



CNSC Integrated Action Plan

On the Lessons Learned From the Fukushima Daiichi Nuclear Accident

August 2013



CNSC Integrated Action Plan on the Lessons Learned From the Fukushima Daiichi Nuclear Accident

© Canadian Nuclear Safety Commission (CNSC) 2013
PWGSC catalogue number CC172-100/2013E-PDF
ISBN 978-1-100-22536-4

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This document supersedes all previous versions of the *CNSC Action Plan*.

Également disponible en français sous le titre de : Plan d'action intégré de la CCSN sur les leçons tirées de l'accident nucléaire de Fukushima Daiichi

Document availability

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Preface

This document is prepared by the Canadian Nuclear Safety Commission (CNSC), and describes specific actions to be implemented by staff, licensees and affected federal and provincial stakeholders, to strengthen the defence in depth of Canadian nuclear power plants (NPPs) and major nuclear facilities (Class I nuclear facilities and uranium mines and mills), enhance emergency preparedness, as well as improve regulatory oversight and crisis communication capabilities. This document supersedes all previous versions of the *CNSC Action Plan*.

This *CNSC Integrated Action Plan* encompasses all public and stakeholders' recommendations and comments received during public consultations, as well as the outcomes from two independent reviews: one by the International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) follow-up mission, and the second by an external advisory committee (EAC) established by the President of the CNSC. The IRRS mission concluded that the CNSC response to the Fukushima Daiichi Nuclear accident was robust and comprehensive, and that the CNSC had an "effective and pragmatic framework" in place to implement the lessons learned from this event. In turn, the EAC concluded that the CNSC had acted promptly and appropriately to the Fukushima Daiichi events. The EAC also identified some areas for further enhancements that were considered in the development of the draft *CNSC Action Plan*.

The CNSC Fukushima Task Force concluded that Canadian NPPs are safe and rely on multiple layers of defence in depth. Additional CNSC staff reviews, conducted in response to the event, confirmed that major nuclear facilities and uranium mines and mills are safe, and pose a very small risk to the health and safety of Canadians, or to the environment.

The CNSC management has endorsed the findings and recommendations of the Fukushima Task Force and committed to address each recommendation, as well as those of the EAC, together with comments from stakeholders, through actions described in this *CNSC Integrated Action Plan*.

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Executive Summary

On March 11, 2011, a magnitude 9.0 earthquake, followed by a devastating tsunami, struck Japan. The combined impacts of the earthquake and tsunami caused a severe nuclear accident at the Fukushima Daiichi nuclear power plants (NPP). In response to these events, the Canadian Nuclear Safety Commission (CNSC) requested all licensees of Class I nuclear facilities (which include nuclear processing plants, waste and research facilities) and uranium mines and mills to conduct a review of the initial lessons learned from Fukushima, under subsection 12(2) of the *General Nuclear Safety and Control Regulations*.

In April 2011, the CNSC Executive Vice-President and Chief Regulatory Operations Officer convened a task force to review the licensees' responses to the 12(2) request and evaluate the operational, technical and regulatory implications of the Fukushima Daiichi nuclear accident for the Canadian NPPs. In parallel, CNSC staff reviewed non-power reactor facilities, as well as uranium mines and mills, to confirm that these installations were safe and adequately prepared to deal with potential emergencies. The non-power reactor reviews used a risk-informed approach consistent with the recommendations of the CNSC Task Force, taking into account the specificities of the facilities (including licensed activities, site characteristics and nature of the hazards present at each nuclear site). The areas of improvement identified by the CNSC Task Force for NPPs were also considered for all Class I facilities, and applied in a graded approach.

To address the CNSC Task Force recommendations, the CNSC developed a draft *CNSC Action Plan*, which was presented to the Commission for consideration at a public meeting on May 3, 2012. The document established a four-year plan, for both licensees and CNSC staff, to strengthen reactor defence in depth, enhance emergency response, improve regulatory oversight and crisis communication capabilities, and enhance international collaboration.

The draft *CNSC Action Plan* was subjected to three rounds of public consultations and two independent reviews: one by the International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) follow-up mission, and the second by an external advisory committee (EAC) established by the President of the CNSC. The IRRS mission concluded that the CNSC response to the Fukushima Daiichi nuclear accident was robust and comprehensive, and that Canada had an "effective and pragmatic framework" in place to implement the lessons learned from the event. The EAC concluded that the process followed by the CNSC in response to the accident was appropriate, and identified a number of complementary areas for further enhancements.

At the May 3, 2012 public meeting, the Commission requested that CNSC staff broaden the draft *CNSC Action Plan* to better integrate the EAC recommendations – in particular, to clarify the outcomes of the Fukushima reviews for nuclear facilities other than NPPs, examine areas of human and organizational performance, and to address crisis communication.

This document presents the *CNSC Integrated Action Plan* to be implemented by licensees and CNSC staff. The document reflects comments received from stakeholders during public consultations, and integrates the outcomes from the two independent reviews by the IAEA and EAC, as well as responses to the Commission's requests.

