



***Comments on Discussion Paper DIS-16-01***  
***How the CNSC Considers Information on Costs and Benefits:***  
***Opportunities to Improve Guidance and Clarity***

Submitted by:

The Canadian Environmental Law Association

Greenpeace Canada

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## **I. INTRODUCTION**

The Canadian Nuclear Safety Commission (CNSC), established under the *Nuclear Safety and Control Act (NSCA)*, is mandated to regulate the use of nuclear energy and materials to protect health, safety, security and the environment, to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public<sup>1</sup>.

In order to fulfill its mandate, among others CNSC rolled out in 2000 its regulatory policy entitled P-242, Considering Cost-benefit Information to enable CNSC and its staff to consider relevant cost-benefit information submitted by any participant in the process of issuing new licenses and ensuring the compliance. The Policy has been in operation for 15 years. Now, it is replacing that policy with a new guidance on considering cost-benefit information, and seeking feedback from stakeholders to determine if there is a need for more guidance on its expectations for the submission of information on costs and benefits.<sup>2</sup>

The Canadian Environmental Law Association (CELA) is a non-profit, public interest organization established in 1970 to use existing laws to protect the environment and to advocate environmental law reforms. CELA advocates for the reduction of adverse

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<sup>1</sup> How the CNSC Considers Information on Costs and Benefits: Opportunities to Improve Guidance and Clarity, Canadian Nuclear Safety Commission (2016) at 2.

<sup>2</sup> *Ibid.*

impact on the environment and human health from the nuclear activities through litigation, law reform efforts, research and public legal education.

Greenpeace is an independent global campaigning organization that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace. Greenpeace today operates in more than 40 countries and has more than 90,000 supporters in Canada and 2.9 millions members worldwide. To maintain its independence, Greenpeace does not accept donations from governments or corporations.

In this context, the draft guidance has drawn our attention. CELA and Greenpeace welcome the review of CNSC's 15-year old policy on considering cost-benefit information and the seeking of feedback from stakeholders on it. However, our organizations have several concerns with the discussion paper. Please find below our observations on the draft and some recommendations for improvement.

## **OBSERVATIONS AND ANALYSIS**

### **1. Intention to revise the CBA guidance unclear**

The Discussion Paper does not clearly reflect the rationale for updating or revising the existing policy now. The Paper mentions that the proposed cost-benefit analyses (CBA) guidance will replace the 15-year old P-242. CNSC is considering inclusion of the proposed guidance into a regulatory framework by 2018. Hence, it wants to consider whether the updates to the existing policy would be beneficial. CNSC has a procedure to seek feedback from stakeholders on the alternatives, costs and other potential impacts associated with new or recently amended draft regulatory documents.

The Paper fails to outline any other pressing or substantial reasons as to replacing the existing P-242 other than mentioned above. In addition, the Paper also doesn't mention that the existing policy has fallen short of achieving or facilitating the objectives set out in NSCA. It is also not discussed that more stringent policy is required in order to protect the environment and human health from the nuclear related activity. It seems to be responsive to requests by operators asking CNSC to consider reforming its regulatory framework because the operators expressed their concerns on the requirements of various CNSC policies that they feel are burdensome to comply with.<sup>3</sup> It is also highlighted that the compliance with the new and revised CNSC regulatory requirements has resulted in significant increase in licensees' resources. In addition, it is stated that the costs have outweighed the benefits in a number of cases because of such regulatory requirements.<sup>4</sup> It

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<sup>3</sup> CANDU Owners Group, Cumulative Effects of New Regulation-Cost Benefit of New Regulatory Requirements (2015) at 8.

<sup>4</sup> *Ibid.*

thus appears that the proposed guidance has not been proposed primarily to require the industry to address serious threats to the environment and human health, but rather, primarily to reduce their regulatory burden. Thus the rationale for the revision has not been adequately addressed in view of the purposes of the NSCA.

