



November 22, 2010

Michael Binder, President  
Louise Levert, Secretariat  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O Box 1046, Station B  
Ottawa, Ontario K1P 5S9

Dear Mr. Binder:

On behalf of the Great Lakes and St. Lawrence Cities Initiative, I am enclosing our written supplementary comments on the proposed shipment by Bruce Power of 16 radioactive steam generators on the Great Lakes and St. Lawrence River. The Great Lakes and St. Lawrence are a precious resource providing drinking water to over 40 million people. Because of the vital resources that the Lakes and River contribute to our economy, health and lives, we need to ensure the protection and restoration of the Lakes and River.

Thank you and your fellow Commissioners for recognizing the need for significantly more information regarding the initial proposal, and the difficulty many intervenors have experienced in accessing information. We appreciate the opportunity to review and comment on the revised CNSC staff report.

The revised CNSC staff report does confirm many of our concerns, namely that an accident involving this proposed shipment has the potential to exceed federal drinking water action levels, that this shipment does exceed international safety limits for allowable amount of radioactivity on a single ship, that the environmental review is flawed, and consistently underestimates environmental hazards, and this shipment has the potential to set a Canadian precedent for future shipments. Therefore, we oppose this shipment. We disagree with the conclusion of the revised staff report, and feel that the revised information requires a revised conclusion, namely that an accident involving this shipment could present an environmental risk, and is precedent setting. We conclude that the Commissioners do not have sufficient information, sufficiently clearly presented and/or of sufficient quality to fully evaluate this proposed shipment.

We are pleased to discuss this matter with you at any time.

Yours sincerely,

David A. Ullrich  
Executive Director  
Great Lakes and St. Lawrence Cities Initiative

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**cc:**

**Hon. Pierre Arcand, Quebec Minister of Sustainable Development, Environment and Parks**

**Hon. John Wilkinson, Ontario Minister of Environment**

**Hon. Brad Duguid, Ontario Minister of Energy**

**Hon. Chuck Strahl, Federal Minister of Transport, Infrastructure and Communities**

**Richard Corfe, President, St. Lawrence Seaway Management Corporation**

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**Submission to the  
Canadian Nuclear Safety Commission**

**Supplementary Comments  
On the matter of:**

**Application from Bruce Power to Transport  
Radioactive Steam Generators under  
Special Arrangement and Exclusive Use on the  
Great Lakes and St. Lawrence River**

**Submitted November 22, 2010**



## **Executive Summary**

The Great Lakes and St. Lawrence River are a precious resource providing drinking water for over 40 million people. Because of the vital resources that the Lakes contribute to our economy, health and lives, we need to ensure the protection and restoration of the Lakes and River.

The Great Lakes and St. Lawrence Cities Initiative appreciates the opportunity to comment on the revised CNSC staff report.

This document consists of supplementary comments from the Great Lakes and St. Lawrence Cities Initiative (Cities Initiative) on Bruce Power's application to the Canadian Nuclear Safety Commission for permission to ship sixteen radioactive steam generators on the Great Lakes and St. Lawrence. These comments provide additional information to the Cities Initiative's initial submission, submitted on September 13, 2010, and the Cities Initiative's testimony before the CNSC during its hearings in Ottawa on September 28, 2010.

Great Lakes and St. Lawrence Cities Initiative is pleased that the Commissioners of the Canadian Nuclear Safety Commission (CNSC) recognised the significant information gaps in the original proposal. Many of these information gaps were identified by the Commissioners and intervenors, including the Great Lakes and St. Lawrence Cities Initiative at the CNSC hearing.

It is encouraging that the CNSC Commissioners responded to these information gaps by requesting additional information from CNSC staff, and then inviting intervenors to submit supplementary comments on the revised CNSC staff report. It is also encouraging that the significant difficulty experienced by the Cities Initiative and other intervenors in obtaining additional information on the proposal has also been recognized.

However, while the Commission's request for additional information from CNSC staff is to be commended, in the opinion of the Cities Initiative, the content of the revised CNSC staff report remains inadequate.



Based on Cities Initiative analysis of the supplemental report of CNSC staff to the Commissioners, the Cities Initiative has reached the following key conclusions:

**1. An accident with this proposed shipment has the potential to exceed federal standards for radioactivity in drinking water.**

- If all the total radioactive inventory of one steam generator is released, this would exceed the Health Canada Action Level for intervention in the event of a nuclear emergency by two times (2.52 mSv vs. 1mSv action level).
- If all the total inventory of all 16 generators was released this would exceed the Health Canada Action Level by 40 times (40 mSv vs. 1 mSv action level).
- Even if retaining the original assumption of partial inventory, an accident with 4 generators would be sufficient to exceed the Health Canada Action Level for drinking water.
- An accident with only one generator in Owen Sound Harbour has the potential to exceed the Health Canada Drinking Water Action Levels (if release rate is 100%).
- An accident with only one generator in a ship lock exceeds the Health Canada Drinking Water Action Levels under all accident scenarios.

**2. The proposed shipment exceeds the international allowable safety limits for total amount of radioactivity on a single ship.**

- We are in agreement with the CNSC that this proposed shipment does exceed the international allowable safety limits on the total amount of radioactivity on a single ship.
- However, we continue to disagree on the magnitude of the exceedance. The revised CNSC staff report provides no new rationale for the margin of exceedance of the international safety limit. The revised estimated conveyance value for the shipment of 16 generators is 622 A<sub>2</sub>, an increase from the Bruce Power original estimate of 545 A<sub>2</sub>



### **3. The environmental review is flawed**

- The environmental review of the proposed shipment continues to be based on best case assumptions, and fails to consider other plausible assumptions. There is insufficient evidence given for many of the critical assumptions. As a result, the environmental review consistently underestimates environmental risk.
- The accident scenarios all rely on dilution as the solution to an accident. As environmental management has evolved, using the Great Lakes to dilute radiological contamination is growing less acceptable. In addition, the calculation of dilution factors is a simplistic methodology for determining environmental impact.
- The environmental review still lacks several components: an analysis of the St. Lawrence River, an analysis of an accident scenario along the road route, including downtown Owen Sound, and an analysis of optimum time of transport. The definition of environment is too narrowly scoped to include only drinking water impacts, and so there is also still no analysis of the ecological impacts of an accident, such as impacts on fish, wildlife and food chains. Often radioactivity will be taken up by phytoplankton and zooplankton and so then be passed up the food chain and biomagnified.
- The presentation of public health information is limited and relies on assumptions of exposure measured in seconds. Other plausible scenarios are not presented.

### **4. Continued difficulty in estimating the radioactivity of the shipment is cause for re-evaluation and caution**

- There is a continuing tendency on the part of Bruce Power to underestimate the radioactivity of the generators, and so also to underestimate the risk presented by the generators. Inquiries by CNSC staff to Bruce Power have resulted in a 50% increase in the estimates of radioactivity of the generators. There seems to be questionable assumptions used to translate the survey results of about 50 isotopes into the abbreviated list of about 23 isotopes.



- The revised information indicates that there are “hotspots”, large differences in the amount of radioactivity in different spots on the same generator and among different generators. This confirms that the radioactivity is not uniformly distributed. The CNSC may wish to review whether the hotspots have been adequately considered in the current classification of these generators, their handling, storage, transportation and emergency plans.

## **5. Flawed public process**

- Intervenors and the public have experienced difficulties in accessing information
- There are difficulties in the presentation of the information which does not always fairly summarise the information or outline the underlying assumptions, or the effect of these assumptions
- The CNSC revised report clearly indicates that the process has been rushed, with significant questions in play in August and September, and several unanswered issues right up to the hearing and following the hearing.
- At the CNSC hearing, a number of intervenors noted that they had not been consulted or informed sufficiently to feel comfortable with the proposal. It is not clear from the revised report what additional measures the proponent has undertaken to consult with interested stakeholders.
- The Cities Initiative would respectfully suggest to CNSC that they review their existing procedures to ensure that in the future, all documentation on an application is posted on the CNSC web site, and to create a mechanism to better accommodate intervenor questions, to provide requested information and answer questions in advance and following the hearing, that is fair to all parties.

## **6. Emergency measures need several additions to better respond to local conditions**

- Despite a request from the CNSC Commissioners for additional analysis on the emergency plan, it does not appear that any new information or analysis on the emergency plan has been included in the revised CNSC staff report. For instance, the Emergency Plan needs to be amended to include local Owen Sound and other community’s factors and permit to transport large object requirements.





## **7. The apparent reversal of burden of proof on environmental safety continues**

- There continues to be an apparent reversal of the burden of proof, with CNSC doing most of the work and defence of the environmental review, instead of reviewing the work done by the proponent Bruce Power. It would seem that the onus should be on Bruce Power to demonstrate environmental safety.

## **8. The test of equivalent safety does not seem to have been met**

- CNSC staff arguments for the shipment meeting the test of equivalent safety are incomplete. The IAEA guidelines specify that if a shipment exceeds the international safety limits then the applicant must provide justification and compensatory measures. The test for approval from CNSC, is that the overall level of safety of the shipment in transport must be demonstrated to be at least equivalent to that which would have been provided if all applicable requirements had been met. There is insufficient such analysis of equivalent safety in the revised staff report.

## **9. This proposed shipment is not routine, it appears to be setting the Canadian precedent for the transport, export and processing of used radioactive equipment on the Great Lakes and St. Lawrence**

- This shipment is requesting three special exemptions from international safety rules:
  - i. the use of ``special arrangement`` to violate the international safety limits on total allowable radioactivity on a single ship, to violate the rule which requires demonstration that the level of radioactivity in the generators does meet the correct classification, and to allow the generators to be shipped without using an approved package,
  - ii. the ``exclusive use`` provision to exceed international safety transport index limits
  - iii. and it appears, the ``special use vessel`` to exempt from vessel and other radioactivity limits
- Therefore this proposed shipment is not routine. It still appears to be the first Canadian request for approval to transport large, used radioactive materials that do not meet international safety limits on the Great Lakes and St. Lawrence.





- The proposed shipment has been scoped to be a transport permit request, when in fact, the project poses broader policy questions, which have not been asked or answered. It is part of a growing, global trend, and approval of this proposed shipment will set the bar for Canada. Approval of this proposed shipment would in fact, make a new Canadian policy through practice.

**10.** Taken together, the above conclusions suggest that the environmental impacts continue to be underestimated, the process has been flawed, the shipment presents a precedent and that the original and revised reports fail to provide and present adequate information to enable the CNSC to render an informed decision on whether or not to allow the Bruce Power shipment to proceed.



## Introduction

**These are supplementary comments from the Great Lakes and St. Lawrence Cities Initiative on Bruce Power's application to the Canadian Nuclear Safety Commission for permission to ship sixteen radioactive steam generators on the Great Lakes and St. Lawrence.**

## The Great Lakes and St. Lawrence Cities Initiative

Mayors of the Great Lakes and St. Lawrence Cities Initiative are a prominent voice in efforts to protect and restore the vitality of the Great Lakes and St. Lawrence River and improve the quality of life for the residents of the region. The Great Lakes and St. Lawrence Cities Initiative (GLSLCI) is a binational coalition of mayors and other local officials that works actively with federal, state, and provincial governments to advance the protection and restoration of the Great Lakes and the St. Lawrence River.

