

April 14, 2008

Louise Levert
Commission Operations Officer
Canadian Nuclear Safety Commission
280 Slater St., P.O. Box 1046
Ottawa, Ontario K1P 5S9
Fax: (613) 995-5086
Email: interventions@cnsccsn.gc.ca

Re: Recommendations regarding the proposed license renewal of the Pickering B nuclear station

Dear Ms. Levert,

Thank you for the invitation to comment on the proposed licence renewal for the Pickering B Nuclear Station.

Greenpeace was founded in Canada in 1971. Since then, Greenpeace offices have opened in over 30 countries across the globe, with 2.8 million members internationally, including more than 88,000 members in Canada. Greenpeace has had a long-standing interest in issues relating to nuclear power plant operation.

Participation in this process should not be interpreted as an endorsement of the Canadian Nuclear Safety Commission (CNSC) Rules of Procedure for hearings. These rules are unfair to public-interest intervenors due to the tight time restrictions placed on presentations, the prohibition on presenting at both days of two-day hearings, the lack of opportunity for intervenors to test evidence through cross examination, and the failure to provide intervenor funding for expert testimony and other intervention expenses.

Greenpeace would like to cite a few examples of the positive improvements that public interventions have had on the CNSC's oversight of the nuclear industry in Canada. Public intervenors, for example, are often well placed to point to gaps or weaknesses in the CNSC's regulatory approach. For example:

- In 2005, Greenpeace raised its concerns regarding the CNSC's *ad hoc* approach to approving the life-extension of nuclear stations in Canada. In 2006, Ian Grant, the CNSC's Director General of Power Reactor Regulation, admitted that the publication of regulatory guide G-360, *Life Extension o. Nuclear Power Plants*, was produced due to Greenpeace's concerns.
- In a 2006 petition to the federal Environment Commissioner, Greenpeace raised its concern that, unlike other nuclear regulators, the CNSC had no system for classifying radioactive wastes. Following the petition, CNSC staff acknowledged the need to develop a classification system and the Commission ruled "...that a clear classification system would bring added clarity to nuclear waste categorization in Canada."
- At licence renewal hearings in 2006, Greenpeace exposed the fact that neither New Brunswick Power nor Hydro-Quebec had a plan for managing its non-fuel radioactive waste over the long-term. Forced to respond to questions by the Commission spurred by Greenpeace's concerns, CNSC staff committed to ask Hydro-Quebec "in the days to come" to present a plan for managing these wastes.

These examples point to the ability of public-interest intervenors to identify gaps or weaknesses in the CNSC's regulatory approach. Although the CNSC is often initially defensive when presented with these critiques, subsequent Commission efforts to address these gaps and weaknesses in regulatory policy have led to improved oversight of the nuclear industry in Canada.

1. Summary of Concerns and Principal Recommendations

Due to its design flaws and location, the Pickering Nuclear Generating Station (PNGS) is arguably Canada's most dangerous nuclear power station.

PNGS is also approaching the end of its operational life, a period during which unpredictable component degradation will increase the potential for accidents and unplanned shut-downs. Concurrently, Ontario is facing an electricity shortage over

the next decade and is proposing to continue to operate Pickering B past the date which Ontario Power Generation (OPG) would typically consider it uneconomic to operate the station safely.

The pressure on OPG to ensure electricity supply while minimizing the costs of maintaining ageing reactors is an obvious motivation to operate at reduced safety margins. Given this, Greenpeace is deeply concerned that the CNSC has no clear set of criteria for determining the end-of-life of nuclear stations in Canada. Without such transparent criteria the CNSC will be highly vulnerable to back-room pressures to ageing reactors to continue operating with reduced safety margins.