## **2. The Precautionary Principle vs. Cost-Benefit Analysis**

Currently, it is not a requirement for the proponents or stakeholders to submit cost-benefit information to the CNSC under the existing nuclear legal framework in Canada. P-242 or its replacement is not or will not be a part of NSCA or its regulations.<sup>5</sup> However, the Discussion Paper indicates that the CNSC is considering inclusion of some additional policies including P-242 in the new regulatory structure by 2018.<sup>6</sup> As a general comment, there are a number of disadvantages of using a cost-benefit analysis (CBA) where the environment or human health is at issue. Not only the proponents of the precautionary principle but also the proponents of CBA have also accepted that there are problems associated with CBA when the environment or human health comes into play.<sup>7</sup> While some of the common disadvantages of CBA against the precautionary principle are highlighted here, other specific flaws will be discussed later in detail.

While valuing or weighing costs and benefits, issues of equity, morality and public acceptability are usually neglected in cost-benefit frameworks, as CBA primarily considers economic aspects. Similarly, cumulative impacts, irreversibility and irreplaceability generally are given no weight in CBA.<sup>8</sup> Under CBA, the factors that are considered are quantified and converted into monetary terms. However the ability to do this is questionable when the environment or human health is in question. Critics say that ‘the value of clean air and water, unspoilt wilderness areas, ecological balance, and diversity, and social values, such as community feeling and a sense of security, are important and are typically not measured adequately or at all in many cost-benefit frameworks.’<sup>9</sup> In addition, the equities of who receives the benefits or avoid the costs and suffers the costs are not often addressed well in CBA frameworks. Even when a small group of people at the expense of a large group of people receive benefits and the benefits outweigh the costs then CBA in theory does not have any objection.<sup>10</sup>

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<sup>5</sup> *supra* note 1 at 4.

<sup>6</sup> *supra* note 1 at 3.

<sup>7</sup> Gregory N. Mandel & James Thuo Gathii, “Cost-Benefit Analysis versus the Precautionary Principle: Beyond Cass Sunstein’s Laws of Fear” (2006) 05 Illinois Law Review 1037.

<sup>8</sup> World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), United Nations Educational, Scientific and Cultural Organization, *The Precautionary Principle*, (2005) at 31. Online: <http://unesdoc.unesco.org/images/0013/001395/139578e.pdf>

<sup>9</sup> *Ibid.*

<sup>10</sup> *Ibid.*

## **2. The environment or human health is not optional**

Section 4.3.4 of the draft guidance requires the analyses be focused on the proponent, and the environment and human health are not made mandatory part of the analyses. This is a significant shortcoming of the guidance. The section reads:

### **4.3.4 Factors to consider**

Depending on the nature of the decision being taken, in addition to an analysis focused on the proponent, it may be appropriate to consider other factors, such as human health and environmental. In all cases, information provided should be relevant to the CNSC's mandate.

Lee and Kang<sup>11</sup> mention that the nuclear energy generation is not free from health and environment impacts, and the impacts have not been accounted for in the market price. Therefore, they proposed a new methodology to fill in such gaps. They are of the opinion that this could be achieved by 'considering that the risk situation faced by an individual in the case of a nuclear power plant (NPP) accident can be described as a "low-probability with high-consequence" situation compared to the case of a general risk situation in economic markets.<sup>12</sup>

In order to assess both 'cost' and 'benefits' of operation of an NPP, its impacts on the environment and human health should be taken into account. Leaving it solely to the discretion of the proponents or stakeholders to consider the environment and health will not serve the objective of CBA or the purposes of the Nuclear Safety Control Act. Therefore, given the impact of the nuclear activities on the environment and human health, it should be made mandatory to focus the analysis on the environment and human health regardless of the level of impact on the environment and human health.