Progress on the implementation of the *CNSC Integrated Action Plan* will be reported to the Commission annually.

Benchmarking activities have demonstrated that the CNSC actions to date compare favourably to those of international peers and in certain areas exceeded international efforts. Nuclear facilities in Canada were

found to be safe and pose a very small risk to the health and safety of Canadians and the environment. This *CNSC Integrated Action Plan* is intended to enhance the safety of these facilities and provide to the Commission a clear statement of planned improvements. The implementation status will be reported annually.

1. Overview

On March 11, 2011, a magnitude 9.0 earthquake, followed by a devastating tsunami, struck Japan. The combined impacts of the earthquake and tsunami caused a severe nuclear accident at the Fukushima Daiichi nuclear power plants (NPP). In response to these events, the Canadian Nuclear Safety Commission (CNSC) issued a request to all 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 facilities. In April 2011, the CNSC Executive Vice-President and Chief Regulatory Operations Officer announced the establishment of a task force to evaluate the operational, technical and regulatory implications of the nuclear accident in relation to Canadian NPPs.

On September 30, 2011, the CNSC Fukushima Task Force completed its review and presented its findings and recommendations in the [CNSC Fukushima Task Force Report](#) (Task Force report). The Task Force made 13 recommendations to further enhance the safety of Canadian NPPs, with a particular emphasis on:

- the capability of Canadian plants to withstand external hazards comparable to those that triggered the Fukushima Daiichi nuclear accident
- emergency preparedness and response in Canada
- the effectiveness of the CNSC regulatory framework
- international collaboration

CNSC Action Plan

To address the CNSC Task Force recommendations, the CNSC developed a four-year *CNSC Action Plan* to be implemented by licensees and CNSC staff to:

- strengthen reactor defence-in-depth
- enhance emergency response
- improve the regulatory framework, and
- foster international collaboration.

The *CNSC Fukushima Task Force Report* and *CNSC Action Plan on the CNSC Fukushima Task Force Recommendations* were subjected to public consultations and independent reviews, as outlined in the following sections.

Public consultations

After the preparation of the draft Task Force report, the CNSC embarked on a series of public consultations to seek additional input and create broader public awareness of the nuclear accident and to engage stakeholders in the development of measures to address the lessons learned from the accident.

These activities included:

- October 28, 2011: Round 1 consultation on the Task Force report and accompanying CNSC management response document
- December 21, 2011: Round 2 consultation on the draft *CNSC Action Plan on the Lessons Learned From the Fukushima Nuclear Accident* and the comments received during the first round
- March 2, 2012: Round 3 consultation on the draft *CNSC Action Plan on the Lessons Learned From the Fukushima Nuclear Accident* and comments received during the previous consultation

- May 3, 2012: Presentation to the Commission of supplementary CMD 12-M23.B, integrating the EAC recommendations for actions related to NPPs, major nuclear facilities other than NPPs and, communication and public education.

External advisory committee report

On August 5, 2011, the President of the CNSC established an [external advisory committee](#) (EAC), to provide an independent assessment of the federal regulator's actions in response to the Fukushima Daiichi nuclear incident, and to make recommendations for improvements. The EAC submitted its [final report](#) on April 12, 2012.

The EAC concluded that the process followed by the CNSC in responding to the Fukushima Daiichi nuclear event was appropriate. This included a flexible, open and transparent process, with three opportunities for public input in the development of its response. The resulting *CNSC Action Plan* established the measures needed to strengthen defence in depth for major nuclear facilities, enhance emergency preparedness and response in Canada and improve the CNSC regulatory framework and processes. In carrying out its mandate, the EAC noted areas for improvement. In particular, these covered: (1) public communication in layman's terms, when describing complex technical matters related to nuclear safety; (2) added clarity on the outcome of the safety assessments of non-NPP facilities; and (3) the incorporation of human and organizational performance aspects in actions being considered to address the apparent gaps identified in the *CNSC Fukushima Task Force Report*.

Specifically, the EAC recommended that the CNSC:

1. continue to work with regulators of other member states of the International Atomic Energy Agency (IAEA) to ensure that the Integrated Regulatory Review Service (IRRS) process is mandatory and transparent, and that the findings and recommendations are enforced
2. work with its fellow regulators in convincing World Association of Nuclear Operators (WANO) members to share the results of their peer review process to promote nuclear safety in all nations with nuclear power plants
3. 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
4. meet with its partner organizations and licensees to establish the frequency and extent of multi-level emergency exercises
5. clarify its position on the 12(2) orders with respect to the non-NPPs
6. examine the area of human and organizational performance (HOP) to achieve a more complete understanding of lessons learned from the Fukushima crisis
7. clarify its plans to address tornado hazards
8. 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
9. should play an active role in ensuring that emergency planning exercises with the United States are conducted regularly

The above recommendations have been fully addressed through the consideration of specific actions, including the assessment of design-basis and beyond-design-basis tornado hazards identified by the CNSC Fukushima Task Force, within the related sections of the *CNSC Integrated Action Plan*.