For these reasons, Greenpeace recommends the following:

1. Given the uncertainties associated with the operational life of the Pickering B Nuclear Station, Greenpeace Canada requests that the Commission approve a 2 year license renewal instead of a 5 year renewal.
2. Given that there is a strong possibility that OPG may decide not to rebuild the Pickering B nuclear station and that the four reactors may be unable to operate until the stated end-of-life date in 2014, Greenpeace Canada recommends that the CNSC include a licence condition requiring OPG to develop an end-of-life plan for the station.
3. Given the current lack of end-of-life criteria and the political pressures to maintain electricity supply post 2010, Greenpeace Canada recommends that the Commission require OPG (as well as other licencees) and CNSC staff to submit and report annually on the fitness-for-service assessments and forecasts for the life-limiting components for each of the nuclear stations in Canada in its annual report on the performance of the Canadian nuclear power industry. The Commission should also require OPG to make available on request – outside of Access to Information - any studies regarding fitness for service.
4. Given the lack of a coherent approach to determining end-of-life criteria, Greenpeace requests that the Commission direct staff to develop an approach to the issue end-of-life criteria. Staff should present their approach and research regarding end-of-life criteria at a public meeting so that the Commission and the public can evaluate whether staff are addressing safety criteria related to ageing in a timely and precautionary manner.
5. Given the undue and untransparent input Atomic Energy of Canada Limited (AECL) has had in influencing CNSC standards to accommodate a fundamental design flaws of CANDU reactors, Greenpeace recommends that the CNSC proactively release all internal documents and correspondence from the “positive reactivity feedback working team” which has been developing the CNSC’s approach to dealing with the positive void coefficient.
6. Greenpeace requests that the Commission improve its disclosure protocols and require the proactive release all safety studies, including probabilistic risk assessments, deterministic safety studies, hazards analysis and S-99 reports.
7. Greenpeace requests that OPG and CNSC staff be required to assess and report on the impacts of a large international commercial aircraft crash at the Pickering nuclear station at a public meeting of the CNSC.
8. Given recent findings regarding the magnitude and impact of positive void reactivity on the safety case for Pickering B, CNSC staff should make recommendations regarding what precautionary operational measures, such as de-rating the station, should be taken to mitigate the uncertainties in Pickering B’s safety margins.

1. The End of Life of the Pickering B Nuclear Station: Uncertainties & Vulnerabilities

OPG and CNSC staff are recommending a five-year licence renewal, which, they claim, would fall a year before Pickering B’s projected end-of-life in 2014.

Greenpeace does not believe that there is adequate or trustworthy information in the public domain for assessing the safety case for operating the Pickering B reactors until 2013. There are two reasons for this: First, the CNSC’s failure to develop transparent end-of-life criteria for assessing the point at which ageing reactors must be shut down; and second, the political and business pressures on OPG to operate its ageing nuclear stations as long as possible to fill Ontario’s looming electricity gap.

OPG’s end-of-life estimates for the Pickering B nuclear station have changed significantly during the past three years. In 2006, OPG changed the estimated end of life for the station from 2009 to 2014. In 2006 OPG also began the environmental

and safety reviews to decide whether it would rebuild or permanently close Pickering B in 2014.

OPG, however, makes the claim in its submission for this licence renewal that it can operate Pickering B past 2014, stating that: “Based on current information and the life cycle management plans, OPG’s current view is that the units will operation for approximately a further ten years.” In 2006, however, OPG informed Greenpeace that the end of service life for Pickering B units 5 – 7 was 2014 and that unit 8 would reach its end of service life in 2016.

As will be discussed, Greenpeace believes that OPG’s operational life projections for the Pickering B nuclear station are being motivated by business and electricity supply pressures instead of safety assessments.

Greenpeace believes that it is incumbent upon the CNSC to obligate OPG to openly release all studies used to rationalize the operational lives of its reactors. Furthermore, the Commission should develop transparent criteria for assessing the end-of-life of nuclear plants so that the public can assess OPG’s safety studies and the CNSC’s oversight of ageing reactors.

2. CNSC Approach to Ageing and End-of-Life

The CNSC has no criteria for determining the end of life of Canada’s nuclear stations. Instead, the CNSC requires licencees to demonstrate the “fitness-for-service” of its reactors through near-term projections of component integrity.