Currently GLSLCI includes over 70 mayors from around the Lakes, representing over 13 million people.

## Nature of GLSLCI involvement

The GLSLCI has been actively engaged in gathering information about this application over the past six months. Staff attended the summer Owen Sound Council meeting, reviewed the August CNSC staff report and multiple applications from Bruce Power, submitted a number of emails and letters to CNSC requesting additional information in August and September, submitted detailed written comments to the CNSC on September 13, intervened in the September 28 and 29 CNSC hearing, reviewed the revised CNSC staff reports and with this document, submitted supplementary comments to the CNSC on November 22.

The Mayors of the Great Lakes and St. Lawrence Cities Initiative focused on answering the following questions about the proposed shipment including: What are the potential environmental and health impacts of shipment of the generators and an accident involving the generators? What safeguards have been applied and are these sufficient? Is there a sound emergency response plan in case of accident and adequate resources on hand in case of accident and clean up? Have all communities been informed? Does this proposed shipment meet all requirements and does it represent a precedent?

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The Board of the Great Lakes and St. Lawrence Cities Initiative has discussed this proposal at length within the organization. We believe it is a very significant issue that deserves the closest possible attention and scrutiny of the Great Lakes and St. Lawrence community.

### **Current status**

Following the September CNSC hearing, the Commissioners requested additional information in three areas: Environmental Impact Assessment, the emergency plan, including accident scenarios and the IAEA regulations for the Safe Transport of Radioactive Material and the amount of radioactivity allowed in shipments.

The Cities Initiative is pleased that the Commissioners recognised the significant information gaps in this proposal. Many of these information gaps were identified by intervenors including GLSLCI. The Commissioners are also to be commended for asking that these information gaps be filled, and so directing staff to provide additional information. Taking the additional step of asking for supplementary comments from intervenors is also very welcome. The Great Lakes and St. Lawrence Cities Initiative is pleased to have the opportunity to comment on the revised CNSC staff report.

However, while the actions of the Commissioners to increase the amount of information and sharing with intervenors are to be commended, the content of the revised CNSC staff report remains inadequate. Much of the report simply reiterates previous assumptions and opinions that upon analysis are not adequately substantiated.

Based on Cities Initiative analysis of the supplemental report of CNSC staff to the Commissioners, the Cities Initiative has reached the following key conclusions:

- 1. An accident with this proposed shipment has the potential to exceed federal standards for radioactivity in drinking water**
- 2. The proposed shipment exceeds the international allowable safety limits for total amount of radioactivity on a single ship**
- 3. The environmental review is flawed**



**4. Continued difficulty in estimating the radioactivity of the shipment is cause for re-evaluation and caution**

**5. Flawed public process**

**6. Emergency measures need several additions to better respond to local conditions**

**7. The apparent reversal of burden of proof on environmental safety continues**

**8. The test of equivalent safety does not seem to have been met**

**9. This proposed shipment is not routine, it appears to be setting the Canadian precedent for the transport, export and processing of used radioactive equipment on the Great Lakes and St. Lawrence**

**10. Taken together, the above conclusions suggest that the environmental impacts continue to be underestimated, the process has been flawed, the shipment presents a precedent and that the original and revised reports fail to provide and present adequate information to enable the CNSC to render an informed decision on whether or not to allow the Bruce Power shipment to proceed.**

The following sections of this report discuss each of these conclusions.



## **Conclusion 1: An accident with this proposed shipment has the potential to exceed Health Canada’s drinking water action levels**

### **1.1 Accident in the Nearshore of the Great Lakes**

It is highly significant that in the CNSC revised report, for the accident scenario in the nearshore Great Lakes, the environmental impact is revealed to be higher than previously anticipated. This supports the previous comments by Great Lakes and St. Lawrence Cities Initiative.

The revised accident scenario for an accident in nearshore Great Lakes, using more realistic assumptions, clearly illustrates the potential for environmental impact:

- If all the total radioactive inventory of one steam generator is released, this would exceed the Health Canada Action level for intervention in the event of a nuclear emergency by two times (2.52 mSv vs. 1 mSv action level).
- If the total inventory of all 16 generators was released this would exceed the Health Canada guidelines by 40 times (40 mSv vs 1 mSv action level).
- Even if retain original assumption of only partial inventory is released, an accident with 4 generators would be sufficient to exceed Health Canada action levels for drinking water.

It is also important to note that the Health Canada’s Action Levels of 1 mSv are ten times higher than the dose limit used to set provincial and federal drinking water levels (0.1 mSv). So the environmental impacts in these accident scenarios are being compared against the less stringent number. If comparisons are made against the more stringent drinking water guidelines, all environmental impacts increase by a factor of 10. This further illustrates the potential for significant drinking water impacts in a generator accident scenario.

**The revised CNSC staff report clearly shows that if more than one generator is involved in an accident in the nearshore Great Lakes, or different assumptions are used, then would exceed Health Canada’s drinking water action levels. So there is a significant potential for an environmental and public health impact on drinking water of an accident with this shipment.**



The presentation of the environmental impacts in the CNSC revised report is not clear. The report does not clearly present the range of the assumptions used, their alternatives and the impact of drinking water. Therefore it is difficult for the reader to understand the importance of the assumptions used. The reader is often left to do the math themselves.

In addition, in the revised report, section 2 on environmental impact does not fairly or accurately reflect the conclusions of the environmental review. Most of the critical information is in Appendix A, and a series of memos.

We would have expected the CNSC revised report to present the environmental information in a similar way to Table 1. The table below clearly illustrates the environmental information related to the impact on drinking water.



Table 1: The impact of assumptions used in the CNSC staff report to estimate effects on drinking water of an accident with the steam generators in the nearshore Great Lakes.

Number of generators assumed to be involved in accident	Amount of radioactive material in generator assumed to be released `Release rate`	Amount of radioactive material in generator assumed to be available for release `Partial or total inventory`	Results in drinking water ( in mSv millisieverts)	Impact on Drinking Water ( Health Canada Action level of 1 mSv)
1 generator	1%	13.2%	0.0033 mSv	Does not exceed limit
1 generator	100%	13.2%	0.33 mSv	Does not exceed limit
1 generator	100%	100%	2.52 mSv	<b>Exceeds limit</b>
4 generators	1%	13.2%	0.0132 mSv	Does not exceed limit
4 generators	100%	13.2%	1.32 mSv	<b>Exceeds limit</b>
4 generators	100%	100%	10.08 mSv	<b>Exceeds limit</b>
16 generators	1%	13.2%	0.053 mSv	Does not exceed limit
16 generators	100%	13.2%	5.28 mSv	<b>Exceeds limit</b>
16 generators	100%	100%	40.32 mSv	<b>Exceeds limit</b>

Note: all based on CNSC assumption of large water dilution factor of 45 billion litres





**Conclusion 1.2: An accident with only one generator in Owen Sound Harbour has the potential to exceed Health Canada’s Drinking Water Action Levels (if release rate is 100%)**

The revised report demonstrates that the loading dock in Owen Sound is very close to the intakes for drinking water for Owen Sound (less than 2 km). An accident in Owen Sound Harbour with only 1 generator and assuming a 100% release rate would result in radioactivity levels that exceed Health Canada Drinking Water Action levels by 6 times (Table 2). This is of concern.

The accident with 1 generator in Owen Sound has already been considered a “credible accident at the loading dock” (Appendix A, page 11). Only altering the release rate, then gives a significant finding of environmental risk for the drinking water for the people of Owen Sound. If an accident involved 4 generators, then the drinking water action level is exceeded by 24 times. Therefore we conclude that a credible accident in Owen Sound harbour can lead to Health Canada Drinking Water Action Level being exceeded.

The new material submitted in the revised report describes the difficulty experienced in handling a steam generator in Germany. It is noted that in testing, “package integrity could not be demonstrated in certain drop positions.” (page 233). This is of concern to the Bruce Power shipment, as the steam generators are not required to be tested in the same way (requirements only apply to SCO-II). So Bruce Power may not have identified critical drop positions to avoid, and so may have difficulty with loading the steam generators. It is recommended that Bruce Power be required to demonstrate that it is prepared to anticipate and avoid these critical drop positions.

Ontario’s source water protection program is designed to protect drinking water supplies. An accident with the radioactive steam generators in the Owen Sound Harbour area would be within the Source Water Protection Program’s Intake Protection Zone 2 and within the 2 hour Time of Travel Capture Zone (Appendix 1, page 11). This means that within 2 hours of an accident with the generators at the dock, it could be expected that radioactivity could enter the Owen Sound drinking water plant. This is of concern.

The revised report also does not clearly present the full range of impacts of drinking water in Owen Sound (only the same conservative 1 generator, 1% and 13 % assumptions). To fully understand the potential impacts on Owen Sound we have prepared Table 2, which illustrates the impact of these assumptions on

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the conclusions. It clearly shows that there is potential for an accident in loading the generators in Owen Sound that would exceed the Health Canada drinking water levels.

The revised CNSC staff report uses a back of the envelope method to estimate the dilution potential in Owen Sound harbour at 2.5 billion litres. This is twenty times less water than the dilution used for the nearshore Great Lakes accident scenario, and so the potential for drinking water impacts in Owen Sound is high.

The revised CNSC staff report underplays this significant finding. “More extreme but improbable scenarios could nevertheless result in short or long term contamination of the drinking water supply of the municipality. The exact outcome of any accident in the sound would be highly dependent on the nature of the spill and the weather/ currents before salvage occurred.” (Appendix 1 page 11). This significant finding is also not highlighted in the Section 2, summary of the environmental impact. The emergency plan also does not provide any detailed specific salvage plans for an accident in Owen Sound harbour.

**We conclude that the close proximity of the drinking water intakes to the Owen Sound loading dock, the smaller water dilution available and the risks involved in loading, all illustrate the plausible potential for an accident with the generators to impact the drinking water of the people of Owen Sound.**



Table 2: The impact of assumptions used in the CNSC staff report to estimate effects on drinking water of an accident with the steam generators in Owen Sound Harbour.