International Atomic Energy Agency (IAEA) follow-up mission

From November 28, 2011 to December 9, 2011, the CNSC hosted an international team of experts for a follow-up IAEA Integrated Regulatory Review Service (IRRS) mission, which included a review dedicated to the regulatory implications of the Fukushima Daiichi nuclear accident for the Canadian nuclear industry. The IRRS report stated that CNSC actions and responses to the nuclear accident were prompt, comprehensive and robust. Specifically, the IRRS team rated the CNSC response to the Fukushima event as a good practice and approach for international peers to follow, indicating as well that the Canadian regulator had systematically and thoroughly reviewed the lessons learned from the accident, and had made full use of available information, including the review of actions taken by other international regulators.

The IRRS team also acknowledged that the CNSC has an “effective and pragmatic” regulatory framework in place to follow up on the Fukushima Daiichi nuclear accident. The IRRS team did not raise any concerns or make any observations that impacted the draft *CNSC Action Plan*.

Requests from the Commission

Comments from all public consultations (together with revisions to the draft *CNSC Action Plan* arising from EAC recommendations) were presented to the Commission for endorsement at a public meeting on May 3, 2012.

The Commission requested that CNSC staff broaden the draft *CNSC Action Plan* to better integrate the EAC recommendations. Specifically, staff was requested to consider the measures identified by the EAC to clarify the outcome of the Fukushima reviews for major nuclear facilities (other than NPPs), to improve crisis communication, and to consider human and organizational performance.

The actions outlined in this *CNSC Integrated Action Plan* reflect the outcome and comments received from stakeholders during public consultations; they also incorporate the recommendations of the EAC and response to the Commission requests from the May 2012 public meeting.

2. *CNSC Integrated Action Plan*

CNSC staff revised the *CNSC Action Plan*, to reflect the EAC recommendations, as well as the comments received from the public and stakeholders during the three rounds of public consultations, and to address the Commission’s requests.

The *CNSC Action Plan* was based on the findings and recommendations of the *CNSC Fukushima Task Force Report*, which led to the development of specific actions for licensees and the CNSC, aimed at strengthening defence in depth, enhancing emergency response, improving the regulatory framework and enhancing international collaboration. Subsequently, the *CNSC Action Plan* was amended to integrate measures arising from the CNSC staff’s post-Fukushima reviews of major nuclear facilities (other than NPPs) and, as well as the EAC’s recommendation concerning improved crisis communication capabilities.

The *CNSC Integrated Action Plan* is thus applied to all major nuclear facilities and consists of the following categories:

- strengthening defence in depth
- enhancing emergency response

- improving the regulatory framework and processes
- enhancing international collaboration
- communications and public consultation

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 also recommended that the CNSC examine the areas of human and organizational performance (HOP) to achieve a more complete understanding of lessons learned from the events in Japan. CNSC staff recognizes HOP is integral to all design, analysis and procedural activities, and supports all levels of defence in depth. As part of the design-basis of NPP operations, the CNSC has in place a comprehensive HOP program that assesses elements such as safety culture, minimum shift complement and fitness for service.

CNSC staff will therefore examine HOP in beyond-design-basis scenarios and accident management. Actions affected by the EAC report have been modified to incorporate HOP considerations. Licensee submissions are expected to demonstrate support of their implementation of the *CNSC Integrated Action Plan*, while taking into account the necessary HOP factors, according to the criteria and expectations developed by CNSC staff.

2.1 Actions related to nuclear power plants

The actions presented in **Annex A – Actions Related to Nuclear Power Plants** outline the measures imposed on nuclear power plant (NPP) licensees to fully address the *CNSC Fukushima Task Force Report* and EAC recommendations, as well as actions required of the CNSC and affected government stakeholders.

The [*CNSC Management Response to CNSC Fukushima Task Force Recommendations*](#) – released concurrently with the *CNSC Fukushima Task Force Report* – established the timeline for implementing the *CNSC Action Plan* in a phased approach (in the short-, medium- and long-term timeframe), as shown in table 1 below.

The management response also established general guidance for implementing these recommendations, consistent with risk-informed considerations and related cost-benefit implications.

The actions described in **Annex A** for each recommendation include the following information:

- specific Task Force recommendation
- associated EAC recommendation(s), where applicable
- actions arising from the recommendations include:
 - required deliverable(s)
 - applicable site
 - timeline for completion
- implementation details for the overall recommendations

Table 1: Task Force recommendations and implementation timeline

CNSC 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. <i>Class I Nuclear Facilities Regulations</i> amendments		✓	
8. <i>Radiation Protection Regulations</i> amendments		✓	
9. Update regulatory document framework	✓	✓	
10. Amend power reactor operating licences	✓		
11. Implementation of periodic safety reviews	✓		
Enhancing international collaboration			
12. Enhance collaboration with CANDU owner countries	✓		
13. Enhance international cooperation	✓		

2.2 Actions related to major nuclear facilities other than NPPs

The review of major facilities other than NPPs was not implicit in the [CNSC Fukushima Task Force Terms of Reference](#) but was subsequently conducted under the CNSC request to licensees of Class I nuclear facilities and uranium mines and mills, under subsection 12(2) of the *General Nuclear Safety and Control Regulations*.