Licensees, meanwhile, determine the operational life of their reactors based on the ability of “life-limiting components” - such as feeder pipes, pressure tubes and steam generators – to operate while economically meeting safety goals established by the CNSC. The operational life dates claimed by nuclear operators, then, have not been assessed or approved by CNSC staff.

Greenpeace is deeply concerned that this lack of clear-cut safety criteria for determining end-of-life leaves the CNSC vulnerable to political pressures to keep ageing reactors with declining safety margins operating to ensure electricity supply. It also makes it difficult for public intervenors to assess the adequacy of the safety case used to justify the continued operation of ageing reactors.

It is noteworthy that the CNSC may have internally admitted the need to develop such requirements. The CNSC’s research program, for instance, commissioned a study in 2007 to “define end-of-life criteria” for pressure tubes. The study will evaluate “ageing management plans; fitness-for-service criteria and technical data” as well as “...the risks posed by the ageing processes.”

Greenpeace believes the CNSC’s preparation for the end-of-life of Canada’s nuclear stations is similar to the way it prepared to oversee reactor life-extension proposals: *ad hoc*, uncoordinated and without public input. Greenpeace believes that the Commission should look at issues of reactor end-of-life comprehensively and transparently to identify and address gaps and weaknesses in its regulator approach.

Recommendation: Greenpeace requests that the Commission direct staff to develop a gap analysis on the issue of end-of-life criteria. Staff should present their approach and research regarding end-of-life criteria at a public meeting so that the Commission and the public can evaluate whether staff are addressing safety criteria related to ageing in a timely and precautionary manner.

3. Ontario’s Electricity Gap: The Threat to Nuclear Safety

Without transparent end-of-life criteria and public scrutiny of OPG’s assessments regarding the projected end-of-life of its nuclear stations, Greenpeace believes the CNSC will be vulnerable political pressure to allow ageing reactors with declining safety margins to continue operating in order to ensure electricity supply.

Greenpeace has raised its concern before that Ontario’s looming electricity supply crunch will exert pressure on licensees, and subsequently on the CNSC, to make guaranteeing electricity supply a priority over safety in the coming decade. The CNSC has yet to respond to Greenpeace’s concerns.

As mentioned in past submissions, Greenpeace is concerned that the Ontario Power Authority (OPA), which is responsible for the province’s electricity planning, is calling for the “**Sequencing** [emphasis added] of refurbishments, given that many of the reactors currently in service will require refurbishment within a narrow time window, and that there is limited technical capability available province wide for refurbishment.”

Greenpeace has requested that the OPA release its schedule for reactor shut down and refurbishment used in its Integrated Power System Plan (IPSP). Given that nuclear generation provides 50% of Ontario's electricity supply, the ability of Ontario's nuclear operators to meet the OPA's proposed schedule will be essential to maintaining adequate electricity supply after 2010 if alternative are not developed. The OPA, however, has refused to release this schedule.

The OPA's mandate is to ensure electricity supply, not nuclear safety. The OPA, then, will have an obvious motivation to cut corners, speed up refurbishment projects and run reactors longer than would be otherwise deemed safe.

Notably, OPG has revised its end-of-life estimates based on the electricity planning estimates of the OPA. OPG states, for instance, in its 2007 annual report that "The Company has extended the service life of Bruce B nuclear generating station to 2014 for depreciation purposes effective January 1, 2008 **after reviewing future capacity plans in the OPA's IPSP** [emphasis added], and historical information regarding the service lives of major life limiting components of the station."

The OPA has also proposed "service extensions to some or all of the Pickering B Units" until new reactors can come online post 2019 if a decision is made not to rebuild the Pickering B nuclear station. The OPA states that reactor lives are "determined by the technical or economic end-of-life of major components such as nuclear channels, feeder pipes and/or steam generators." It makes no mention, however, of increased safety risks associated with running ageing reactors.

Evidence of the influence of this proposition is reflected in the following claim made in OPG's submission: "...OPG's current view is that the units will operate for approximately a further ten years."

Greenpeace opposes proposals for service extensions at Ontario's nuclear stations. Moreover, Greenpeace is concerned that the OPA's and OPG's proposals for service extension as well as revised claims of reactor life-span are being presented unquestioned and unverified from a safety perspective.