Number of generators assumed to be involved in accident	Amount of radioactive material in generator assumed to be released `Release rate`	Amount of radioactive material in generator assumed to be available for release `Partial or total inventory`	Results ( in mSv millisieverts)	Impact on Drinking Water ( Health Canada Action Level of 1 mSv)
1 generator	1%	13.2%	0.06 mSv	Does not exceed limit
1 generator	17%	13.2%	1 mSv	<b>Exceeds limit</b>
1 generator	100%	13.2%	6 mSv	<b>Exceeds limit</b>
1 generator	100%	100%	45 mSv	<b>Exceeds limit</b>
4 generators	1%	13.2%	0.24 mSv	Does not exceed limit
4 generators	100%	13.2%	24 mSv	<b>Exceeds limit</b>
4 generators	100%	100%	181 mSv	<b>Exceeds limit</b>
16 generators	1%	13.2%	0.96 mSv	Does not exceed limit- close to limit
16 generators	100%	13.2%	96 mSv	<b>Exceeds limit</b>
16 generators	100%	100%	727 mSv	<b>Exceeds limit</b>

Note: all based on CNSC assumption of water dilution factor of 2.5 billion litres  
Only the first accident scenario is presented in the CNSC revised report.



### **Conclusion 1.3: An accident with only one generator in a ship lock exceeds Health Canada's Drinking Water Action Levels**

The CNSC report did present new information on the environmental impact of an accident in a lock. The proposed shipment would need to pass through a series of 19 locks, along the Welland Canal and in the St. Lawrence River. This is one of the areas raised by Great Lakes and St. Lawrence Cities Initiative as cause for concern.

The amount of water available in a lock for dilution was estimated at 91 million litres, much smaller than nearshore Great Lakes (45 billion litres) and Owen Sound harbour (2.5 billion litres), so it is expected that the concentrations of radioactivity from an accident would be very high in a lock. And the results bear this out: an accident in a lock with only one generator (and using most conservative assumptions 1% release rate and partial inventory) results in the highest amount of radioactivity of all accident scenarios, 1.64 mSv, well above the Health Canada drinking water Action Level of 1 mSv (CNSC staff report, Appendix A, page 9-10).

It is also worth noting that some municipal drinking water intakes, agricultural intakes and private industrial water intakes are near locks. For example, St. Catharines and surrounding towns, takes its drinking water from the Welland Canal (providing a water supply for about 165,000 people). Other communities along the St. Lawrence take their drinking water from the St. Lawrence. There is no information presented on the proximity of water intakes to locks in the revised report.

Unfortunately the lock analysis in the CNSC report applies the same conservative 'best case' assumptions of 1 generator, a 1% release rate and partial inventory. Table 3 presents the results of this scenario and other plausible scenarios. **All accident scenarios in a lock result in exceedance of the Health Canada Action Levels, often by a large margin.**

Despite this significant result of only one generator significantly exceeding drinking water guidelines, the CNSC report does not present this finding clearly, or evaluate the significance of this finding fully. This contributes to the Commissioners not having sufficient information of sufficient quality to evaluate this proposal.



The report also goes on to discuss what might happen to the contaminated water now contained in the lock. “If an accident of this type did occur, the lock water could be recovered, and if warranted, disposed of in a licensed waste management facility. If lock water was not recovered, further dilution in lake or canal water would occur.” However there is no mention of this scenario in the emergency plan and no contingency plan in place for this scenario. This would also appear to be a reportable spill. If this accident did occur and the ship and contaminated water was stuck in the lock for a period of days or weeks, this can cause a backup of loaded ships in the entire seaway, causing considerable economic impact.

Table 3: The impact of assumptions used in the CNSC staff report to estimate effects on drinking water of an accident with the steam generators in a lock in the Welland Canal and St. Lawrence Seaway.

<b>Number of generators assumed to be involved in accident</b>	<b>Amount of radioactive material in generator assumed to be released `Release rate`</b>	<b>Amount of radioactive material in generator assumed to be available for release `Partial or total inventory`</b>	<b>Results (in mSv millisieverts)</b>	<b>Impact on Drinking Water (Health Canada Action Level of 1 mSv)</b>
1 generator	1%	13.2%	1.64 mSv	<b>Exceeds limit</b>
1 generator	100%	13.2%	164 mSv	<b>Exceeds limit</b>
1 generator	100%	100%	1,242 mSv	<b>Exceeds limit</b>
4 generators	1%	13.2%	6.56 mSv	<b>Exceeds limit</b>
4 generators	100%	13.2%	656 mSv	<b>Exceeds limit</b>
4 generators	100%	100%	4,970 mSv	<b>Exceeds limit</b>
16 generators	1%	13.2%	26.24 mSv	<b>Exceeds limit</b>
16 generators	100%	13.2%	2,624 mSv	<b>Exceeds limit</b>
16 generators	100%	100%	19,879 mSv	<b>Exceeds limit</b>

Note: all based on CNSC assumption of water dilution factor of 91 million litres  
Only first accident scenario presented in the CNSC revised report.



**Conclusion 2: The proposed shipment exceeds the international allowable safety limits for total amount of radioactivity on a single ship**

**We are in agreement with the CNSC that this proposed shipment does exceed the international allowable safety limits on the total amount of radioactivity on a single ship. We therefore feel that this is sufficient reason why this shipment should not proceed.**

This exceedance of the international safety limits is one of the three reasons why this shipment requires a special approval, called a special arrangement. At the hearing, it was suggested many times that the only reason a special arrangement approval was required was due to the *size* of the generators. This is incorrect. One of the three reasons that a special agreement is required is because of the *content* of the steam generators. **The radioactive content of the steam generators exceeds the international safety limits for the total amount of radioactivity allowed on a single ship. There is no dispute or disagreement about this fact.** This exceedance of an international safety limits is significant.

Much of the revised CNSC staff report describes the CNSC's opinion on the amount of the margin of exceedance of the international safety limit. While this is important, it tends to overshadow the more important fact, that this shipment exceeds the international safety limits for the total amount of radioactivity allowed on a ship. Not enough information or emphasis has been placed on this most important finding.

We would have expected the revised report to provide to the Commissioners detailed information about this most important fact, the exceedance of an international safety limit. The type of information that we expected to see provided to the Commissioners and the intervenors includes: how many requests for special arrangements are reviewed each year, a break down of these requests by mode of transport and type of material, whether this is the first application that exceeds the international safety limit for a ship on the Great Lakes and Atlantic Ocean, what type of controls are common on other special arrangement shipments, and what are other countries practises for this situation etc.

In particular, the CNSC report has not included any description of the draft guideline being developed by International Atomic Energy Association (IAEA) for exactly this type of situation, the transport of large components under special arrangement. This guideline is now out for comment until December. We would have thought that the revised report would have described this IAEA draft

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guideline in detail, and assessed whether the current proposal is consistent or not with this IAEA draft guideline. The fact that IAEA is developing this guideline is highly significant and merits discussion: it illustrates that there is a growing global need for regulations and guidance in this area, that there is expected to be increase in global trade in steam generators and other used radioactive equipment, that the process and decisions being made by the CNSC Commissioner are being watched by many, the type of conditions and controls placed on this shipment may have implications for other countries and that this shipment is therefore precedent setting in Canada.

The Commissioners did ask about this very point at the September hearing, on whether there was a need for CNSC to develop guidance for the transportation of large components. The reply was that something was being developed in the next year or two. This was the point when it would have been expected for the existence of this IAEA draft guideline to be raised, discussed and debated. The Commissioners could consider asking for additional information and assessment of this application under this draft guideline.

***No new evidence to justify CNSC staff opinion on margin of exceedence of international safety limit (conveyance limits)***

The revised CNSC staff report provides no new rationale for the margin of exceedence of the international safety limit on conveyance limits. The revised estimated conveyance value for the shipment of 16 generators is 622 A<sub>2</sub>, an increase from the Bruce Power's original estimate of 545 A<sub>2</sub> (April 1 application).

We can agree to disagree with the CNSC on the margin of exceedence of the international safety level. The CNSC revised staff report states that this proposed shipment exceeds the international allowable safety limits on the total amount of radioactivity on a single ship by 6 times, and Cities Initiative analysis concludes that this shipment exceeds the international safety limit by 50 times (or now 60 times with revised and increased estimates of radioactivity). This difference of opinion comes down to whether the International Atomic Energy Agency guidelines are interpreted as applying to an inland *water way* or to an inland *watercraft and the definition of an inland watercraft*. One column of Table 5 of the guidelines states that the limit applies to an inland waterway and the other column states that it applies to an inland watercraft.





A fair interpretation of the IAEA guidelines would be that the guidelines are not clear on whether the 10 A<sub>2</sub> limit applies to an inland waterway or an inland watercraft, and what type of vessel is considered an inland watercraft. We note that the IAEA guidelines do not define “an inland watercraft”, and hence no mention of an inland watercraft being a barge. An inland water craft could be a seagoing vessel travelling on an inland waterway. In addition, on the Great Lakes there are a number of vessels known as “lakers” which travel only the Great Lakes, and do not travel to the sea due to the wider berth. These lakers are not barges, but sturdy vessels, and could also be considered inland watercraft.

We note that CNSC staff promised at the September hearing to provide comments from the IAEA on the interpretation of IAEA guidelines to clarify this matter. These IAEA written comments were not provided in the revised staff report. This makes it very difficult to accurately determine which interpretation of Table 5 of the IAEA guidelines is correct. It would have been helpful for CNSC staff to follow through and to provide an IAEA letter or memo clarifying this interpretation of the IAEA guidelines. The revised report reiterates CNSC staff assertions, rather than providing new information or a ruling from IAEA. **Without this letter from IAEA we feel that this matter on which IAEA conveyance limits applies, and what type of vessel is considered an inland watercraft has not been sufficiently clarified.** Nevertheless, there is agreement on the fact that all parties agree that this shipment does exceed the international safety limits for total amount of radioactivity of a single ship.



### **Conclusion 3: The environmental review is flawed**

**Conclusion 3.1: The environmental review of the proposed shipment continues to be based on best case assumptions, and fails to consider other plausible assumptions. As a result, the environmental review consistently underestimates environmental risk.**

**Conclusion 3.2: The environmental review is flawed because of a poor choice of “bounding scenario” used in the environmental review. There is little or insufficient evidence given to support many of these critical assumptions.**

In our previous comments and at the hearing, GLSLCI pointed out that one of the main problems with the CNSC environmental analysis was that it rested on best case assumptions instead of other plausible assumptions. There is little or insufficient evidence given to support many of these critical assumptions. The consequence of these assumptions is that it leads to consistently underestimating the environmental risks.

The August CNSC environmental analysis rested on four best case assumptions including:

- 1) only one of the 16 generators is involved in an accident,
- 2) only a very small amount (1%) of the radioactive materials is released in an accident,
- 3) not all of the radioactive materials in the generators are available for release (only 13% of total inventory is available),
- 4) the use of large water dilution factors.

The CNSC report calls the first three of these best case assumptions “a bounding scenario”. It then uses these critical assumptions in the “bounding scenario” to assess environmental impact. This poor choice of bounding scenario, and unwillingness to consider other scenarios is one of the critical flaws of the environmental review. The revised report does little to correct this critical flaw.

When all these assumptions are combined in the CNSC staff report, it results in underestimates of the environmental risk of the shipment. The effect of the assumptions is mathematically to take a large numerical risk and then multiply it by 0.00132 to get an answer. So in other words, mathematically the effect of these assumptions is to take a big number and make it into a small number. However, the assumptions used in the environmental review are not always

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valid. Nor are there always adequate reasons given to support these critical assumptions. Therefore the entire environmental review is flawed because it is based on these invalid and often inadequately supported assumptions.