The Task Force was mandated to focus on NPPs for two reasons. Firstly, the accident took place at a nuclear plant, and therefore the early lessons learned were most relevant to NPPs. Secondly, NPPs (unlike most other Canadian major nuclear facilities) require cooling for a significant period of time following shutdown, to maintain fuel and containment integrity. This adds a level of complexity to accident management and emergency response at a power plant, which does not exist at other facilities. Given this complexity, CNSC staff applied a graded, risk-informed approach for the review of major nuclear facilities other than NPPs.

The major nuclear facilities under consideration include: the Chalk River Laboratories (including the National Research Universal [NRU] reactor), small Canadian research reactors, Class I accelerators, uranium processing facilities, nuclear substance processing facilities, uranium mines and mills and waste management facilities. Since the Chalk River Laboratories (that include the NRU), which are operated by Atomic Energy of Canada Limited (AECL), were 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 *Integrated Implementation*

Plan in October 2011. This was an important part of the public hearings on the licence renewal in June and October 2011. The impact of Fukushima has also been discussed with the Commission at licence renewals for other major nuclear facilities (e.g., Cameco's Blind River and Port Hope facilities) and update reports to the Commission since March 2011.

Table 2 presents the CNSC staff recommendations used for major nuclear facilities (other than NPPs) on strengthening defence in depth, enhancing emergency response, improving the regulatory framework and enhancing international collaboration along with associated timeline for completion. These are closely aligned with the recommendations of the CNSC Task Force with respect to NPPs, as shown in **Annex B**.

Table 2: Major nuclear facilities (other than NPPs) actions and implementation timeline

CNSC Staff recommendations	Implementation timeline		
	Short-term (Dec. 2012)	Medium-term (Dec. 2013/14)	Long-term (Dec. 2016)*
Strengthening defence in depth			
1. Review facilities' safety case	✓	✓	✓
2. Assessment of site-specific external hazards	✓	✓	✓
3. Enhance modelling capabilities (NRU)		✓	✓
Enhancing emergency response			
4. Assess emergency plans (onsite)	✓	✓	✓
5. Update emergency facilities and equipment (CRL)	✓	✓	✓
6. Offsite emergency plans and programs		✓	
Improving the regulatory framework and processes			
7. Improve the regulatory framework and processes		✓	
Enhancing international collaboration			
8. Enhance international collaboration	✓		

* to coincide with the Chalk River Laboratories licence expiry

The actions required of the CNSC and licensees to address the gaps identified by CNSC staff in their review of licensee 12(2) submissions and from the EAC recommendations to strengthen defence in depth and enhance emergency preparedness related to nuclear facilities other than NPPs are presented in **Annex B - Actions Related to Major Nuclear Facilities (Other Than NPPs)**.

The implementation timeframe for actions by CNSC staff and nuclear facilities other than NPPs are consistent with the *CNSC Management Response to CNSC Fukushima Task Force Recommendations*. These actions will be completed in the short-term, medium-term and long-term timeframe.

2.3 Actions related to communication and public education

The EAC recommended that the CNSC develop a comprehensive communication and education strategy, which incorporates the use of various tools – including social media and expanded partnerships and relationships with various science media organizations that have the ability to inform the public on nuclear safety. Moreover, the EAC stressed the importance of communication and public education to provide complex and technical information to members of the public in clear, plain language and in an accessible manner, using the latest technological tools (including social media). The following section highlights several CNSC initiatives that were identified to enhance communications with stakeholders and the public.

The program areas identified by CNSC staff to enhance communications with stakeholders, strengthen readiness, and improve cooperation and ties with organizations involved in the dissemination of information related to nuclear safety include:

- CNSC Web site and social media
- crisis Web site
- educational initiatives
- media
- international participation
- extreme accident scenario video

The CNSC communications and education response to Fukushima consists of several measures and programs to be implemented in the short-term, medium-term and long-term timeframe. The actions required of the CNSC to address the communication gaps identified in the *CNSC Fukushima Task Force Report* and EAC report are presented in **Annex C - Actions Related to Communications and Public Education**.

3. Implementation

The *CNSC Integrated Action Plan* will be implemented by licensees (through existing regulatory oversight programs) for initiatives that pertain to design and operational enhancements, or by the CNSC for those actions dealing with regulatory framework improvements, communications and education, and enhanced international collaboration.