The recent firing of CNSC president Linda Keen shows that political pressure or interference can result from the CNSC fulfilling its mandate if it leads to a high-profile shortage of a product, such as radio-isotopes from AECL's NRU reactor or potentially electricity from OPG's reactors. As seen by the OPA's proposal to operate reactors as long as possible to maintain electricity supply, Ontario's looming electricity shortage will put nuclear safety in conflict with maintaining electricity supply.

The unplanned shutdown of any of Ontario's nuclear stations over the next decade could lead to the electricity shortages or an inability for the Ontario government to phase out coal, undermining action on climate change – both would be high profile issues of public concern. Greenpeace believes that the CNSC should enact policies now to pre-empt political pressures on the tribunal.

As noted, Greenpeace recommends that the Commission establish and make public clear cut criteria for determining the end-of-life for nuclear stations in Canada. Such transparent criteria, Greenpeace feels, will aide in mitigating the potential for political pressures to influence nuclear regulation.

Moreover, Greenpeace believes that the CNSC should review and publish reviews of OPG's estimates of the fitness-for-service of life-limiting components. Such independent and public assessments would provide much needed scrutiny the OPA's and OPG's claims regarding reactor service life, which are being used as the basis for regarding Ontario's long-term electricity plan.

Recommendation: Given the current lack of end-of-life criteria and the political pressures to maintain electricity supply post 2010, Greenpeace Canada requests that the Commission require OPG (as well as other licencees) and CNSC staff to submit and report annually on the fitness-for-service assessments and forecasts for the life-limiting components for nuclear stations in Canada in its annual report on the performance of the Canadian nuclear power industry. The Commission should also require OPG to make available on request – outside of Access to Information - any studies regarding fitness-for-service.

4. Pickering B Reactor Risks—High and Rising

The proposed licence period until 2013 would, if approved, bring the Pickering B nuclear station to the end of its operational life.

As noted, OPG's end-of-life estimates for the Pickering B nuclear station changed significantly in 2006, moving from 2009 to 2014. OPG claims in its licence renewal submission that it could operate the station until 2018. As discussed, Greenpeace

believes OPG has placed Ontario's electricity supply needs above safety considerations in establishing these dates.

Greenpeace believes that the Commission must acknowledge that the proposed licence period to 2013 is most likely Pickering B's last operational licence. This period is arguably when the Pickering B reactors will pose the greatest hazard to the environment and Toronto.

Engineers use a concept called the "bath-tub curve" to assess the impacts of ageing on facilities. The bath-tub curve plots the hypothetical failure rates of components of an engineered system, such as a nuclear reactor, over its life-time. The bath-tub curve has three stages, each with a different hazard profile: the break-in phase, the middle-life phase, and the wear-out, end-of-life phase.

The two highest-risk phases are the break-in phase and the wear-out, end-of-life phase. During the break-in phase, for example, a reactor will have a higher risk of accidents as construction and design flaws manifest themselves. Several well-known international nuclear accidents occurred during or shortly after the start-up of new reactors, notably the Fermi, Three Mile Island, and Chernobyl accidents.

In Canada, a significant unforeseen accident occurred at the Pickering A nuclear station in 1983 when a metre-long break ruptured a pressure tube in Pickering Reactor 2, spilling 17 kg of heavy water per second onto the floor of the reactor vault. The leak rate was gradually reduced as the coolant pressure dropped. The leak was stopped two weeks later.

The Pickering B reactors are now entering the wear-out end phase of the bath-tub curve. This phase is when materials and components deteriorate after years of operation, leading to increased risk of system failures and accidents.

Given the complexity of a nuclear plant, the impacts of ageing are not well understood and often only become apparent after component failures, such as tubes bursting.

The Canadian nuclear industry uses modeling to try to predict the rates of thinning, cracking and sagging but has repeatedly been faced with ageing impacts unforeseen in its modeling. In 2006, for instance, Hydro Quebec reported to the CNSC the appearance of cracking in the feeder pipes of its Gentilly-2 reactor that were unforeseen in the models used by the industry to predict the ageing of pressure tubes.