The Commissioners, and the GLSLCI, requested that these critical assumptions used in the bounding scenario be altered. In the revised CNSC staff report, this has only been partially done and only for one accident scenario. For the other accident scenarios, such as accident in a lock, or accident in Owen Sound, unfortunately, the same faulty best case assumptions are carried through. Therefore, the revised report seems to repeat the original error of using faulty best case assumptions in most accident scenarios. It does not present other plausible scenarios. Therefore, the revised report continues to underestimate the environmental risk of the proposed shipment.

Because these assumptions are so critical to the conclusions about environmental impact, we comment on each of them.

***No evidence provided to justify assumption of only one generator involved in accident***

The first assumption that only one generator is involved in an accident, does not seem to make sense when all 16 generators are the same hold of one ship. Indeed all 16 generators are fairly closely packed together in the ship hold, so much so, that two of the generators have to be placed in opposite orientation. An accident which only involved one of these generators is hard to imagine when they are all packaged so tightly together.

The CNSC staff revised report still refuses to see any scenario in which more than 1 generator is involved in an accident as “probable”. Yet there is no solid evidence given for this assumption. There is no accident reports referenced, no data provided. There is a complete lack of evidence provided by the CNSC to justify the assumption of only 1 generator being involved in an accident. Because of this lack of evidence to support a critical assumption, the Commissioners still do not have sufficient information to evaluate the proposal.

Alternative accident scenarios are labeled as “extreme”, whereas staff scenarios are labeled as “credible”. In the accident scenario in a lock and in Owen Sound, there are no analysis presented using other than this assumption than only one generator is involved in an accident. This is of concern.



***Assumption that only 1% of material is released not based on actual accidents but outdated concepts***

The second assumption in the environmental review is that only 1% of the radioactive material would be released in case of an accident. This is a critical assumption, and plays a major factor in determining the analysis of environmental risk. The revised CNSC document states that this 1% assumption is drawn from IAEA advisory materials (TS-G-1.1 Appendix 1 paragraphs 1.32 to 1.35). These guidance documents are to assist in the interpretation of the IAEA guideline and are not considered legally binding. This 1% release rate is questionable. It is based on the Q system, an old system, full of assumptions. As the same IAEA guidance document states “Many of the assumptions made are similar to those stated, or implied, in the 1973 Edition of the Transport regulations.... In particular, pragmatic assumptions are made regarding the extent of the package damage and the release of contents...” (TS-G-1.1 Appendix 1 paragraph 1.7).

This 1% release rate is not based on actual performance of packages in accidents. In fact, IAEA descriptions on one actual accident documents 30% of the material was released. The 1% release rate is used to determine the amount of radioactivity that can be allowed in certain types of packages. It is a theoretical calculation designed to derive package limits. It is not designed to be applied in this type of situation, to determine the environmental impacts of a release.

Therefore, in previous written comments and at the hearing, GLSLCI urged the CNSC to examine the environmental impacts if this critical 1% release rate is altered. In any analysis where one factor is identified as driving the analysis, it is common to do sensitivity analysis to determine the impacts of alternative values. We would have expected the revised CNSC report to present a range of release factors and the corresponding impacts on drinking water quality. However, in the revised CNSC staff report, only in one scenario (nearshore Great Lakes) is this critical assumption altered. This is not sufficient. This critical 1% release rate assumption should also have been altered for all accident scenarios, and the information clearly presented. Instead the reader cannot gather this information from the summary and has to go to the Appendices and calculate the impacts for themselves for most accident scenarios. Because of this omission, the Commissioners do not have sufficient information to evaluate this proposal.



When the release rate is assumed to be 100%, instead of 1% then an accident with four generators (assuming still 13% available inventory only), then this nearshore accident scenario will result in exceedance of the Health Canada Drinking Water Action Levels in nearby drinking water plants (Table 1).

We conclude that there is still an excessive reliance on the 1% release fraction in the revised report, which is a critical assumption, and based on dated scientific concepts and limited knowledge of actual accidents.

### ***Low confidence in the estimate of non fixed inventory***

The third assumption states that not all the radioactive materials in the generators are available to be released in an accident. This is because some of the material is contained within the metal tubes (called fixed) and some is in the form of a dust on the tubes (called non-fixed). What becomes critical then is the accuracy of the estimate of how much of the total inventory is in the non fixed or dust form. Here there are only very preliminary estimates provided by Bruce Power on the amount of non fixed form of 4-13%. It does not appear to be verified by any actual testing or observations of the generators. It is a back of the envelope theoretical type of calculation. It therefore appears to be reasonable to assume that there is a low confidence in this estimate. It is therefore reasonable to expect the revised CNSC report to represent a range of values for the amount of available inventory.

### **Conclusion 3.3: The accident scenarios all rely on dilution as the solution to an accident**

The fourth assumption in the environmental review rests on the amount of dilution provided by the Great Lakes and Owen Sound Harbour. However, as environmental management has evolved, using the Great Lakes to dilute radiological contamination is growing less acceptable. **It is not really acceptable to take advantage of the size of the Great Lakes as a way to justify the environmental safety of the shipment.**

The revised staff report contains several of GLSLCI requested pieces of information about the dilution factors used in the environmental analysis.



This new information reveals that there is a huge reliance on assuming large amounts of dilution as the solution to an accident with this proposed shipment. The dilution factors used in the environmental analysis are very high, over 45 billion litres for the nearshore Great Lakes scenario and 2.5 billion litres for Owen Sound. There is no evidence presented on how these dilution factors compare to other studies and findings.

There is only a dilution factor calculated in the report for one Great Lake (Lake Ontario) and then this dilution factor is assumed to be representative of all nearshore Great Lakes. This is inadequate. Each Great Lake and especially the connecting channels are unique. Each Lake and river has very different volumes, currents and ecology, so one size does not fit all. An accident could occur on the smaller Lake Erie (with about one quarter the volume of Lake Ontario) or the smaller still Lake St. Clair (with one hundredth the volume of Lake Ontario), or the connecting channels such as St. Clair river. There are many drinking water intakes along the connecting channels such as Lake St. Clair and the St. Clair river. These smaller volume lakes and rivers would have the effect of having less water available for dilution and so increasing the concentration of radioactivity.

We would have expected the report to present an analysis of how the dilution factor compares to other studies and findings, how a dilution factor calculated for Lake Ontario can be legitimately applied to all the Great Lakes, and especially the smaller Lakes like Erie, St. Clair and the connecting channels. It does not seem appropriate to calculate a dilution factor for one Lake and then assume it is valid for all the Great Lakes.

We also expect the wind and waves to effect the concentration of radioactivity at the nearshore intake pipes. These are not considered in the current analysis. We would appreciate receiving a copy of the document in the revised report that discusses seasonality as a factor (Reference 5, Appendix A page 12).

However, even using these mammoth dilution factors, still results in significant environmental impacts. Even assuming dilution with 45 billion litres of water in Lake Ontario, an accident with 4 generators will still exceed Health Canada drinking water Action Level.





It is also curious why the environmental analysis is not based on a different methodology entirely. We would have expected the environmental review to use a sophisticated environmental modelling approach, instead of the simplistic calculation of a dilution factor. There are a number of good sophisticated environmental models used to predict concentrations in the Great Lakes and St. Lawrence.

CNSC staff review guidance documents anticipates and encourages the use of these modeling methods by applicants in other situations (including SRG-2.01-EIS Environmental Impact Statement Modelling). These models use a variety of inputs to predict concentrations at different locations and points in time, and have been used to assess critical factors, concentrations over time and concentrations in ecological food webs etc. They are often computer model simulations run with changing inputs.

The computer models have several advantages over the dilution factor method presented in this environmental review: they allow for multiple scenarios to be run, they identify the critical factors driving concentrations, they can be applied to different Great Lakes to get customized results for each Great Lake, they can give a time sequence, they can identify critical seasons or weather conditions that would increase impacts and they can identify expected concentrations in algae, fish and other food chain. Why did CNSC not require Bruce Power to do a more sophisticated assessment of environmental impacts using one of the environmental modelling approaches? Why CNSC did not seek the advice of other federal experts on the Great Lakes and St. Lawrence such as Environment Canada for their assistance and review of the environmental impacts?

Instead of using one of these environmental models, the report estimates the dilution factor from a spill in Lake Ontario, and then uses this dilution factor as the basis for the environmental review. It is not clear why this method was chosen over other methods to predict environmental impacts of the proposed shipment.





**Conclusion 3.4: The revised report still lacks several components:**

- 1) an analysis of the St. Lawrence River,**
- 2) an ecological analysis,**
- 3) an assessment of the transport index and if this shipment exceeds the normal transport index limit,**
- 4) an analysis of an accident scenario along the road route, including in downtown Owen Sound,**
- 5) analysis of the optimum time of shipment.**

**This missing information makes it difficult for the proposal to be properly evaluated.**

***No analysis of accident on the St. Lawrence***

The GLSLCI has serious concerns with the failure to comprehensively evaluate the potential environmental impacts of an accident in the St. Lawrence in the revised staff report. The report suggests that this accident scenario “was not carried forward for quantitative analysis as the Nearshore Lake Ontario scenario was deemed to be a bounding scenario.”(Appendix A, page 10). However, there is no evidence presented to support this conclusion. The amount of water in the St. Lawrence and the dilution factor are not presented. There is only an unreferenced statement of the large (not quantified) amount of water in the St. Lawrence. This is not sufficiently precise an analysis to rule out quantitative analysis on the St. Lawrence. This is a significant omission.

In addition, the analysis does not consider the narrowness of the river in some parts with the close proximity between ships and drinking water intakes, the large number of people living in major cities along the route, and the nearshore currents which often cause contaminants to hug along the shorelines, or the effect of freshwater and salinity mixing zones.

***No analysis of ecological impact***

In the revised CNSC staff report, there is still no analysis of the ecological impacts of an accident, such as impacts on fish, wildlife and food chains. Often



radioactivity will be taken up by phytoplankton and zooplankton and so then be passed up the food chain and biomagnifies. In the revised report, **the environmental impacts have been overly narrowly scoped** to include only impacts on drinking water. The definition of the environment in various nuclear safety regulations is broad, and so would seem to require a broader environmental analysis. The CNSC staff guidance documents do provide a framework for ecological risk assessment. The full range of environmental impacts are not considered, including the lack of consideration of ecological impacts, which is an omission in the revised report.