Sharing information and ensuring the public receives clear and consistent information is critical during an emergency. In keeping with its mandate to disseminate objective scientific, technical and regulatory information, the CNSC continues to improve communication and public education, including better communication to Canadians in the event of a nuclear emergency.

Effective clear language communications with stakeholders and the public is a process that requires continuous improvement, and evolves along state-of-the-art means of communication technology. The CNSC is continuously evaluating all facets and means of communication, to remain relevant and to maintain a strong presence in this ever-changing and evolving media.

The Commission will be kept informed on the *CNSC Integrated Action Plan* implementation progress, through annual updates by CNSC staff.

4. Conclusion

The CNSC Fukushima Task Force confirmed that Canadian nuclear power plants are safe and have a robust design that relies on multiple layers of defence. The CNSC management has endorsed the findings and recommendations of the Task Force, and has committed to addressing each recommendation through the actions outlined in this *CNSC Integrated Action Plan*, together with those of the EAC.

CNSC staff also concluded that Class I major nuclear facilities, as well as uranium mines and mills licensees, have demonstrated a strong commitment to nuclear safety. Reviews and safety assessments post-Fukushima demonstrate that these facilities are safe and do not pose any significant risk to the health and safety of Canadians, or to the environment.

To address the recommendations made by the *CNSC Fukushima Task Force Report*, together with those of the EAC report, the CNSC has developed an integrated action plan to reinforce defence in depth at Canadian NPPs, enhance the safety of non-power reactor facilities, strengthen emergency preparedness, improve the regulatory framework, foster international collaboration, and enhance crisis communication capabilities.

The *CNSC Integrated Action Plan* reflects stakeholder input (obtained through several rounds of public consultations), incorporates the outcomes of independent reviews (made by the IAEA and the EAC), and responds to the requests of the Commission.

CNSC staff will update the Commission annually on the *CNSC Integrated Action Plan*'s implementation progress by licensees and staff.

Annex A - Actions Related to Nuclear Power Plants

Part A1 – Strengthening reactor defence in depth

The CNSC Task Force confirmed that Canadian nuclear power plants (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 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. As part of the design-basis of NPP operations, the CNSC has in place a comprehensive HOP program, which 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 of these measures have already been implemented. The following sections describe actions 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 A.1.1, A.1.2**)
- b) containment performance to prevent unfiltered releases of radioactive products (**Action A.1.3**)
- c) control capabilities for hydrogen and other combustible gases:
 - i) accelerate installation of the hydrogen management capability and sampling provisions (**Action A.1.4**)
 - ii) include spent fuel bays and any other areas where hydrogen accumulation cannot be precluded (**Action A.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 A.1.6, A.1.7, A.1.8, A.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 A.1.10**)
- f) control facilities for personnel involved in accident management (**Action A.1.9**)
- g) emergency mitigating equipment and resources that could be stored offsite and brought onsite if needed (**Action A.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 A.1.3, A.1.6, A.1.7, A.1.8, A.1.9, A.1.10, A.1.11.)**

CNSC staff actions**A.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):

A.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.

A.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.

A.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):

A.1.2.1 An assessment of the capability of shield tank/calandria vault relief.

A.1.2.2 If relief capacity is inadequate, an assessment of the benefits available from adequate relief capacity and the practicability of providing additional relief.

A.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.

A.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.

Action item(s):

A.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.

A.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.

A.1.4 Action:

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

Action item(s):

A.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.

A.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):

A.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.

A.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):

A.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.

A.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.

A.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 make-up 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):

A.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.

A.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):

A.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.

A.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):

A.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.

A.1.10 Action:

Licenseses 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):

A.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.

A.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.

A.1.11 Action:

Licenseses 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):

A.1.11.1 A plan and schedule for procurement.

Applicable to: All sites.

Timeline: Completion by end of December 2012.

Recommendation 2 – Assessment of site-specific external hazards

Task Force recommendation

Licenseses 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

A.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*:

- A.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.
- A.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.

A.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):

- A.2.2.1 No new requirement, since it is already being implemented.

Applicable to: All sites.

Timeline: Completion by end of December 2013.

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 A.3.1, A.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 A.3.1, A.3.2.**)

CNSC staff actions

A.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):

- A.3.1.1 Where SAMGs have not been developed/finalized or fully implemented, provide plans and schedules for completion.
- A.3.1.2 For multi-unit stations, provide plans and schedules for the inclusion of multi-unit events in SAMGs.
- A.3.1.3 For all stations, provide plans and schedules for the inclusion of IFB events in station operating documentation where appropriate.
- A.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.

A.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):

- A.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.
- A.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.

Part A2 – Enhancing emergency response

The CNSC Task Force also confirmed that the current emergency preparedness and response measures in Canada (both onsite and offsite) 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 A.4.1, A.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 Actions A.4.1, A.4.2.**)

CNSC staff actions

A.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):

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

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

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

Timeline: Completion by end of December 2012.

A.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):

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

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

Timeline: Completion by end of December 2012.