The unpredictability of the impacts of reactor ageing increases the likelihood of a greater number of shut-downs and inspections for shut-down and maintenance.

Indeed, even the OPA acknowledges the potential for the Pickering B reactors not reaching their claimed end-of-operation date in 2014 in its discussions regarding electricity system adequacy between 2008 and 2014. The OPA states: "There is a risk that Pickering B units may reach the end of their operating life ahead of schedule. For risk analysis purposes it was assumed that there is a 10% probability that each Pickering B unit will cease operation one year before its schedule end-of-life date."

As noted, OPG changed the estimated end of life from 2009 to 2014 for Pickering B in early 2006. Greenpeace believes that OPG was motivated to push back the end of life date for Pickering B due to the planning schedule it needs to prepare for rebuilding a nuclear station. OPG informed the OPA in 2005, for instance, that extending the life of a CANDU reactor requires up to six years of planning and approvals, making it impossible for OPG prepare in time for a refurbishment of Pickering B in 2009.

Greenpeace, then, is not confident that the OPG's projected end-of-life – and the proposed licence period recommended to the Commission - for the Pickering B nuclear station is founded on a safety analysis uninfluenced by the business requirements of OPG. There is a possibility that some Pickering B reactors may reach the end of their operational life before the end of the proposed licence period.

Recommendation: Given the uncertainties associated with the operational life of the Pickering B Nuclear Station, Greenpeace Canada requests that the Commission approve a 2 year licence renewal instead of a 5 year renewal.

5. Requirement for an End of Life Plan

As discussed, there is a strong possibility that OPG may decide not to rebuild the Pickering B nuclear station and or that the four reactors will be unable to operate until their claimed end-of-life date in 2014. For planning purposes, OPG and CNSC

staff should begin to plan for the safe shutdown and mothballing of the Pickering B reactors.

According to correspondence acquired by Greenpeace through Access to Information, CNSC staff were preparing in 2005 to introduce a licence condition requiring New Brunswick Power to prepare an acceptable plan for the end of life of the nuclear station if a decision was made not to proceed with the refurbishment of the Point Lepreau Nuclear Station. New Brunswick Power also committed to prepare such a plan.

Given the uncertainties associated with Pickering B's operational lifespan, OPG and CNSC staff should plan for the safe shutdown and mothballing of the Pickering B reactors.

Recommendation: Greenpeace Canada requests that the CNSC include a licence condition requiring OPG to develop an 'end of life' plan for the station by 2010.

6. No Public Safety Case: Uncertainties and Transparency

Greenpeace is concerned that component wear-out will compound the risks associated with Pickering B's design flaws.

This concern is heightened by the fact that many of Pickering B's safety studies are conducted by OPG, which has shown a pattern of behaviour that minimizes the risks a hazards posed by the station. These studies are also not readily available for public review, undermining their credibility.

Greenpeace has requested that the Commission direct OPG to release the Pickering B Probabilistic Risk Assessment (PBPA). The Commission has refused Greenpeace's request, citing security concerns.

Probabilistic Risk Assessments (PRA) are foundational safety documents that inform nuclear licensing in Canada and Greenpeace believes that they should be proactively released for public scrutiny. Withholding PRAs in totality prevents the public and decision-makers from being fully informed about nuclear risks. It also prevents any possibility of independent peer review, thereby undermining the credibility of the studies.

Because the Commission has used security concerns to withhold the PBPA in its entirety, Greenpeace feels that the Commission has failed to make an adequate safety case for the continued operation of the Pickering B nuclear station.

In its submission regarding the environmental assessment guidelines for the life-extension of Pickering B in January 2007, Greenpeace Canada stated its concern that OPG had refused to include external hazards (such as seismic events, aircraft crash, explosion, extreme temperatures, etc.) in the PBPA. External hazards contribute significantly to the probability of accidents at nuclear stations and excluding such events contributes to an underestimation of accident probabilities.