## **3. Discounting at high rates does not comply with Canada's national and international commitments**

The draft guidance allows the proponent to set a discount rate.<sup>13</sup> Environmental jurists do not support the idea of discounting where the proposed policy or project may cause adverse impact on the environment because one of several objectives of environmental

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<sup>11</sup> Lee, Sang Hun and Kang, Hyun Gook, "Integrated framework for the external cost assessment of nuclear power plant accident considering risk aversion: The Korean case, Energy Policy" 92 (2016) 111–123

<sup>12</sup> *Ibid.*

<sup>13</sup> See *Supra* Note 1, at 12.

law is to reduce harm to people and the environment in future.<sup>14</sup> The reason behind this is that the harm extends not only to this generation but often also to future generations. Something that happens today may result in after decades or even after centuries. If pure mathematics were applied, on the logic of traditional cost-benefit analysis, it is estimated that death of a billion people after 500 years will be less serious than the death of a person today at discount rate of 5 percent.<sup>15</sup> It is also said that discounting in the context of the environment often is to delay something worse that will happen, or just to postpone catastrophes.

Furthermore, discounting at high rates offends the precautionary principle and sustainable development. Some notable economists accept the arguments of the proponents of the precautionary principle that “this generation’s preferences should not determine the scope of allowable harms to future generations and therefore use close to a zero discount rate for the rate of pure time preference.”<sup>16</sup> The principle, on the one hand, anticipates and prevents serious negative consequences to the environment or human health before they occur. Discounting is one approach that simply postpones such consequences, on the other. For example, once greenhouse gases are emitted to the atmosphere, they will remain there for several decades and much of the harm they cause to nature in the short and long term cannot later be undone.<sup>17</sup>

Discounting also breaches the core values of sustainable development. Sustainable development requires the present generation to exploit natural resources without compromising the ability of future generations to sustain themselves. The present generation receives the environment and natural resources on trust for the future generations. The UN World Commission on Environment and Development which is also popularly known as the *Brundtland* Commission defined sustainable development as “the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.<sup>18</sup> Therefore, both ‘sustainable development’ and ‘the precautionary principle’ have received significant recognition at both the national and international environmental laws as tools of environmental protection for the future generations.

The Preamble of the *Canadian Environmental Protection Act of 1999* states one of its objectives as “to achieve sustainable development that is based on an ecologically

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<sup>14</sup> Lisa Heinzerling and Frank Ackerman, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, (Georgetown: Georgetown Environmental Law and Policy Institute, 2002) at 21.

<sup>15</sup> *Ibid.*, at 21.

<sup>16</sup> David M. Driesen, “Cost-Benefit Analysis and the Precautionary Principle: Can they be reconciled?” (2013) *Mich. St. Law Rev.* 771.

<sup>17</sup> *Ibid.*

<sup>18</sup> The Report of the World Commission Development and Environment, *Our Common Future: Environment* (New York: United Nations, 1987).

efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government and private entities”. The federal parliament enacted a separate statute entitled “*Federal Sustainable Development Act*” to deal with the issue of sustainable development in 2008. Section 2 of that Act defines “sustainable development” as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’. Similarly, s 5 of that Act lays down the basic principle of sustainable development for the Government of Canada that ‘is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government.’”

The draft guidance provides a list of resources including Canadian Cost Benefit Analysis Guide on preparing cost-benefit information. The Guide mentions that in Canada, 8 percent is set as a maximum discount rate which is 2 percent lower than that of recommended by the Treasury Board of Canada Secretariat in 1998.<sup>19</sup> Although the Guide states that the discount rate for human health and the environment could be lower than 8 percent, it recommends the other method called “social time preference rate” which has set the rate at 3 percent. This rate is “based on the rate at which individuals discount future consumption and projected growth rate in consumption.” However, the Guide accepts the controversy over using the social preference rate and requires the proponents to hold more discussion before applying it.<sup>20</sup>

Even if we accept the arguments of the proponents of CBA that more lives would be saved or higher quality of living standard would be achieved at the expense of the lives lost due to discounting, experts point out problems with that approach. First, discounting cannot ensure that wealth transfer occurs. Second, members of future generations would unlikely to agree to be sacrificed to improve quality of life of others now or future.<sup>21</sup> Therefore, allowing discounting where the environment and human health are at risk not only breach Canada's national and international commitments but also is unreasonable.