***No Transportation Index given for the proposed shipment, or any discussion or evaluation if this shipment's transportation index exceeds a second international allowable safety limit. Bruce Power invokes "exclusive use" provision to exempt from regulatory safety limits. Exclusive use therefore provides more than "administrative relief".***

In our earlier submitted questions to the CNSC we had requested the transport index for each generator and for the shipment. The revised report still does not answer this question or provide discussion or analysis on the transport index. The transport index matters for two reasons: there is an international regulatory limit on transport index for shipments, and the transport index is often used by emergency personnel to evaluate what type of response is required in the event of an accident or emergency. The revised report does provide a July 16, 2010 memo from WMG which carefully avoids saying what the transport index is. It also states that ``Declaring these shipments exclusive use excepts the steam generators from the regulatory limit for individual package or conveyance TI `` (transport index). Exclusive use means that no other cargo is carried on the road trailer or the ship at the same time. This memo does indicate that in calculating the transport index for each steam generator and for the entire shipment, the original estimate calculated has to be multiplied by 10 to get the final transport index values( from Table VI).

In a followup GLSLCI question to the CNSC, staff noted that while each Transport Index would be assigned prior to shipment, the transport index was expected to be about 8 for each generator. If this number is then multiplied by the agreed upon factor of 10, this would mean the transport index for one generator could be about 80 and for the entire shipment could be about 1,280 (sum of all TI's). These are very high transport indices. This would seem to exceed the international regulatory limit for a package transport index of 50. It would also seem to exceed the international safety limit set for a total vessel of 200.



Therefore this shipment appears to exceed the international allowable safety limit on another matter, the transport index. This time, to exempt from this international safety limit, another, different mechanism is used, the “exclusive use” provision. Bruce Power proposes to ship these generators under the “exclusive use” provision, so argues that this exempts the proposed shipment from these international safety limits.

We would encourage the CNSC to follow through on its good original line of questioning about the transport index, and to provide the individual and shipment transport index, and assessment of whether this exceeds the international limit and then an evaluation of why this shipment is being considered if it exceeds a second international safety limit. This is missing from the revised report.

At the hearing, during a discussion of this point raised by GLSLCI that exclusive use provision loosens regulatory requirements, the CNSC staff replied that the exclusive use provision provided “administrative relief only”. This does not seem to be the case here. It seems that the use of exclusive use provision is a way to allow this shipment to exceed the international safety rules for safe shipment on both roads and ships. This proposed shipment would not be allowed if it were not for the declaration of exclusive use provision. Therefore, it seems that exclusive use provision provides more than administrative relief. We conclude that the information around the transport index has not been clearly presented or assessed and that the exceedence of the transport index limit is another reason for this shipment not to be approved.

### ***No analysis of the optimum time of shipment or lowered lake levels***

In our previous comments we noted that the lack of analysis on the optimum time of shipment. The revised report also does not analyse the shipment to determine the optimum time of shipment.

As time has progressed, the potential dates of shipment (originally listed as June 30 to Sept 7) have become later this year or potentially 2011. During winter and spring, the roads from Bruce Power to Owen Sound, including the large hill down to the harbour can become slippery, windy and icy. At the hearing, it was suggested that it would take 16-21 days to transport the generators the 80 km to Owen Sound. If approval is given in December, this could make the shipment in late December. Late fall and winter are stormy, cold times on the lakes, prone to high winds and waves on some of the Lakes and the Atlantic. For example, December has the highest possible storm induced rises of all months (example given for Buffalo, US Army Corps of Engineers). Bruce Power’s application could

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have taken advantage of the wealth of information on the shipping conditions during different months to determine the optimum time of shipment.

In addition, parts of the shipping route and Seaway close in December depending on conditions. These dates are also often very busy times on the Welland Canal and Seaway. With the changes in the world grain market, a very busy fall shipping season is currently underway on the Lakes and Seaway. St. Lawrence Seaway 2010 year to date shipments have increased by 17% from 2009. Has the changed potential shipment date been considered and analysed for likelihood of accident? Has the optimum time of shipment been considered?

The lake levels in many of the Great Lakes are low. Lake Huron is currently 16-17 inches below its long term average, Superior 11- 13 inches, Erie 4 to 7 inches, Ontario 4 to 8 inches and Lake St. Clair 7 to 9 inches (US Army Corps of Engineers Great Lakes Water Summary). Has the lowered levels in the Lakes and the port of Owen Sound been considered in this shipment?

### **Radiation Protection**

**Conclusion 3.5: There is little information presented in the report on the radiation dose to the public in different situations. The dose is stated to be low, but this is based on exposures measured in seconds. Other plausible scenarios, involving longer times or more than one generator are not presented. In particular, there is no information available on public dose rates during an accident along the road route and during loading in Owen Sound or for people exposed for longer times. The dose to the shipworkers also appears to be high.**

In general, both the original and the revised report do not present much information on estimating the public dose in a variety of situations. In a similar situation to the environmental review, only a few scenarios are presented, and also make best case assumptions. Other plausible scenarios involving longer times, accidents along the route or exposure to more than one generator are not presented.



The revised report could have also presented:

- The estimated dose to the public in the event of a road accident along the route, in both rural and within the several towns the shipment passes through
- The estimated dose to the public of the cumulative effect of the 16 generators during the estimated 20 days of loading in the harbour of Owen Sound
- A map of the Owen Sound harbour, indicating the loading dock and the proximity to the nearest houses and businesses, and the estimated number of people and expected doses in various zones
- An estimated dose to people watching the loading of the steam generators
- The estimated dose to workers handling the steam generators with known hotspots
- The estimated dose to the public and workers in the event of an accident during loading at the Owen Sound harbour
- Dose rates at 1, 2 and 3 meters from one generator and the accumulated 16 generators
- The requirements for checking the boat before loading to ensure radioactivity levels are within limits

***No public health information using plausible longer exposures and all generators***

The public dose information is very limited and also not clearly presented in the original or revised report. The actual dose estimates are contained in a series of question and answers buried in the technical materials of the report. These tables state that the public dose is low (0.1% of annual dose), mainly because the exposure is assumed to be measured in seconds. Exposure is calculated for someone driving by the shipments and for someone walking by quickly and slowly. Using these same rates and assuming a longer exposure does give significant public dose rates. A reasonable question to ask is: how long would a member of the public have to be exposed to these steam generators to receive the maximum recommended annual public dose limit of 1 millisievert? This question is not asked or answered in the reports. This is a significant omission.





In our attempt to understand the public dose, we did some preliminary calculations based on Bruce Power's information. **It appears that if a person is standing watching the generators go by (so has no speed), then it would take only 37 minutes for this person to receive the total recommended maximum public dose for one year (1 millisivert).** We would welcome the CNSC and Bruce Power's thoughts on this, and would encourage them to present additional information on the public dose. Without this information, and with the information presently given and in the manner it is presented, does not allow the Commissioner or the public the opportunity to fully understand the impact of this shipment on the public and workers.

We would have expected the report to present the information on public dose rates in way that allows the Commissioners and readers to easily understand the information, and the effect of the assumptions behind the information. Some places along the route are well travelled fairly busy roads with lots of pedestrians (i.e. Highway 6 and 10 in Owen Sound), where more people could be exposed and for longer than the assumed 30 seconds. We would have expected something like Table 4, with the other scenarios calculated.

Table 4: Estimated public dose from exposure to the steam generators as they travel along the road route from Bruce Power to Owen Sound

Scenario	Speed	Exposure time	Exposure (millisieverts)	Exposure (microsieverts)
Driving past	15 km/hour	4 seconds	0.000891	0.89
Walking past quickly	4 km/hour	15 seconds	0.003	3.34
Walking past Slowly	2 km/hour	30 seconds	0.00668	6.68
Watching the generators pass by	0 km/ hour	37 minutes	1	1000
Watching the loading of the generators	?	?	?	?
Exposure to the public if an accident occurs during road transport	?	?	?	?
Exposure to the workers if an accident occurs during road transport	?	?	?	?



Based on Bruce Power July 22, 2010 memo to CNSC which estimates a dose rate of 8mR/hour, and a distance of 16.7 metres. The first three scenarios are presented in the question and answers from Bruce Power.

***No public health information for an accident along the road route***

It is also curious that the revised report does not provide an accident scenario or public dose estimates for a truck accident and release of radioactivity near the centre of Owen Sound and the several other towns that this shipment will pass through. In Bruce Power's Summary report of August 20, 2010, this scenario is described. "hypothetical highway transportation could occur on highways, rural/county secondary roads or City/ municipality urban roads. Although considered an unlikely scenario, for planning purposes it could be considered that the vehicle overturns, and the package closure is breached during a snow, rain and/or wind event, resulting in the release of some radioactive contamination" (page A4). We would have expected the revised report to describe this accident scenario, and estimate the public and worker dose of this scenario, using the revised radioactivity estimates. This lack of public dose estimates, and lack of updating existing public dose estimates is a serious omission in the revised report.

Therefore the report does not seem to provide adequate information to the Commission on the public dose expected from this shipment under a variety of plausible transport situations, and also in an accident situation along the road or during loading at Owen Sound.

Because of these omissions, vague evidence presented to rule out an accident scenario on the St. Lawrence, lack of ecological impacts, and lack of accident scenarios along the road route, including Owen Sound, lack of consideration of optimum transportation time, the Commission does not have sufficient information of sufficient quality to evaluate this proposal.





## **Conclusion 4: Continued difficulty in estimating the radioactivity of the shipment is cause for re-evaluation and caution**

There is a continuing tendency to underestimate the radioactivity of the generators, and so also to underestimate the risk presented by the generators. It appears that CNSC staff has been asking Bruce Power good questions about the estimates of radioactivity of the generators, and this has resulted in a **significant increase of 50 % in the estimates of radioactivity of the generators.**

There continues to be difficulty in accurately estimating and reporting the amount of radioactivity in the shipment. Just prior to the September hearing, CNSC issued revised values for the estimates of radioactivity of the shipment. The estimate of the total activity contained in the 16 steam generators went from 3.67 to 5.46 tera bequerels (a trillion bequerels or E 12). This is an increase of 50% in the total radioactivity of the generators.

### ***Revision in radioactivity requires new application from Bruce Power, with revised estimates of public and worker dose***

This revision in radioactivity is significant, as much of the original public and worker dose estimates and environmental work was done on the lower estimate. In the revised CNSC report, there are not revised estimates available for the public dose based on the revised, increased radioactivity levels. Perhaps the radioactivity has increased without increasing the effective dose. This seems to be an omission in the information provided to the Commission. The CNSC revised staff report does use the corrected higher estimates in the environmental review.

It seems curious that it was the CNSC staff, not Bruce Power who issued the revised radioactivity estimates, and that this material change in the information did not seem to trigger a revised application from Bruce Power. The memos between CNSC and Bruce Power explaining the reason for the omission of the missing plutonium and other isotopes have not been included in the revised CNSC staff report.

The revised report adds another level of estimation to the radioactivity of the generators, with new error values of plus or minus 30%. The revised CNSC staff report also gives an example of a shipment in Germany, noting that they also experienced difficulties in accurately estimating radioactivity of the shipment.