Greenpeace noted that the CNSC's regulatory guide on probabilistic risk assessment (S-294) requires the inclusion of external events, although it does allow for the use of an alternative analysis approach if an agreement is made between CNSC staff and the licensee. OPG, however, did not consult CNSC staff when it decided to exclude external events from the PBPA. Indeed, OPG verbally informed CNSC staff that "they do not intend to carry out these assessments as the PRA is already done."

OPG's decision to exclude external events from the PBPA without consulting CNSC staff, Greenpeace believes, points to an approach to developing safety studies that aims to underestimate nuclear safety issues instead of addressing and mitigating such risks. This undermines the credibility of the safety studies used by the CNSC to justify the ongoing operation of Pickering B.

Notably, CNSC staff rightfully instructed OPG to include an additional accident scenario in the environmental assessment for the life-extension of Pickering B, citing the fact that if external events were included in the PBPA it would increase the frequency of the accident scenario to or greater than one in a million years, which is the bounding probability for inclusion in environmental assessments. OPG's response to this directive was to "...to revise PBPA to reassess specific event sequences to improve their frequency of occurrence." OPG, however, was unable to lower the frequency of the accident scenario to the satisfaction of CNSC staff.

OPG's refusal to redo the PBPA to include external events when considered alongside its willingness to rewrite the PRPA to lower the frequency a specific accident scenario points to an approach to nuclear safety that aims to purposely underestimate the probability accident sequences that may draw public attention to the hazards of the Pickering nuclear

station.

It is notable that the accident scenario OPG attempted to have excluded from the environmental assessment for the life-extension of Pickering B involves radioactive releases. According to Emergency Management Ontario (EMO) radiation levels from this accident scenario could necessitate evacuating up to a 10 km around Pickering B. Such an accident would arguably have a greater economic impact on Toronto than SARS. There are currently 238,088 people within 10 km of the Pickering nuclear station, the costs of evacuation and lost economic activity would be enormous. Indeed, a recent federal government study estimated that the cost of the damage from a relatively small “dirty bomb” spreading radioactivity for four kilometres in downtown Toronto would be \$23.5 billion.

The CNSC regulatory approach relies on safety studies produced by OPG and other nuclear licencees. A danger of this approach is that it depends on the expertise of companies with an economic motivation to minimize the costs of operating nuclear stations and to downplay the probability of accidents that would negatively impact the social acceptability of nuclear facilities. Due to claims of commercial confidentiality, this approach also provides limited opportunity for public scrutiny or independent assessment to verify safety OPG’s safety studies, undermining their credibility.

It is notable that during the most recent licence period OPG failed to inform CNSC staff of important safety studies regarding the safety margins of the Pickering nuclear station. In June 2007, OPG announced the closure of Pickering A units 1 and 4 in order to perform maintenance on a backup electrical connection between Pickering A and Pickering B. OPG acknowledged after the shut-down that it was aware of the deficient backup electrical connection in 2005, but was studying the issue.

CNSC staff told Commission tribunal members that OPG should have informed them of the issue in 2005 but that they did not learn of it until 2007. The Pickering A nuclear station, then, operated for two years outside of accepted safety standards due to OPG’s failure to inform CNSC staff of plant deficiencies.

As discussed, Greenpeace feels that the inability for the public to scrutinize or verify OPG’s safety studies undermines the credibility of the safety claims made by the Commission.

It is noteworthy that CNSC staff evaluations of the Pickering B Probabilistic Risk Assessment, however, point to additional problems with the study that may underestimate risk, including “significant deficiencies in the methodology” as well as a lack of a sensitivity and uncertainty analysis.

Given OPG’s pattern of underestimating or minimizing nuclear hazards in its safety studies and the inability of the public to scrutinize or review these studies, Greenpeace feels that the Commission has failed to make an adequate safety case for the continued operation of the Pickering B nuclear station.

Recommendation: Greenpeace requests that the Commission improve its disclosure protocols and require the proactive release all safety studies, including probabilistic risk assessments, deterministic safety studies, hazards analysis and S-99 reports.