## **5. Level of Uncertainty and the Precautionary Principle**

The proposed guidance would allow some level of uncertainty that could be either above or below the expected outcome. Uncertainty is an inevitable feature of CBA because it ‘requires a wealth of information concerning the costs and benefits of the action being

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<sup>19</sup> Treasury Board of Canada Secretariat, Canadian Cost Benefit Analysis Guide: Regulatory Proposal (2007) at 37.

<sup>20</sup> *Ibid.*

<sup>21</sup> Gregory N. Mandel & James Thuo Gathii, “Cost-Benefit Analysis versus the Precautionary Principle: Beyond Cass Sunstein’s Laws of Fear” (2006) 05 Illinois Law Review 1037.

evaluated' which may not be always possible. Therefore, scholars have agreed that CBA routinely faces uncertainty in calculating costs and benefits of most responses to most significant threats.<sup>22</sup> In contrast, the precautionary principle which has now become a part of the international customary law applies “when there is the potential for serious harm to the environment or human health and uncertainty as to the extent of the harm or the causes of the harm.”<sup>23</sup> Although the principle came into precedence during the Rio Conference on the Environment and Development, Canada advocated inclusion of the same during the Bergen Conference negotiation.<sup>24</sup> Hence, the provisions on the principle were included in the Bergen Ministerial Declaration on Sustainable Development.<sup>25</sup> Para 7 of that Declaration reads,

“In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.”

Subsequently, the principle was adopted under the auspices of the United Nations at the Rio Conference in 1992. The Conference adopted the Rio Declaration and Principle 15 of the Declaration incorporated such legal principle. The Principle 15 reads,

“In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

This principle has been recognized both in common law and statutes in Canada. The Government of Canada has made its commitment to this principle through incorporating a clause in the Preamble of the *Canadian Environmental Protection Act of 1999*. The clause reads,

“Whereas the Government of Canada is committed to implementing the

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<sup>22</sup> *Ibid.*

<sup>23</sup> Theresa McClenaghan, “Precautionary Principle” in Alex C. Michalos ed *Encyclopedia of Quality of Life and Well-Being Research* (Dordrecht: Springer Netherlands, 2014) 5004.

<sup>24</sup> D. Vander Zwaag, CEPA Issue Elaboration Paper No. 18, CEPA and the Precautionary Principle/Approach (1995), at p. 8), referred to in *14957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town)*, [2001] 2 SCR 241, 2001 SCC 40 (CanLII)

<sup>25</sup> [http://www.ospar.org/site/assets/files/1239/5nsc-2002\\_bergen\\_declaration\\_english.pdf](http://www.ospar.org/site/assets/files/1239/5nsc-2002_bergen_declaration_english.pdf) accessed on 2016/03/30

precautionary principle that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

Other pieces of federal legislation, such as the *Ocean Act of 1996* and the *Endangered Species Act of 1998* have also recognized this principle. Similarly, the Supreme Court of Canada, in *114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town)*, [2001] 2 SCR 241, 2001 SCC 40 (CanLII) has discussed the principle in length. L’Heureux-Dubé J. upheld a town by-law as she found the concerns of the town about pesticides comply with the precautionary principle because the provision in question was adopted as a preventive measure.

As per the words used in both the Declarations, the principle may not be triggered in all cases but the principle is triggered when there are “threats of serious or irreversible” harm. The same phrase is used in the Canadian legislation. However, the principle may be applicable beyond “threats of serious or irreversible” if threats are ‘morally unacceptable’, ‘theoretically reversible, but extremely costly to reverse’, or ‘it will be inequitable in terms of bearing the costs or suffering the harm’.<sup>26</sup> The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) provides a list of harms to the environment or human health as ‘morally unacceptable harm’ and requires actions to avoid or diminish such harms if it is scientifically plausible but uncertain. They are those threats that are as follows:<sup>27</sup>

- threatening to human life or health, or
- serious and effectively irreversible, or
- inequitable to present or future generations, or
- imposed without adequate consideration of the human rights of those affected.