***Questionable rationale in moving from full Kinetrics list of 50 radioisotopes to abbreviated list of about 23 radioisotopes used in the Bruce Power application***

The revised CNSC report notes that Bruce Power does not include uranium in its estimates of radioactivity of the generators. It is not clear why these uranium isotopes are not included in the inventory of the steam generators. It is clear that there is uranium in the generators: U-234 (approximately 8,000,000 Bq), U-235 (130,000 Bq) U-236 (1,500,000 Bq) and U-238 (9,900,000 Bq) (Table C.7 Kinetrics Isotopic Inventory). This would increase the estimate of radioactivity and also increase the estimate of  $A_2$ .

There are also a number of other isotopes in the Kinetrics report (the total list of radionuclide's in the steam generators is over 50) that are not on the final list provided by Bruce Power. Some of these were discussed at the hearing, and others seem to be different.

We would recommend that CNSC clarify the reasoning used in moving from the Kinetrics list of 50 radioisotopes (Table C.7) in the generators to the abbreviated summary list of the 23 isotopes in the generators. There are many assumptions and screening criteria used to move from the full Kinetrics list to the final abbreviated list of radioisotopes used in the Bruce Power application. Some of these screening criteria may have been appropriate for the original purpose of the list, to determine classification, but they do not seem to be appropriate for other uses, including determination of the  $A_2$  value of the shipment and as a basis for determining environmental and public health impacts.

We would encourage CNSC to carefully consider the assumptions and screening criteria as these merit careful review, and may not be valid. As noted in the new IAEA draft guideline, "Care should be taken about the radio isotopic composition of inventory." Bruce Power and OPG have a number of useful surveys on the generators, but it is the *translation* of these survey results into the final list that requires re- assessment.

This difficulty in accurately estimating and reporting the radioactivity of the shipment is cause for caution in all aspects of the proposed shipment.



***Not all generators are the same, some are more radioactive than others, and some have “hotspots”. No consideration of importance of hotspots in classifying handling, transportation, storage and processing of these generators***

The CNSC and Bruce Power documents recognize that not all generators have the same amount of radioactivity. However, it appears that the range in radioactivity among generators may be greater than previously thought. It appears that some generators have “hotspots”, **areas on a generator where radioactivity levels are much higher**. This has important implications for the classifying, handling, transportation, storage and processing of these generators.

In September 2010, CNSC issued revised estimate of the maximum contact dose rate on one spot on one generator, **increasing the maximum contact dose rate from 270 microsieverts to 740 microsieverts, an increase of 174 %** (CNSC Supplemental document with corrections CMD 10-H19C). This is further confirmation that the generators are not all alike, and some generators and some spots on generators are much more radioactive than others.

The existence of hotspots on the generators is **an important warning sign** that needs to be taken into account in all aspects of this proposed shipment, particularly when classifying, handling, transporting, storing and processing the generators. It would seem prudent for Bruce Power to investigate the possible reasons for this hotspot, as it may indicate internal breakage, leakage or other conditions. It would also seem prudent to investigate if other generators have similar hotspots. It would seem prudent to know and visibly mark which spots are the most radioactive, and then avoid contact with these as much as possible. It would also seem advisable for Bruce Power to tell this information to WMG, Studskvik, ship workers and others so that it can be taken into account if the generators are handled and processed. This information also needs to be part of the emergency plan and the radiological protection plans.

Knowledge of the revised maximum contact dose of this one generator would also have been highly important for the painters and welders who have already prepared the generators, and for the people who may yet handle this generator. It would be highly important for the workers who are proposed to weld these generator saddles into the ship. Yet these revised estimates and the existence of hotspots do not appear in the Bruce Power’s estimates of dose for the workers or the radiological protection plan.



**Surveys confirm radioactivity is not uniformly distributed in the generators, therefore need to assess whether the more radioactive parts of the generator are actually SCO-II**

The existence of hotspots is also a strong confirmation that the **radioactivity is not uniformly distributed** within the generators. From the Kinetrics Surveys, radioactivity appears to be lower at the top of the generators, highest in the bottom sides and high, in some, but not all bowls. This highly variable distribution of radioactivity, may also be a strong indication that the **SCO-I limits are not met for all parts of the generator**. CNSC may wish to confirm the extent of hotspots and variability on all generators, and whether these hotspots and variability means that part of the generators do not meet the SCO-I definition, and some parts of the generator, **are actually SCO-II**. It needs to be evaluated whether some parts of the generators are SCO-II and some parts are SCO-I.

In fact, if the original radiation surveys of the steam generators are reviewed (Appendix B, Steam Generator Radiation Surveys, Kinetrics Isotopic Inventory, 2009), it clearly demonstrates large variations in the amount of radioactivity at different spots for **all** the steam generators. The hot spots seem to be at the middle sides of the generator closest to the ground (sample point 3,4,5) and also in the bottom bowl. The original radiation surveys clearly show tremendous differences between generators and in different spots on the generators. For example, the bottom of the bowl on Unit 1 steam generator 1 has a contact dose rate of 27 mrem per hour compared to 0.5 mrem per hour for Unit 1 steam generator 7 bottom bowl. For the sides of the generator, Unit 1 steam generator 7 has a contact dose rate of 18 mrem per hour (sample point 3D) which decreases to 1 mrem on the same generator closer to the top of the generator (sample point 7a). While some of the variation might be expected given the nature of the deposition, **it does appear that the each generator is highly unique, and that there are hot spots on each generator**.

We would suggest that the Commissioners and the public need additional information on the extent of the hotspots on the steam generators, whether this requires a reconsideration of the generators classification from SCO-I to SCO-II, and how the existence of hotspots has been accounted for in the classification, handling, transportation, storage and processing of the generators. It may be prudent for Bruce Power to consider not shipping the generators, especially the ones with very high hotspots, until the reasons for hotspots and the appropriate classification are fully understood.



## **Conclusion 5: Flawed public process**

### ***Intervenors and the public have experienced difficulties in accessing information***

There is a broad question about adequacy of access to information. It is difficult for intervenors to access all relevant documents on this application for a few reasons:

- the documents, including the CNSC staff summaries (CMDs), Bruce Power's multiple applications, supporting documentation etc. are not currently posted on the CNSC web site, so there is no easy, quick way for the public and intervenors to get all information on this application, or a list of all documentation
- the public and an intervenor has to request in writing or by email to be on the list to receive all documentation
- if a member of the public or intervenor does not know or does not make this request in writing for all documents, they do not then receive any subsequent documentation
- the important technical information often appears in memos and technical documents which are not included in the CMD, and have to be specially requested
- there is no clear procedure for the public or intervenors to follow when they have questions about the documents
- in this case, GLSLCI was refused access to CNSC technical staff to discuss the environmental review, which made it more difficult to assess the environmental review
- significant pieces of information were not included in the original CMD
- GLSLCI did submit a detailed list of 36 questions to the CNSC, CNSC committed at the hearing to answer these questions, GLSLCI has not received an answer, has to guess that the intent was for the revised CNSC report to answer these questions, and upon review, some of the original list of questions still remain unanswered
- GLSCLI did submit additional questions following the hearing, and has received a timely answer
- it is not clear if CNSC has a policy or guidance governing intervenors or public access to information from CNSC, to supplement the broader federal governmental policies.





CNSC should consider an improved process to answer intervenor questions once a staff report has been published. It is frustrating and difficult for all parties not to be able to get questions answered. Other forums have these processes. We would respectfully suggest to CNSC to review their existing procedures to better accommodate intervenor questions, including creating a mechanism to provide requested information, answer questions in advance and following the hearing, that is fair to all parties.

We would also recommend that the CNSC review its current practise of not posting CMD and other key documents on the CNSC website, and move to posting all documents, including CMDs and the proponent's application on the CNSC web site. This would greatly increase the public's access to information.

***The revised report does not adequately present the information to allow a decision to be made***

There is also a question about the adequacy of the presentation of the information:

- the report summaries do not always clearly and accurately present the underlying information
- the report summaries do not always explain the significance of the findings
- the report summaries do not present the information in a way that allows the underlying assumptions to be understood
- the report summaries do not present the range of scenarios
- it also seems inappropriate for the CNSC to promote the web site of the applicant, Bruce Power at any time, but especially during the time and on the issue that the Commissioners are considering an application from Bruce Power
- the public notice for this application was limited to certain local papers in Ontario, and in the future should include notices in additional locations along the shipping route, including Quebec papers

***Need to improve communication of a significant change in the proposal, a 50% increase in radioactivity***

The 50% increase in the total amount of radioactivity of the generators announced about two weeks before the hearing, was a significant development, yet many intervenors at the hearing were unaware of the revision and so the importance of this revision. This is partly because of the way the material was





presented- the revised CNSC report just changed the figures, without providing the original figures. In the future it would seem that CNSC could consider providing the revised figures and the original figures to allow for easier comparison. The difficulty in communication was also partly the way the material was distributed, for, like all CNSC CMD documents, it did not appear on the CNSC web site.

### ***The process has been rushed***

The CNSC revised report clearly indicates that the process has been rushed, with significant questions in play in August and September, and several unanswered issues right up to the hearing and following the hearing. The environmental review appears to have been requested on August 13, 2010. The revised estimates of radioactivity of the generators which increased the estimate of radioactivity by 50% were noted in memo dated September 7, 2010. The request for additional environmental review is dated October 6, 2010. The documentation clearly shows the impact of the initial error to consider this shipment as routine, has been staff scrambling to fill information gaps and little time for additional accident scenarios or thoughtful review.

### ***The initial lack of consultation increased difficulties***

The hearing also clearly illustrated the impact of lack of early consultation, with many parties noting that they found out about the project through the media reports. At the hearing, intervenor after intervenor noted that they had not been consulted or informed sufficiently to feel comfortable with the proposal. It is not clear from the revised report what additional measures the proponent has undertaken to consult with interested stakeholders. If the project is approved, it is also not clear what process of consultation Bruce Power would follow immediately before the generators are shipped.

Many municipalities along the Great Lakes and St. Lawrence passed Council resolutions expressing concerns and opposing this shipment. In addition, seven US Senators have written to the CNSC and US departments expressing their concerns with this shipment.

### ***No information provided on the current state of other required approvals***

The revised report also does not indicate the current state of the other required multilateral approvals. Approval of this proposed shipment is also required from U.S Department of Transport and Swedish regulatory agency (two permits-

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permission to process in addition to permit to import). It is our understanding that the neither the US permit nor the Swedish approval to process have been given. In addition the two federal export permits previously given to Bruce Power for this proposed shipment expire at the end of January 2011. It would seem that Bruce Power may need to reapply for these federal export permits. It would seem prudent for the Department of Foreign Affairs and Trade to have a new review process for these new permits, given the new information available and the level of public interest and to request advice from Environment Canada and others.

***Need to consider all proposals for special arrangements as candidates for public hearing***

We would also suggest that proponent's requests for special arrangement and exclusive use be automatically considered as candidates for CNSC public hearing.