6.1 Design Vulnerabilities: Positive Void Coefficient

Being a CANDU design, the Pickering nuclear station shares an inherent design flaw with the Chernobyl RBMK reactor design – the positive void coefficient.

An important contributor to the 1986 Chernobyl accident was the presence of steam in the fuel channels, which affected the nuclear reaction in the core. The increase in reactor temperature resulted in an increased production of steam, which has a lower density than water. This created steam “voids” with no water coolant.

The Positive Void Effect, in particular its behaviour during Large Loss of Coolant Accidents (LLOCAs), has long been categorized as a Generic Action Item (GAI) by the Canadian Nuclear Safety Commission and its predecessor the Atomic Energy Control Board (AECB). GAIs are fundamental safety problems associated with CANDU reactor technology

Since Chernobyl, international standards have developed to favour more inherently safe reactor designs – that is, designs not dependent on engineered safety systems or operational procedures for the control of risk to prevent accidents - to the detriment of reactors with positive void reactivity, specifically the Chernobyl RBMK and CANDU designs.

In 2005, the CNSC released a draft design guide to the nuclear industry for comment without informing non-industry

stakeholders. The draft design guide sought to be technology neutral and based on international standards. In line with the direction of international standards, the CNSC's 2005 draft design guide stated that "...priority shall be given to nuclear reactor's inherent negative feedbacks that shall mitigate any rapid increase in reactivity and reactor power."

Greenpeace has requested the Commission's disposition of the nuclear industry's comments on the 2005 draft design guide, but has been denied by CNSC staff. Greenpeace has learned, however, that Atomic Energy of Canada Limited (AECL) opposed the negative reactivity requirement proposed in the 2005 design guide after acquiring an internal CNSC memorandum that was mistakenly posted to the CNSC website.

The memo notes that AECL opposed the requirement regarding negative reactivity due to the negative impact it would have on selling the CANDU design internationally and domestically. Specifically, AECL complained to the CNSC staff that "...the clause would impact on marketing of CANDU 6 reactors" and reflect badly on operating CANDUs because "...every current reactor design has some inherent characteristics that may increase reactivity in certain design-basis events."

CNSC staff responded to AECL's concerns without broader public consultation. Staff noted "...the need to address the immediate urgent priority of providing regulatory guidance, especially for new builds, imposes adopting an interim option using existing approved regulatory documents and framework."

CNSC staff recommended removing wording requiring reactor designs to "...attain at least a net negative effect of reactivity..." with wording designed to accommodate reactors with positive reactivity in draft regulatory guide S-337. Specifically, staff recommended that the wording be changed to: "...it shall be demonstrated that the consequences of those accidents that would be aggravated by a positive reactivity feedback are either acceptable or could be satisfactorily mitigated by other design features."

Greenpeace is disturbed that the CNSC has allowed the business interests of AECL without public scrutiny to water down design guidelines seeking more inherently safe reactor designs.

Recommendation: Given the undue and untransparent input AECL has had in influencing CNSC standards to accommodate a fundamental design flaw of CANDU reactors, Greenpeace requests that the CNSC proactively release all internal documents and correspondence from the "positive reactivity feedback working team" which has been developing the CNSC's approach to dealing with the positive void coefficient.

The international trend toward more inherently safe reactor designs and away from designs with positive reactivity, such as the CANDU and Chernobyl RBMK designs, calls for precaution in relicensing the ageing Pickering B nuclear station.

Indeed, recent analysis regarding the extent of positive void reactivity of the Pickering B reactors raises questions of whether the safe operation of the station can be assured under the current licensing basis, especially given that Pickering B would not comply with modern standards requiring negative reactivity.

The positive void effect has been long-standing and significant because of the large power pulse it creates following a Large Loss of Coolant Accidents (LLOCA).

Due to doubts that computer codes used to predict reactor behaviour were not accurately estimating the impacts of positive void reactivity, CNSC staff requested in 2001 that all licencees confirm that their safety analysis still conformed to the licensing basis.

Because of the large safety margins predicted in earlier analysis, Pickering B was the last station scheduled for a re-assessment of a Large Break Loss of Coolant Accidents (LBLOCA) with updated computer codes.