Therefore, no action of federal government agencies can ignore or postpone any serious or irreversible threats to the environment just because of lack of scientific certainty. In addition, costs should not be a justification to postpone such harm. There are two ways to respond when the precautionary principle is triggered. The application of the Principle should be ‘proportional’ or ‘cost-effective’ which enables the decision-makers to choose the best appropriate option to address such threats.<sup>28</sup> “Proportionality” refers to a measure that should commensurate with the desired level of protection or the precautionary measures undertaken as response to threats should not be lower than that of the threats. On the

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<sup>26</sup> McClenaghan, *supra* note 18 at 5005.

<sup>27</sup> World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), *The Precautionary Principle* (Paris: UNESCO: 2005) at 13. Online: <http://unesdoc.unesco.org/images/0013/001395/139578e.pdf>

<sup>28</sup> McClenaghan, *supra* note 18 at 5007.

other hand, ‘cost-effective’ indicates that ‘... the harm is to be dealt with in a way that maximizes global benefits at the lowest possible cost. This may not be at a low cost per se but rather at a lower cost than allowing the harm to occur.’<sup>29</sup>

## 6. Valuation or Weighting

The draft guidance leaves valuation and weighting to the proponents or stakeholders and recommends use of the existing literature for appropriate valuation and accounting methods. The proponents of CBA focus exclusively on monetizing potential lives saved, and devote considerable attention to the tremendous hurdles of carrying out this task. As there is no actual market price for non-economic costs and benefits, most of the CBA proponents use “willingness-to-pay” as the metric. In other words, “the amount a person would pay to avoid a cost or receive a benefit.”<sup>30</sup>

“Willingness-to-pay” is not an exception to problems in valuating or weighting the costs and benefits. The CBA proponents have themselves identify several drawbacks associated with this metric.<sup>31</sup> For example, two people can view a same problem differently and their analysis for the same would be also different. There is no objective test for it. Another major problem is willingness or ability to pay. Because of uneven distribution of resources, all people do not have equal capacity or may not be willing to pay to avoid the costs or receive the benefits. Again, low income people may have to suffer from more environmental problems because of their inability to pay and willingness to pay of wealthy people. Heinzerling and Ackerman opine that “If decisions are based strictly on cost-benefit analysis and willingness to pay, most environmental burdens will end up being imposed on the countries, communities, and individuals with the least resources.”<sup>32</sup> Hence, value of humans is also treated differently based on wealth.

This metric cannot be applicable for the case of future generations as they cannot take part in the present decision making and of course will not be given a chance to pay to receive benefits or avoid costs because of their present non-existence. Much harm could occur after decades or even after centuries.<sup>33</sup> As discussed earlier, the future generations would be unlikely to be willing to be sacrificed or suffer harm for the benefit of others now or in the future. Similarly, it has also not been possible to account for values or costs associated with non-monetizable impacts, such as the destruction of coral reefs, human physical and emotional suffering short of fatality, or the extinction of species.<sup>34</sup>

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<sup>29</sup> *Ibid.*

<sup>30</sup> Heinzerling and Ackerman, *supra* 9 at 22.

<sup>31</sup> Mandel & Gathii, *supra* note 12.

<sup>32</sup> Heinzerling and Ackerman, *supra* note 4 at 23.

<sup>33</sup> McClenaghan, *supra* note 18 at 5008.

<sup>34</sup> *Ibid.*

## 7. Requirements for Transparency Needed

The draft guidance is silent on the issue of transparency while performing CBA. It is claimed that ‘transparency’ and ‘objectivity’ are key features of the decision making process where CBA is performed. CBA provides decision makers a rational choice on the decision to be made. It prevents the decision makers from making arbitrary decisions and ensures public participation in decision making process. However, Ackerman and Heinzerling counter that claim that decisions made through applying CBA are less objective and not transparent.<sup>35</sup> They contend that the decision making process will only be transparent if the report on CBA is made public in a plain and simple language. They consider that ‘Decisions about environmental protection are notoriously complex.’<sup>36</sup> It involves works of a wide range of experts from lawyers to biologists. The decisions also often contain scientific jargon which is not explained in accessible terms available to the general public. The public often do not have technical expertise to interpret the results of analysis in order to express their views on the proposed project or policy. If the decisions are offered and debated in publicly accessible language then the public could be a part of the decision making process and transparency could be ensured.<sup>37</sup> The public should be able to know why and how trade-offs have been made.

