outcome of others; these are shown as “to be determined” (tbd). Others show the time completion dates (tcd).

Each AI will only be closed when all stations have produced the required deliverable and it has been accepted by the CNSC. In some cases, station-specific Action Items may then be opened to track the performance of further deliverables.

Appendix B - Proposed Major Multi-Level NPP Exercise Timeline with US NRC Participation

NPP	Proposed Exercise Date	*Proposed dates by which stakeholders must be engaged to ensure the proposed exercise date will be met*				Possible Participation			
		Federal Engagement		Provincial Engagement	US NRC Engagement				
		ADM Level	DM Level			Federal	Provincial	Municipal/Local	US NRC
Bruce	Fall[5] 2012				Immediate TSB/DSS to initiate discussion	CNSC, Health Canada/Public Health Agency Canada, Public Safety and other Federal Departments[6]	Emergency Management Ontario (EMO) and Provincial Ministries[7]	Municipality of Kincardine, Emergency management services, Police, Fire, etc.	TBD
Darlington	Fall[8] 2013	Summer 2012	Fall 2012	Summer 2012	Fall 2012	Same as above	EMO and Provincial Ministries[9]	Region of Durham, Municipality of Clarington, Emergency management services, Police, Fire, etc.	Possible

[5] Exercise Huron Challenge is confirmed. U.S. NRC involvement is to be determined and must be confirmed immediately.
[6] Canadian Food Inspection Agency, Canada Border Services Agency, Canadian Security Intelligence Service, Department of Foreign Affairs and International Trade, Department of National Defence, Environment Canada, Indian and Northern Affairs Canada, Natural Resources Canada, Royal Canadian Mounted Police and Transport Canada.
[7] Ministries of: Agriculture, Food and Rural Affairs; Attorney General; Community and Social Services; Correctional Services and Community Safety; Energy; Environment; Health and Long Term Care; Labour; Municipal Affairs and Housing; Natural Resources; Northern Development and Mines; and Transportation.
[8] OPG has tentatively scheduled conducting a multi-unit beyond-design-basis exercise in Fall 2013 for Darlington NGS. This is the first good opportunity to involve all levels of participation, including the U.S. NRC.
[9] Ministries of: Agriculture, Food and Rural Affairs; Attorney General; Community and Social Services; Correctional Services and Community Safety; Energy; Environment; Health and Long Term Care; Labour; Municipal Affairs and Housing; Natural Resources; Northern Development and Mines; and Transportation.

NPP	Proposed Exercise Date	*Proposed dates by which stakeholders must be engaged to ensure the proposed exercise date will be met*				Possible Participation			
		Federal Engagement		**Provincial Engagement**	**US NRC Engagement**				
		ADM Level	DM Level			Federal	Provincial	Municipal/Local	US NRC
Gentilly-2	Spring 2015	Spring 2013	Summer 2013	Spring 2013	Summer 2013	Same as above	Securité Civile and other Provincial Ministries[10]	Trois-Rivières, Emergency management services: police, fire, etc.	Yes
Pickering[11]	Fall 2016	Summer 2014	Fall 2014	Summer 2014	Fall 2014	Same as above	EMO and Provincial Ministries[12]	Region of Durham, City of Pickering, City of Toronto, Emergency management services, police, fire, etc.	Yes
Point LePreau[13]	Spring 2016	Winter 2014	Spring 2014	Winter 2014	Spring 2014	Same as above	Emergency Measures Organization-New Brunswick and Provincial Departments[14]	Region of Musquach, City of St. John, Emergency management services, police, fire, etc.	Yes

[10] Ministries of: Santé et des Services Sociaux; Agriculture, Pêcheries et de l'Alimentation; Développement durable, Environnement et des Parcs; Transports; Services Québec; and Sûreté du Québec.
[11] All of Pickering's units are going to be shut down by 2020. It is to be determined whether OPG is willing to conduct a beyond-design-basis exercise at this proposed time.
[12] Ministries of: Agriculture, Food and Rural Affairs; Attorney General; Community and Social Services; Correctional Services and Community Safety; Energy; Environment; Health and Long Term Care; Labour; Municipal Affairs and Housing; Natural Resources; Northern Development and Mines; and Transportation.
[13] PLNGS conducted Exercise Intrepid 2012 in the spring of 2012. Exercise results will be available late May 2012.
[14] Departments of: Agriculture, Aquaculture and Fisheries; Environment; Health; Attorney General; Justice and Consumer Affairs; Public Safety/Fire Marshall; Natural Resources; Social Development; Transportation; Communications New Brunswick; Education; Public Safety-Policing Services; and Point Lepreau Warden Service.