It is of great concern to Greenpeace that "...the new analysis has resulted in prediction of consequences which are substantially worse than reported previously." CNSC staff state that "...the new analysis indicates a significant change in the licensing case results and large reduction of previously reported safety margins...". Furthermore, the results "...potentially invalidate large parts of the licensing analysis documented in the Safety Report, in particular, the moderator subcooling calculations, containment analysis and assessment of radioactive releases and population doses." According to staff, "...recent findings related to magnitude of coolant void reactivity (CVR) and the other key parameters of reactor core nuclear design further emphasize the need for a comprehensive revisit of the safety case supporting the shutdown systems effectiveness for AOOs [Anticipated Operational Occurrences] and DBAs [Design Basis Accidents]."

Recommendation: Given recent findings regarding the magnitude and impact of positive void reactivity on the safety case for Pickering B, CNSC staff should make recommendations regarding what precautionary operational measures, such as de-

rating the station, should be taken to mitigate the uncertainties in Pickering B's safety margins.

6.2 Design Vulnerabilities: Containment

The Pickering nuclear station has a significant design flaw in that eight reactors share both the containment and Emergency Coolant Injection System (ECIS).

Containment at the Pickering Nuclear Station consists of eight individual reactor buildings connected to one vacuum building by a pressure relief duct. In the event of a serious accident, the vacuum building is designed to suck up radioactive material and steam, and to douse the steam with water in order to reduce pressure on the containment system. This containment system is designed to handle 530 gigajoules (GJ) of thermal energy (stored energy and radioactive decay heat) from one reactor during a one-hour period after shutdown. Thus, the containment system can only deal with one accident at one reactor. This station design was clearly motivated by a desire to reduce construction costs by not building individual systems for each reactor. The designers ignored the possibility of simultaneous accidents at two or more reactors. Such accidents (known as common mode failures) can be caused by external events such as earthquakes, weather-related problems, electricity failures, or acts of malice due to war, terrorism or sabotage.

Similarly, the ECIS at Pickering is a shared system. Pickering "A" did not originally have an ECIS, and the system was built during construction of Pickering "B". It was designed to provide a flow rate of 640 litres per second (l/s), in order to deal with the largest assumed leak at one reactor. Thus, the system can only deal with one accident at one reactor. Like the containment system, ECIS cannot deal with common mode failures resulting in major loss of coolant accidents (LOCAs).

In its review of the OPG's Probabilistic Risk Assessment, CNSC staff note the following significant omission:

"At Pickering B some initiating events could produce multiunit accidents. For instance, a medium or large steam line break event at one unit might produce a harsh environment in the common powerhouse leading to common cause accidents at all units with multiple failures of mitigating systems. Since these types of accidents are major contributors to the plant risk according to PRA results, additional risk from adjacent units may not be negligible. Furthermore, if multiple mitigating systems fail due to the harsh environment, several units may have severe core damage simultaneously. This may create such a challenge to the containment that its failure may not be precluded. We think these scenarios should be considered."

As noted, the Pickering nuclear station is highly vulnerable to terrorist attack because 8 reactors rely on the same containment structures. Greenpeace is deeply concerned that OPG has only assessed the impacts of a small aircraft strike in its safety studies, but not that of an "...international large commercial aircraft crash or other similar malevolent actions..."

Recommendation: Greenpeace requests that OPG and CNSC staff be required to assess and report on the impacts of an international large commercial aircraft crash at the Pickering at a public meeting of the CNSC

7. Conclusion

Because of the high population density, regulatory authorities would not allow a new plant to be built at Pickering today.

Given Pickering's location, design flaws and its ageing, Greenpeace believes that the CNSC should exercise the utmost precaution in determining the duration and level of scrutiny for what could be Pickering B's final licence renewal.

Thank you for this opportunity to comment on the licence renewal of the Pickering nuclear station.

If you have any questions or require any clarifications, please don't hesitate to contact me.

Shawn-Patrick Stensil
Energy Campaigner
Greenpeace