If we consider the current cost-benefit proposal according to the recommendations outlined by Ackerman and Heinzerling, it lacks both of the hallmarks of transparency. An NPP accident may result in serious damage to the environment and public health and Canadians will have to suffer heavily. It means all affected people should be heard and be able to participate in the decision making process. However, the draft guidance does not assure public participation in the decision making process. How the public will be involved in the decision making process or how their views will be taken into account is not mentioned in the draft guidance. It is also not a requirement to make the report on CBA public. In contrast, it seems that this process will be done even more secretly as the draft guidance would take away the policy statement on transparency from the existing guidance. The existing P-242 acknowledges ‘rights of affected people to participation’ in the decision making process. s 4 of P-242 states that ‘Accordingly, the Commission’s decision-making processes include the opportunity for affected persons and for others to participate.’

Notably, licensees have refused to release information on CBA information to civil society organizations.

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<sup>35</sup> Ackerman, Frank, and Lisa Heinzerling. “Pricing the Priceless: Cost-benefit Analysis of Environmental Protection”. *University of Pennsylvania Law Review* 150.5 (2002): 1553–1584.

<sup>36</sup> *Ibid*

<sup>37</sup> *Ibid*.

For example, Greenpeace asked OPG in 2015 to release the cost-benefit analysis used to justify the limited range of Safety Improvement Opportunities (SIO) it proposed as part of the Darlington life-extension. OPG refused to release the information, stating:

*OPG cannot provide the Business Case Assessment (similar to a Cost Benefit Analysis) for the Safety Improvement Opportunities (SIOs), as this document contains information from the Darlington Probabilistic Risk Assessment (DARA) which has been classified as confidential.*

Moreover, OPG asserted the “conceptual SIOs were subjected to a comprehensive evaluation process using the DARA that quantified and identified the most appropriate and practical alternatives for reducing public risk and increasing plant safety.”<sup>38</sup>

This, however, should not be accepted as a justification for withholding CBA information. In our view, the critical lesson from the Fukushima disaster is that the public must be able to challenge organizational and regulatory systems that supported faulty rationales for decisions. This requires transparency and pro-active disclosure.

Notably, while OPG has asserted such information is security sensitive, Greenpeace has received such information for the Bruce nuclear station through Access to Information requests filed with the CNSC. This shows that OPG’s assertions that such information is security sensitive are unfounded.

What’s more, OPG regularly releases cost-benefit information on reactor upgrades to the Ontario Energy Board (OEB) as part of its rate-request applications.<sup>39</sup> These requests typically contain information on the cost and the public safety benefit, as well as the risk of not implementing such measures. Where there is in fact commercially confidential information it is redacted as appropriate. In the present case, however, OPG has asserted that all cost benefit information related to the SIOs are confidential.

Allowing such secretive behaviour to continue raises questions about the quality and trustworthiness of industry produced CBA. This in turn may erode public confidence in the CNSC. This highlights why the CNSC should include new requirements for transparency and public scrutiny in any changes to CBA guidance.

## **8. Alternatives to CBA**

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<sup>38</sup> R. Manley to S-P Stensil, “Re: Information Request,” *letter*, June 26, 2015.

<sup>39</sup> Greenpeace is a member of the Green Energy Coalition, which intervenes regularly at the Ontario Energy Board regarding rate-applications from gas and electric utilities.