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 A.5.1**)
- b) formalize all arrangements and agreements for external support and document these in the applicable emergency plans and procedures (**Action A.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 A.5.3, A.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 Actions A.5.1, A.5.2.**)

CNSC staff actions

A.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):

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

A.5.1.2 A plan and schedule to address any gaps identified.

Applicable to: All sites.

Timeline: Completion by end of December 2012.

A.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):

A.5.2.1 Identify the external support and resources that may be required during an emergency.

A.5.2.2 Identify the external support and resource agreements that have been formalized and documented.

A.5.2.3 Confirm if any undocumented arrangements can be formalized.

Applicable to: All sites.

Timeline: Completed by end of December 2012.

A.5.3 Action:

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

Action item(s):

A.5.3.1 Provide a project plan and installation schedule.

Applicable to: All sites.

Timeline: Completion by end of December 2012.

A.5.4 Action:

Licensees should develop source term estimation capability, including dose modelling tools.

Action item(s):

A.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.

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 A.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 A.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 A.6.1.**)

CNSC Staff Actions

A.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):

A.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.

Part A3 – 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, supporting regulatory documents, and well as the licensing basis, which would strengthen the oversight of existing programs (or programs currently 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 A.7.1, A.7.2**)

CNSC staff action

A.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):

A.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.

A.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.

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 A.8.1**)

CNSC staff action

A.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):

- A.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.
- A.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.
- A.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.

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 A.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 A.9.2**)
- c) strengthening the suite of emergency preparedness regulatory documents (**Action A.9.3**)
- d) reviewing applicable Canadian Standards Association standards (**Action A.9.4**)

EAC recommendation 7

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

CNSC staff actions

A.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):

- A.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.
- A.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.
- A.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.

A.9.2 Action:

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

Action item(s):

- A.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.

A.9.3 Action:

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

Action item(s):

- A.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.

A.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):

A.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.

Recommendation 10 – Amend power reactor operating licences (PROLs)

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 A.10.1, A.10.2**)

CNSC staff action

A.10.1 Action:

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

Action item(s):

A.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 conditions handbook template, to clarify the compliance verification criteria for the new licence conditions.

A.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.

A.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):

A.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.

A.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.

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 A.11.1**).

CNSC staff action

A.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):

A.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.

A.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.

Part A4 – Enhancing international collaboration

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 Second Extraordinary Meeting of the Convention on Nuclear Safety) are consistent with actions outlined in the Task Force recommendations, 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 A.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 A.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 A.12.1)**

CNSC staff action

A.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):

A.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.

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 A.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 A.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 A.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 A.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 A.13.1.**)

CNSC staff action

A.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):

A.13.1.1 Prepare a national report on lessons learned from the Fukushima Daiichi nuclear accident, consistent with the requirements established by contracting parties at the Fifth Review Meeting in April 2011. The national report is to be submitted to the IAEA Secretariat in May 2012, for peer review by the CNS 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.

Annex B – Actions Related to Major Nuclear Facilities (Other Than NPPs)

Part B1 – Strengthening defence in depth

The actions described in this section are derived from CNSC staff review of licensee 12(2) submissions. The recommendations have been adapted to major nuclear facilities (other than NPPs). These are shown below together with their associated EAC and CNSC Fukushima Task Force recommendations.

The sites affected by these measures include: Chalk River Laboratories (including the National Research Universal [NRU] reactor), Slowpoke-2 reactors, the McMaster nuclear reactor, uranium processing facilities, nuclear substance processing facilities, waste management facilities, accelerators, as well as uranium mines and mills.

Recommendation 1 - Review facilities safety case

Review facilities' safety case (design of the facilities, internal and external credible events, facilities' safety features).

The following CNSC staff actions incorporate **EAC recommendation 5** and **Task Force recommendation 1**, applied in a graded risk-informed manner.

CNSC staff actions

B.1.1 Action:

Conduct a review of major nuclear facilities' design basis safety case.

Action item(s):

B.1.1.1 An evaluation of the design of the facilities, internal and external credible events, and the facilities' safety features.

B.1.1.2 Assessment of plant equipment and instrumentation, for potential upgrades.

B.1.1.3 A plan and schedule to address any gaps identified.

Applicable to:

B.1.1.1 and B.1.1.3 are applicable to all facilities.

B.1.1.2 is applicable only to Chalk River Laboratories (CRL).

Timeline:

B.1.1.1 and B.1.1.3 – completion by end of December 2014.

B.1.1.2 – completion by end of December 2016 (coincident with licence expiry).

Recommendation 2 - Assessment of site-specific external hazards

Assessment of site-specific external hazards.

The following CNSC staff actions incorporate **Task Force recommendation 2**, applied in a graded risk-informed manner.

CNSC staff actions

B.2.1 Action:

Licensees to re-assess external events (including, but not limited to earthquake, floods, tornadoes, extreme weather events and fire), to demonstrate that consequences of events are within applicable limits.