**Conclusion 6: Emergency measures need several additions to better respond to local conditions**

The Commissioners also asked for additional analysis on the emergency plan. It does not appear that any new information or analysis on the emergency plan has been included in the revised CNSC staff report.

However, there are some areas in the emergency plan that we would have expected to be revised based on the hearing and also the need for additional information. For example, the initial cordon area for safety in the event of an accident is 300 feet. This safety area is the same as that proposed when the generators were 50% lower in radioactivity. It would seem prudent to review this cordon area with the revised radioactivity estimates to determine if in fact this is an adequate safety zone.

***Emergency plan needs to be amended to include local Owen Sound and other community's factors and permit to transport large object requirements***

Along the 80 km transport route, there are a number of sensitive land uses, including the centre of several towns, schools, farms, houses, retirement homes, several rivers, hotels, stores, a church and conservation areas. The geography of Owen Sound harbour also means that the generators have a limited number of routes to get to the harbour. Many of these routes are very close to the



downtown core with its clusters of stores, businesses and people. Other routes are lined with houses. Even a 300 foot safety zone in Owen Sound could involve shops, houses and businesses and significant number of people. As the Mayor in Owen Sound testified at the hearing, there is also a steep hill going down into Owen Sound from most directions, which becomes icy in winter and spring conditions. Several bridges are being rebuilt in Owen Sound and so traffic flow is higher and patterns are different. Owen Sound also has a number of festivals throughout the year, which attract significant numbers of people.

There is no mention of these important local factors in the WMG Transportation and Emergency plan. These local measures need to be added as a check off in the WMG Transportation and Emergency plan. Suggested check off to be added, “A month before and two weeks before shipment, consult with Owen Sound municipal staff and municipal staff along the transport route to check on local conditions including traffic flow, bridge repair, occurrence of festivals and other route and timing considerations.”

In addition at the hearing, Bruce Power committed to the Mayor of Owen Sound that they would meet all the requirements of the Owen Sound bylaw on the permit to transport a large object. These requirements need to be written in as conditions of the transport permit and added to the WMG Transport and Emergency Plan. Suggested check off to be added “A month before shipment, obtain letter from Owen Sound verifying that all conditions of the permit to transport a large object have been met.”

If other municipalities along the route also have specific permit requirements, then these also need to be written into the transport conditions and emergency plan.

In our previous comments, we noted that the emergency shipping plan is a generic document created by the shipping company. It is not specific to this shipment. There is only one page (section 7.3) that deals with an emergency causing a release of radioactive material. On this page ( section 7.3.5 j) it states “all aspects to be planned and agreed on with the relevant parties prior to commencement of the intended cargo operations and voyage.” There is not evidence that the specific emergency aspects for a release have been planned and agreed on in advance.

The emergency plan also needs to better respond to the two scenarios were exceedence of drinking water is highly likely, by providing specific, detailed



measures for salvage at Owen Sound Harbour and specific detailed measures to deal with contaminated water in a lock.

***Emergency plan to specifically require immediate notice to drinking water plants in the event of an accident***

We would suggest that the emergency plan to be revised to contain a map of the shipping route and the proximity of the drinking water plants in the Great Lakes and St. Lawrence, and the phone number of the Spills Action Center. **We would also request that the emergency plan be revised to include the requirement for Bruce Power to immediately notify all drinking water plant operators in the event of an accident with this shipment.** This information would be given to the shipping company to augment their emergency plan.

There is an existing provincial protocol in Ontario “Coordination of the Response to a Liquid Emission at OPG and Bruce Power” which specifies roles and responsibilities in the event of “liquid discharges with abnormal levels of radioactivity from OPG and Bruce Power which could impact Ontario drinking water supplies.” It requires the creation of a liquid emission response team. While designed for spills from nuclear power plants, this protocol could provide an important framework for roles and responsibilities that are relevant in the event of an accident with this proposed shipment. Therefore we recommend that this protocol be reviewed by CNSC staff and the elements of the protocol that apply be referenced in the emergency transportation and shipping plan.

**Conclusion 7: The apparent reversal of burden of proof on environmental safety continues**

There continues to be an apparent reversal of the burden of proof, with CNSC doing most of the work and defence of the environmental review, instead of reviewing the work done by the proponent Bruce Power. It would seem that the onus should be on Bruce Power to demonstrate environmental safety (as is required by Nuclear Safety and Control Act regulations). Then the CNSC would review the proponents analysis and environmental safety measures, and if inadequate, suggest additional analysis.



## **Conclusion 8: CNSC Commissioners do not have sufficient information of sufficient quality to conclude that the test of equivalent safety has been met**

CNSC staff arguments for the shipment meeting the test of equivalent safety are also incomplete, and in some places, contorted and contradictory. The IAEA guidelines specify that if a shipment exceeds the international safety limits (as in this case) then the applicant must provide justification and compensatory measures. The test for approval from CNSC, is that the overall level of safety of the shipment in transport must be demonstrated to be at least equivalent to that which would have been provided if all applicable requirements had been met (i.e. the conveyance limit was met).

This test for equivalent safety would seem to require CNSC staff to create two transport scenarios, one that met the applicable requirements and one that did not meet the applicable requirements. Then a systematic analysis of the safety of these two scenarios would be performed to determine if the overall level of safety between the two scenarios is in fact at least equivalent. There is no such analysis of equivalent safety in the revised staff report. Is there CNSC staff review guidance on how to perform a test of equivalent safety? The current approach does not seem to be a systematic comparison of two options, rather a list of ideas. In many instances is not clear what is being compared. There are in addition a number of concepts not made clear: Who does the test for equivalent safety apply to? workers, public and the environment? If the safety level is actually 10  $A_2$  and not 100  $A_2$  does this mean that additional measures would be required for the lower conveyance limit? How can an agency objectively determine that sufficient measures are in place? What is the relationship between the compensatory measures proposed and the test of equivalent safety?

We have reviewed the arguments for determining the test of equivalent safety and conclude that they are not adequate, sufficiently well presented or sufficient in detail for the Commissioners to evaluate if the test of equivalent safety has been met (Table 4). This is of concern.

Table 4: Arguments used by CNSC Staff in the revised report to justify conclusion that level of safety of the proposed shipment is at least equivalent as meeting the 100  $A_2$  limit





Page of CNSC revised staff report	Argument	Comment
7	If forced to meet 100 A <sub>2</sub> then could only allow 2 generators onto ship, so would need more shipments. This would increase the risk of accident by a factor of 8.	<p>Exceeding the IAEA safety limit does not mean splitting shipment into more trips- it is a reason not to ship the generators.</p> <p>There is no proven need to ship the generators- they are in approved storage facility.</p> <p>Also no consideration is given to fact that if have fewer generators on a ship, this decreases the likelihood of exceeding drinking water guidelines. Having fewer generators on a ship decreases the amount of radioactivity available in case of accident.</p> <p>If arguing that increasing the number of shipments increases the risk of an accident proportionately, then this would also apply to the future shipment of the remaining 16 steam generators from the site-</p> <p>So this would mean that Bruce Power's second generator shipment of the remaining 16 generators would have twice the risk of accident of this first shipment. Is this really valid?</p> <p>We are not arguing to split this proposed shipment up, rather that this splitting argument cannot be used a legitimate justification for the existing proposal or for meeting the equivalent level of safety.</p> <p>It is a spurious argument.</p>
7	Release only 82 A <sub>2</sub>	<p>Using this argument, all shipments that met the 100 A<sub>2</sub> limit would also have release rates lower than 100 A<sub>2</sub>, so this reason is not an apples- to- apples comparison.</p> <p>It compares a release rate to a conveyance limit.</p> <p>A valid comparison is a shipment release amount to a release rate limit or a shipment conveyance amount to an international conveyance limit. It is not valid to mix these two concepts and compare a shipment release rate to an international</p>





		<p>conveyance limit.</p> <p>Also it is not a valid interpretation of IAEA guidelines which are set as conveyance limits not as release based limit.</p> <p>This estimate of 82 A<sub>2</sub> is based on assumptions including only 1% release rate, rather than a range of plausible scenarios.</p> <p>Cannot be used as reason to justify shipment or meeting equivalent level of safety.</p>
7	Shell provides equivalent safety to Industrial Package-1	<p>This seems to be irrelevant. IAEA Table 5 conveyance limits apply to SCO, regardless if it is packaged as IP-1 or unpackaged. It is unclear what is being compared here.</p>
8	Ship has extra features	<p>It is positive that the ship has additional safety features, however the exact protection measures provided by these safety features and how they are relevant for this particular shipment is never discussed.</p> <p>Only a promotional brochure and vague assurances are given.</p> <p>To be a valid argument, increased precision in analysis is needed.</p> <p>In the hearing, CNSC staff stated that fire was not a consideration with this shipment, so was fire accident was not considered for an accident scenario, yet the additional fire protection measures provided for in an INF2 ship are considered one of the additional safety measures. This seems contradictory.</p> <p>It also appears to be arbitrary to assign a safety factor of 10 to this type of ship – why not a safety factor 2 or 5 or 100?</p> <p>Also seems incorrect and/or questionable to interpret IAEA conveyance guidelines as being able to be multiplied by arbitrary safety factors to derive new conveyance limits. It seems incorrect to use this arbitrary safety factor of 10, assigned without any evidence to an INF 2 ship, and to then argue that conveyance limit is actually 1000 A<sub>2</sub> (arbitrarily safety factor of 10* limit of 100A<sub>2</sub>).</p>



		<p>This argument cannot be allowed to stand as it would set a new method of interpretation of Table 5 which is not consistent with its purpose.</p> <p>It is good that this is a special purpose vessel, yet it is not clear how this provides the equivalent safety if the 100 A<sub>2</sub> limit had been met.</p> <p>Not sufficient information of sufficient precision is provided for the Commissioners to conclude that this INF2 ship provides an equivalent level of safety if 100 A<sub>2</sub> limit has been met.</p>
		<p>It also appears that Bruce Power may need to use a special use vessel anyway in order to be exempted from some of the radiological limits in the IAEA guideline.</p>
		<p>In some instances, the report argues that the 100 A<sub>2</sub> limit applies, in other places it argues that the limit is 1000 A<sub>2</sub>, in others in argues that a different measure, an estimate of the radioactivity released is the way to evaluate equivalent safety. There is no consistent logic or systematic comparative analysis here. Therefore it is not possible to conclude that the test for equivalent safety has been met.</p>
<p><b>GLSLCI Concludes: there is not sufficient evidence, sufficiently clearly presented and/or of sufficient quality for the Commissioners to conclude that the test of equivalent safety has been met</b></p>		

**We conclude that there is not sufficient evidence, sufficiently clearly presented and/or of sufficient quality for the CNSC Commissions to conclude that the required test of equivalent safety has been met. Therefore we urge the Commissioners to consider that this shipment cannot be approved at this time.**



**Conclusion 9: This proposed shipment is not routine, it appears to be setting the Canadian precedent for the transport, export and processing of used radioactive equipment on the Great Lakes and St. Lawrence**

This proposed shipment is requesting three special exemptions from international safety rules:

- the use of ``special arrangement`` to violate the international safety limits on total allowable radioactivity on a single ship, to violate the rule which requires demonstration that the level of radioactivity in the generators does meet the correct classification, and to allow the generators to be shipped without using an approved package,
- the ``exclusive use`` provision to exceed international safety transport index limits,
- and it appears, the ``special use vessel`` to exempt from vessel and other radioactivity limits.