Although industry often promotes CBA for decision making, it suffers many disadvantages even on its own terms. Mechler<sup>40</sup> mentions that CBA is best suited where benefits can be fully identified in monetary terms. She analyses two types of interventions in the context of disaster risk reduction in her article. For example, ‘hard resilience’ is an option for flood risk prevention where benefits can be identified as flood embankments that will avoid or reduce losses to structures and CBA could be a suitable option for that type of project. However, Mechler writes that CBA is not the best tool to assess economic efficiency for more systematic interventions. She recommends looking for other decision-supporting tools where systematic interventions are required because of CBA's strict focus on monetization and aggregate costs and benefits. Multi-criteria analysis or robust decision-making approaches is proposed as an alternative.

The Discussion Paper outlines three main approaches as to producing quantitative cost-benefit information. They are CBA, cost-effective analyses (CEA) and multi-criteria decision analyses (MCDA). According to the proposal, any of three can be used by the proponent to produce such information. Section 4.3.7 of the draft guidance requires valuation be done through participatory process where MCDA is applied.

## **9. Take disaster low-probability, high-impact**

Section 4.3.1 of the draft guidance mentions that the same level of analysis will not be required for ‘minor routine decisions with minor potential consequences.’ However, the draft fails to define ‘minor routine decisions with minor potential consequences’. In addition, it also fails to prescribe or recommend the level of analysis for projects or policy with minor or major potential consequences. NPP accidents may be viewed as a “low-probability with high-consequence” situation compared to the case of a general risk situation in economic markets.<sup>41</sup> Preparedness for disaster is more cost-effective than that of post-disaster management.

## **10. Consequence Analysis: Need for Level 3 Probabilistic Risk Assessment**

Although risk is typically defined as likelihood times consequence, the CNSC has historically ignored the possible environmental, economic, social and health consequences in its risk assessments. This omission effectively allows licensees to significantly underestimate the risk posed by their facilities.

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<sup>40</sup> R Mechler, “Reviewing estimates of the economic efficiency of disaster risk management: Opportunities and limitations of using risk-based cost-benefit analysis” *Nat Hazards* (2016) 81:2121-2147

<sup>41</sup> Lee and Kang, *supra* 11.

This significant oversight was highlighted John W. Beare in report commissioned by the CNSC regarding the design requirements for new reactors. He said:

*If the Commission is concerned about the cost-benefit aspects of its safety requirements it could start by completing the Severe Accident Study research project started about 1988 but never completed. The conclusion of the preliminary study is that, in the event of a catastrophic accident, a release of radioactive material proportionately as large as that from Chornobyl could not be ruled out. In the case of a water-cooled reactor like CANDU such a release could be in the form of a relatively cool aerosol and not be dispersed as much as much as at Chornobyl. The radiation doses close to the reactor could be higher than at Chornobyl.*<sup>42</sup>

Beare was referring to an accident study initiated by the CNSC's predecessor, the Atomic Energy Control Board, following the Chernobyl disaster. The study was never completed. While Canada abandoned this analysis, the U.S. Nuclear Regulatory Commission completed a similar study (NUREG-1150) in 1990.<sup>43</sup>

This lack of consequence analysis arguably skews risks assessments and the CBA based on such assessments away from risk reduction and increased public safety. This benefits licensees to the detriment of Canadians. Meanwhile, the *Nuclear Liability and Compensation Act* transfers the responsibility for accidents with consequences above a billion dollars to the Canadian tax-payer and society.

To address this weakness in CBA, the CNSC should amend *REGDOC-2.4.2, Safety Analysis: Probabilistic Safety Assessment (PSA) for Nuclear Power Plants* to require licensees to produce level 3 probabilistic risk assessments, which estimate the offsite consequences of reactor accidents.