Action item(s):

- B.2.1.1** Re-evaluate the site-specific magnitudes of each external event to which the facility may be susceptible.
- B.2.1.2** Evaluate measures in place to mitigate each external event. If gaps are identified, a corrective plan should be proposed.

Applicable to: All sites.

Timeline: Completion by end of December 2013 (except for CRL); CRL completion by December 2016 (coincident with licence expiry).

Recommendation 3 - Enhance modelling capabilities (NRU)

Enhance modelling capabilities - consideration of Severe Accident Management Guidelines (SAMG), for NRU only

The following CNSC staff actions incorporate **Task Force recommendation 3**, applied in a graded risk-informed manner.

CNSC staff actions

B.3.1 Action:

1. Licensees should develop and implement severe accident management guidelines (SAMGs) and associated procedures.
2. Licensees should fully implement a Severe Accident Management Program (SAMP), including training of personnel.

This assessment should consider elements of human and organizational performance (HOP) under accident conditions.

Action item(s):

- B.3.1.1** Develop SAMGs and associated procedures for the NRU reactor.
- B.3.1.2** Implement a SAMP, including training of personnel, for the NRU reactor.

Applicable to: CRL only.

Timeline: Completion by end of December 2016 (coincident with licence expiry).

Part B2 – Enhancing emergency response

The recommendations described in this section are derived from the *CNSC Fukushima Task Force Report* and have been adapted to major nuclear facilities other than NPPs.

The sites affected by these measures include: CRL (including the NRU reactor), Slowpoke-2 reactors, the McMaster nuclear reactor, uranium processing facilities, nuclear substance processing facilities, waste management facilities, accelerators, as well as uranium mines and mills.

Recommendation 4 - Assess emergency plans (onsite)

Assess emergency plans (onsite) - review of facilities' emergency response plans, including procedures, training and equipment.

The following CNSC staff actions incorporate **EAC recommendation 5** and **Task Force recommendation 4**, applied in a graded risk-informed manner.

CNSC staff actions

B.4.1 Action:

Licensees should evaluate and revise their emergency plans in regard to severe external events. 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. This assessment should consider elements of HOP under accident conditions.

Action item(s):

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

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

Applicable to: All sites.

Timeline: Completion by end of December 2013 (except for CRL); CRL completion by December 2016 (coincident with licence expiry).

Recommendation 5 - Update emergency facilities and equipment (CRL)

Update emergency facilities and equipment - review and update equipment and design of site Emergency Operation Centre (Chalk River site only)

The following CNSC staff actions incorporate **Task Force recommendation 5**, applied in a graded risk-informed manner.

CNSC staff action

B.5.1 Action:

Licensees should review all emergency response equipment and (where applicable) emergency facilities, to make sure they are available, appropriate and sufficient, and are maintained adequately.

Action item(s):

B.5.1.1 An evaluation of the adequacy of emergency facilities and equipment.

B.5.1.2 A plan and schedule to address any gaps identified.

Applicable to: All sites.

Timeline: Completion by end of December 2013 (except for CRL); CRL completion by December 2016 (coincident with licence expiry).

Recommendation 6 - Offsite emergency plans and programs

Apply improvements to offsite response plans for NPPs to all relevant facilities in a graded manner

The following CNSC staff actions incorporate **Task Force recommendation 6**, applied in a graded risk-informed manner.

CNSC staff action

Federal and provincial plans related to offsite emergency plans and programs for nuclear facilities (other than NPPs) are managed by the same federal and provincial emergency management organizations responsible for offsite emergency plans and programs for NPPs (refer to A2 for details). Enhancements to these plans and programs are currently underway, through various initiatives by the CNSC and responsible emergency management authorities, and will be applied to non-NPPs in a graded approach.

Part B3 – Improving regulatory framework and processes

Recommendation 7 - Improve regulatory framework and processes

The improvement of regulatory framework and processes has not been assessed separately for major nuclear facilities other than NPPs. However, enhancements developed in the course of implementing related measures (identified in **Annex A** for NPPs) will be monitored by CNSC staff; applicable improvements to the regulatory framework and offsite response (as identified by the CNSC Task Force) will be applied in a graded manner to all relevant facilities.

Part B4 – Enhancing international collaboration

Recommendation 8 – Enhance international collaboration

Participation in:

- International meetings with the International Atomic Energy Agency, the Nuclear Energy Agency and the Committee on Nuclear Regulatory Activities to review: (1) national experiences in the conduct of lessons learned on research reactors following the events at Fukushima; and (2) the safety of fuel cycle facilities post-Fukushima
- Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The following CNSC staff actions incorporate **Task Force recommendation 13**, applied in a graded risk-informed manner.

CNSC staff actions**B.13.1** Action:

Participation in international meetings with the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) and the Committee on Nuclear Regulatory Activities (CNRA) to review national experiences in the conduct of lessons learned on nuclear facilities (other than NPPs) post-Fukushima.