Therefore this proposed shipment is not routine. It still appears to be the first Canadian request for approval to transport large, used radioactive materials that do not meet international safety limits on the Great Lakes and St. Lawrence.

***Making new policy through practice***

The proposed shipment has been scoped to be a transport permit request, when in fact, the project poses broader policy questions, which have not been asked or answered. This proposed shipment seems to be moving ahead without a comprehensive national framework in place. It is part of a growing, global trend, and approval of this proposed shipment will set the bar for Canada. Approval of this proposed shipment would in fact, make a new Canadian policy through practice.

The revised staff material does provide another example of shipment of radioactive steam generators in Germany. This provides an example of how this trade in large components from nuclear industry is already increasing. The existence of the draft IAEA guideline on the transport of large components is further evidence. This application could set the Canadian precedent for this growing global trend.



**Conclusion 10. The original and revised CNSC reports fail to provide and present adequate information to enable the CNSC to render an informed decision on whether or not to allow the Bruce Power shipment to proceed.**

Throughout this document we have noted difficulties with the type of information presented and the manner of presentation. Taken together, there does not seem to be adequate information of sufficient quality and sufficiently clearly presented to render an informed decision on whether or not to allow the Bruce Power Shipment to proceed.

**Recommendation**

The Great Lakes and St. Lawrence Cities Initiative would respectfully suggest that the CNSC Commissioners **not approve** this proposed shipment because:

- 1. An accident with this proposed shipment has the potential to exceed federal standards for radioactivity in drinking water**
- 2. The proposed shipment exceeds the international allowable safety limits for total amount of radioactivity on a single ship**
- 3. The environmental review is flawed**
- 4. Continued difficulty in estimating the radioactivity of the shipment is cause for re-evaluation and caution**
- 5. The public process has been flawed**
- 6. Emergency measures need several additions to better respond to local conditions**
- 7. The apparent reversal of burden of proof on environmental safety continues**
- 8. The test of equivalent safety does not seem to have been met**



**9. This proposed shipment is not routine, it appears to be setting the Canadian precedent for the transport, export and processing of used radioactive equipment on the Great Lakes and St. Lawrence**

**10. The original and revised reports fail to provide and present adequate information to enable the CNSC to render an informed decision on whether or not to allow the Bruce Power shipment to proceed.**

## **Conclusion**

The Great Lakes and St. Lawrence River are a precious resource providing drinking water for over 40 million people. Because of the vital resources that the Lakes contribute to our economy, health and lives, we need to ensure the protection and restoration of the Lakes and River.

The Great Lakes and St. Lawrence Cities Initiative appreciates the opportunity to comment on the revised CNSC staff report.

This document consists of supplementary comments from the Great Lakes and St. Lawrence Cities Initiative (Cities Initiative) on Bruce Power's application to the Canadian Nuclear Safety Commission for permission to ship sixteen radioactive steam generators on the Great Lakes and St. Lawrence. These comments provide additional information to the Cities Initiative's initial submission, submitted on September 13, 2010, and the Cities Initiative's testimony before the CNSC during its hearings in Ottawa on September 28, 2010.

Great Lakes and St. Lawrence Cities Initiative is pleased that the Commissioners of the Canadian Nuclear Safety Commission (CNSC) recognised the significant information gaps in the original proposal. Many of these information gaps were identified by the Commissioners and intervenors, including the Great Lakes and St. Lawrence Cities Initiative at the CNSC hearing.

It is encouraging that the CNSC Commissioners responded to these information gaps by requesting additional information from CNSC staff, and then inviting intervenors to submit supplementary comments on the revised CNSC staff report. It is also encouraging that the significant difficulty experienced by the Cities Initiative and other intervenors in obtaining additional information on the proposal has also been recognized.



However, while the Commission's request for additional information from CNSC staff is to be commended, in the opinion of the Cities Initiative, the content of the revised CNSC staff report remains inadequate.

Based on Cities Initiative analysis of the supplemental report of CNSC staff to the Commissioners, the Cities Initiative has reached the following key conclusions:

**1. An accident with this proposed shipment has the potential to exceed federal standards for radioactivity in drinking water.**

- If all the total radioactive inventory of one steam generator is released, this would exceed the Health Canada Action Level for intervention in the event of a nuclear emergency by two times (2.52 mSv vs. 1mSv action level).
- If all the total inventory of all 16 generators was released this would exceed the Health Canada Action Level by 40 times (40 mSv vs1 mSv action level).
- Even if retaining the original assumption of partial inventory, an accident with 4 generators would be sufficient to exceed the Health Canada Action Level for drinking water.
- An accident with only one generator in Owen Sound Harbour has the potential to exceed the Health Canada Drinking Water Action Levels (if release rate is 100%).
- An accident with only one generator in a ship lock exceeds the Health Canada Drinking Water Action Levels under all accident scenarios.

**2. The proposed shipment exceeds the international allowable safety limits for total amount of radioactivity on a single ship.**

- We are in agreement with the CNSC that this proposed shipment does exceed the international allowable safety limits on the total amount of radioactivity on a single ship.
- However, we continue to disagree on the magnitude of the exceedance. The revised CNSC staff report provides no new rationale for the margin of exceedence of the international safety limit. The revised estimated





conveyance value for the shipment of 16 generators is 622 A<sub>2</sub>, an increase from the Bruce Power original estimate of 545 A<sub>2</sub>

### **3. The environmental review is flawed**

- The environmental review of the proposed shipment continues to be based on best case assumptions, and fails to consider other plausible assumptions. There is insufficient evidence given for many of the critical assumptions. As a result, the environmental review consistently underestimates environmental risk.
- The accident scenarios all rely on dilution as the solution to an accident. As environmental management has evolved, using the Great Lakes to dilute radiological contamination is growing less acceptable. In addition, the calculation of dilution factors is a simplistic methodology for determining environmental impact.
- The environmental review still lacks several components: an analysis of the St. Lawrence River, an analysis of an accident scenario along the road route, including downtown Owen Sound, and an analysis of optimum time of transport. The definition of environment is too narrowly scoped to include only drinking water impacts, and so there is also still no analysis of the ecological impacts of an accident, such as impacts on fish, wildlife and food chains. Often radioactivity will be taken up by phytoplankton and zooplankton and so then be passed up the food chain and biomagnified.
- The presentation of public health information is limited and relies on assumptions of exposure measured in seconds. Other plausible scenarios are not presented.

### **4. Continued difficulty in estimating the radioactivity of the shipment is cause for re-evaluation and caution**

- There is a continuing tendency on the part of Bruce Power to underestimate the radioactivity of the generators, and so also to underestimate the risk presented by the generators. Inquiries by CNSC staff to Bruce Power have resulted in a 50% increase in the estimates of radioactivity of the generators. There seems to be questionable



assumptions used to translate the survey results of 50 isotopes into the abbreviated list of 23 isotopes.

- The revised information indicates that there are “hotspots”, large differences in the amount of radioactivity in different spots on the same generator and among different generators. This confirms that the radioactivity is not uniformly distributed. The CNSC may wish to review whether the hotspots have been adequately considered in the current classification of these generators, their handling, storage, transportation and emergency plans.

## **5. Flawed public process**

- Intervenors and the public have experienced difficulties in accessing information
- There are difficulties in the presentation of the information which does not always fairly summarise the information or outline the underlying assumptions, or the effect of these assumptions
- The CNSC revised report clearly indicates that the process has been rushed, with significant questions in play in August and September, and several unanswered issues right up to the hearing and following the hearing.
- At the CNSC hearing, a number of intervenors noted that they had not been consulted or informed sufficiently to feel comfortable with the proposal. It is not clear from the revised report what additional measures the proponent has undertaken to consult with interested stakeholders.
- The Cities Initiative would respectfully suggest to CNSC that they review their existing procedures to ensure that in the future, all documentation on an application is posted on the CNSC web site, and to create a mechanism to better accommodate intervenor questions, to provide requested information and answer questions in advance and following the hearing, that is fair to all parties.

## **6. Emergency measures need several additions to better respond to local conditions**

- Despite a request from the CNSC Commissioners for additional analysis on the emergency plan, it does not appear that any new information or analysis on the emergency plan has been included in the revised CNSC staff report. For instance, the Emergency Plan needs to be amended to

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include local Owen Sound and other community's factors and permit to transport large object requirements.

## **7. The apparent reversal of burden of proof on environmental safety continues**

- There continues to be an apparent reversal of the burden of proof, with CNSC doing most of the work and defence of the environmental review, instead of reviewing the work done by the proponent Bruce Power. It would seem that the onus should be on Bruce Power to demonstrate environmental safety.

## **8. The test of equivalent safety does not seem to have been met**

- CNSC staff arguments for the shipment meeting the test of equivalent safety are incomplete. The IAEA guidelines specify that if a shipment exceeds the international safety limits then the applicant must provide justification and compensatory measures. The test for approval from CNSC is that the overall level of safety of the shipment in transport must be demonstrated to be at least equivalent to that which would have been provided if all applicable requirements had been met. There is insufficient such analysis of equivalent safety in the revised staff report.

## **9. This proposed shipment is not routine, it appears to be setting the Canadian precedent for the transport, export and processing of used radioactive equipment on the Great Lakes and St. Lawrence**

- This shipment is requesting three special exemptions from international safety rules:
  - iv. the use of ``special arrangement`` to violate the international safety limits on total allowable radioactivity on a single ship, to violate the rule which requires demonstration that the level of radioactivity in the generators does meet the correct classification, and to allow the generators to be shipped without using an approved package,
  - v. the ``exclusive use`` provision to exceed international safety transport index limits
  - vi. and it appears, the ``special use vessel`` to exempt from vessel and other radioactivity limits



- Therefore this proposed shipment is not routine. It still appears to be the first Canadian request for approval to transport large, used radioactive materials that do not meet international safety limits on the Great Lakes and St. Lawrence.
- The proposed shipment has been scoped to be a transport permit request, when in fact, the project poses broader policy questions, which have not been asked or answered. It is part of a growing, global trend, and approval of this proposed shipment will set the bar for Canada. Approval of this proposed shipment would in fact, make a new Canadian policy through practice.

**10.** Taken together, the above conclusions suggest that the environmental impacts continue to be underestimated, the process has been flawed, the shipment presents a precedent and that the original and revised reports fail to provide and present adequate information to enable the CNSC to render an informed decision on whether or not to allow the Bruce Power shipment to proceed.

Thank you for the opportunity to submit these comments.