## **11. Sensitivity Analyses in the context of uncertainty**

Section 4.3.9 of the draft guidance acknowledges the significance of conducting sensitivity analyses. It also mentions that this sort of analyses helps the decision maker to make an informed decision. It briefly outlines factors and methodologies important to conducting the analyses. While it seems that the draft guidance favors conducting the sensitivity analyses, the guidance fails to mention where the sensitivity analyses are mandatory or highly desirable. Similarly, section 4.3.8 of the draft guidance accepts that

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<sup>42</sup> John W. Beare, Review of the ACR-LBD-001, Licensing Basis Document for New Nuclear Power Plants in Canada, Draft dated December (Ottawa, CNSC file No. 34-R240-2, 31 March 2005)

<sup>43</sup> *Nuclear Regulatory Commission, Severe Accident Risks: An assessment for Five US Nuclear Power Plants, NUREG-1150, December 1990.*

all forecasts involve some level of uncertainty. In this context, the sensitivity analyses could be an important tool to compensate for the uncertainty in the decision making process. In the *Indian Point*, case, the US NRC made a ruling that where uncertainties arise as to the analyses of CBA, the sensitivity analysis is an appropriate solution. It stated that 'Sensitivity analyses are a common method of addressing uncertainty in specific inputs used in PRA analyses and as such they are a common practice in SAMA analyses. Sensitivity analyses help demonstrate whether and to what extent variations in an uncertain input value might affect the overall cost-benefit conclusions.'<sup>44</sup> The Commission directed the Staff to supplement the SAMA analysis with sensitivity analyses for the CDNFRM and TIMDEC values.

### III. CONCLUSIONS & RECOMMENDATIONS:

Based on the above analysis, CBA is not a good choice to deal with projects, policies, or decisions of the CNSC when getting the decisions wrong could lead to serious or irreversible damage to the environment or human health. CBA not only monetizes all aspects including 'environmental goods' based on market value (which is not ideal in any case as no value can be assigned to them and they are not easily replaceable), but also ignores other values such as equity, humanity and human rights. Furthermore, applying CBA to threats that may be serious and irreversible (such as the potential harm from a large offsite nuclear accident) does not comply with Canada's national and international commitments on the precautionary principle and sustainable development.

We make the following recommendations that CNSC consider to improve the proposed guidance:

Require the proponent to undertake all available precautionary measures to prevent potential harm to the environment or human health rather than based on cost-benefit analysis, where the potential harm is serious or irreversible. In addition, the measures to be taken by the proponents should be 'proportional' to the harm or 'cost-effective'.

Accordingly we recommend that the following provisions be included in the draft guidance:

**1) Require a Precautionary Approach** – Given Canadians assume the risk for major nuclear accidents, an explicit commitment to the precautionary principle should be included in the CNSC's modernized CBA guidance. Many of the following recommendations are needed to implement a precautionary approach.

**2) Continuous Improvement**– Any new regulatory guidance should be explicit

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<sup>44</sup><http://www.nrc.gov/docs/ML1612/ML16125A150.pdf>

that decisions will be made in favour continuous improvement and public safety.

**3) Best Practices** – The CNSC’s self-proclaimed goal is to be “the best nuclear regulator in the world.” New CBA guidance should include provisions to support this goal. Public safety should be prioritized through a preference for best practices. Guidance should state how best practices will be factored into decision-making. This could require the submission of international benchmarking of safety measures under consideration.

**4) Transparency and Public Scrutiny** – Because CBA information is produced by licensees in Canada (and not the regulator), new guidance should require licensees to proactively release such information.

**5) Consequence Analysis** – New guidance should require the environmental, social, economic and health impacts of nuclear accidents to be included in risks assessments used to support CBA. This will require amending REGDOC-2.4.2 to require licensees to produce level 3 probabilistic risk assessments.

**6) Factor in previously ignored risk contributors** – CNSC guidance and licensee risk policies continue to ignore significant known risks contributors such as external events, site-wide risk, and aging. This skews the risks assessments used to inform CBA. New guidance should require licensees to identify and factor in such risk contributors.

All of which is respectfully submitted:

Keshab Presad Dahal, Student-at-Law

Theresa McClenaghan, Executive Director

**CANADIAN ENVIRONMENTAL LAW ASSOCIATION**

And

Shawn-Patrick Stensil

Senior Energy Campaigner

**GREENPEACE**