Action item(s):

- B.13.1.1** Participation in international meetings with the IAEA, NEA and the CNRA, to review national experiences in the conduct of lessons learned on research reactors following the events at Fukushima.
- B.13.1.2** Participation in international meetings with the IAEA and NEA, to review the safety of fuel cycle facilities post-Fukushima.
- B.13.1.3** Participation in the Fourth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Timeline: Completion by end of December 2012.

Annex C – Actions Related to Communication and Public Education

In its report, the EAC stressed the importance of communication and public education, and the need to provide complex and technical information to members of the public in clear, plain language and in an accessible manner, using various tools (including social media). The following section highlights several CNSC initiatives that were identified to enhance communications with stakeholders and the public.

The following CNSC staff actions incorporate **EAC recommendation 8**.

CNSC staff actions

The CNSC staff identified several program areas to enhance communications with stakeholders, strengthening readiness, and improving cooperation and ties with organizations involved in the dissemination of information related to nuclear safety. These include:

- CNSC Web site and social media
- crisis Web site
- educational initiatives
- media
- international participation
- extreme accident scenario video

CNSC Web site and social media

C.1.1 Action:

The CNSC to enhance social media tools through Facebook and YouTube.

Action item(s):

C.1.1.1 Continued development of CNSC Facebook page.

C.1.1.2 Launch of CNSC YouTube channel.

Applicable to: CNSC staff.

Timeline: Completion by December 2013.

C.1.2 Action:

To ensure the CNSC Web site provides information to the public in plain language, including information on the safety aspects of nuclear facilities and measures to deal with nuclear emergencies.

Action item(s):

C.1.2.1 Ensure regular Web updates on topics of interest to the general public and stakeholders, specifically including information on emergency response measures and radiation protection (ongoing).

C.1.2.2 Launch of new Web site, in accordance with the broader Government of Canada Web 2013 initiative.

Applicable to: CNSC staff.

Timeline: C.1.2.2 to be completed by December 2013.

Crisis Web site

C.1.3 Action:

The CNSC is to consider the development of a crisis Web site that can be activated in the event of a nuclear emergency in Canada.

Action item(s):

C.1.3.1 The CNSC is to develop a crisis Web site that will provide real-time information on the nature and evolution of a nuclear emergency. The site should provide precautionary measures and instructions for members of the public affected by the emergency, as well as information on the affected facility.

Applicable to: CNSC staff.

Timeline: Completion by December 2013.

Educational initiatives

C.1.4 Action:

The CNSC is to enhance the existing educational resources section on the CNSC Web site, by targeting a broader audience. CNSC Online is a Web-based educational tool that will present highly technical concepts (such as the nuclear fuel lifecycle and nuclear safety) in plain language to Canadians. Where practicable, this interactive tool will make effective use of animated graphics and illustrations.

Action item(s):

C.1.4.1 Continued development of educational resources to target a broader audience (ongoing).

C.1.4.2 Continued development of plain language educational tools, to facilitate the understanding by the public of highly technical subjects (such as the nuclear fuel lifecycle and nuclear safety).

C.1.4.3 Continued development of public information sessions to stakeholders in communities across the country, to present information and answer questions on how the nuclear industry is regulated (ongoing).

C.1.4.4 Where practicable, explore partnership opportunities to further disseminate information on nuclear, such as through the Canada Science and Technology Museum's Energy Exhibit to promote nuclear safety (ongoing).

Applicable to: CNSC staff.

Timeline: C.1.4.2 to be completed by December 2013.

Media

C.1.5 Action:

The CNSC is to explore partnerships with science-based media organizations, and to provide media training programs for specialists and subject-matter experts (with greater emphasis on crisis communications) and convey information in plain language.

Action item(s):

C.1.5.1 The CNSC is to develop a plan for identifying and qualifying a cadre of specialists and subject-matter experts, and ensure that appropriate media relations training is received.

C.1.5.2 The CNSC is to proactively engage public information agencies (i.e., the Science Media Centre of Canada) to assist media in reporting technical and scientific issues.

Applicable to: CNSC staff.

Timeline: Completion by December 2013.

International participation

C.1.6 Action:

The CNSC is to enhance collaboration with international peers through active participation at various international forums to exchange communications best practices and lessons learned from the Fukushima crisis.

Action item(s):

C.1.6.1 CNSC staff to participate at the Nuclear Energy Agency's Crisis Communications Workshop in Madrid, Spain in May 2012.

C.1.6.2 CNSC staff to participate 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.

Applicable to: CNSC staff.

Timeline: Completion by December 2012.

Extreme accident scenario video

C.1.7 Action:

The CNSC is to develop a graphical representation to illustrate to the public the sequence of potential events during and immediately following an extreme accident at a Canadian nuclear power plant.

Action item(s):

C.1.7.1 The CNSC is to develop a video describing an extreme accident scenario at a Canadian nuclear power plant, along with the safety systems in place.

Applicable to: CNSC staff.

Timeline: Completion by December 2013.