Comments on Bill C-5

by Gordon Edwards, Ph.D., President,
Canadian Coalition for Nuclear Responsibility

before the Standing Committee on Natural Resources
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1. Before it is used in a nuclear reactor, uranium fuel can be safely handled using only a pair of gloves. Inside the reactor, however, hundreds of new radioactive substances are created called "fission products". These are the broken pieces of uranium atoms which have been split. The fission products are millions of times more radioactive than fresh uranium fuel. Immediately after being discharged from a reactor, a single CANDU fuel bundle can deliver a lethal dose of penetrating radiation in just 20 seconds to any unprotected person standing one metre away. This intense radioactivity is due to the presence of fission products. Indeed, the irradiated fuel is so radioactive that it has to be cooled under 14 feet of circulating water for at least 7 to 10 years or it will spontaneously overheat, experience self-inflicted damage, and release radioactive gases and vapours.

2. Inside the core of a reactor, even after the fission process has been completely shut down, the radioactivity of the fission products is so intense that the core continues to generate 7 percent of full power heat. That's an awful lot of heat, and if adequate cooling is not provided – even after complete shutdown of the reactor -- the residual heat is more than enough to melt the core at a temperature of 5000 degrees Fahrenheit. When the fiuel melts, large quantities of fission products are released as gases, vapours, and ashes. I have provided the Committee members with excerpts from four official Canadian documents. These excerpts confirm the fact that core melting accidents are possible and even probable if Canada chooses to build a large fleet of nuclear reactors. The official bodies that produced the douments from which these excerpts were taken are the Ontario Royal Commission on Electric Power Planning, the Atomic Energy Control Board, the federal Department of Energy, Mines and Resources, and the Select Committee on Ontario Hydro Affairs.

3. As a participant in the deliberations of both the Royal Commission on Electric Power Planning and the Select Committee on Ontario Hydro Affairs, I can assure the Committee members that the rationale for Bill C-5 is based on the potential offsite consequences of fuel melting accidents. For without fuel melting, it is not possible for a nuclear accident to have offsite property damages exceeding $10 million. However, the consequences of core melt accidents can typically run to tens of billions of dollars, or even hundreds of billions of dollars, and can make large regions of land uninhabitable for a considerable period of time. In the case of such a catastrophe, Bill C-5 limits the liability of nuclear operators to a very modest amount (less than half the cost of retubing a reactor), it eliminates all liability for nuclear equipment suppliers – even if they supplied defective equipment which caused the accident -- yet it does not address any important measures that would limit the overall financial liability to the Canadian taxpayer or the societal liability of any of the affected populations.

4. The Canadian Coalition for Nuclear Responsibility feels that it is important for the elected representatives of the people to ensure that the nuclear industry is held publicly accountable, and to ensure that the best interests of Canadians are not compromised in order to serve the interests of the nuclear industry. We believe that the figure of $650 million has no sound scientific or financial basis, and that this arbitrary amount serves to distract the Committee from a much more important question: Just how great might the total damage be in case a core melt accident occurs here in Canada? Have such studies been carried out? Has the Committee received copies of them? What if such an accident occurred at the Pickering site? How much of the Toronto population would have to be evacuated, and for how long? And how far would the radioactive contamination spread? It is sobering to realize that even today, 20 years after the Chernobyl accident in the Ukraine, some sheep farmers in Northern England and in Northern Wales cannot market their meat because of radioactive contamination with cesium-137 from the Chernobyl reactor, thousands of kilometres away. Will farmers in the Ottawa Valley and in Quebec have to curtail their agricultural practices following a nuclear accident near Toronto? Is the Canadian Parliament expected to pass bill C-5 to limit the liability of the nuclear industry without giving careful thought to the question of limiting the ultimate financial liability of the Crown?

5. One way of limiting public liability would be to require that any new reactors be sited far away from large population centres. Observers both inside and outside of the nuclear industry have commented that the Pickering reactors are among the worst-sited reactors in the world, because of the catastrophe potential in such close proximity with one of Canada's largest cities. Such a catastrophe could be realized not only in the event of a severe industrial accident, but also as the result of external causes such as a large earthquake causing multiple pipe breaks in the reactor core, or an act of deliberate sabotage or terrorism, which can no longer be discounted as fanciful.

6. I was one of the fortunate few to attend a 1977 Conference on the Nuclear Fuel Cycle sponsored by the International Atomic Energy Agency (IAEA) in Salzburg Austria. At that conference, one of the leading American nuclear scientists, Alvin Weinberg, spoke for an hour to an audience of about 300 nuclear scientists from every corner of the world. His message was stark. "We nuclear scientists," he said "have not faced up to the full consequences of complete success. If we succeed in building tens of thousands of nuclear reactors around the world, which we must do to make any noticeable dent in the world's use of petroleum, we can expect to have a core meltdown approximately every four years. The lesson is clear. We must stop building these reactors near large cities." I was impressed by the sincerity of Mr. Weinberg's proposal. In fact, he recommended that large tracts of land should be set aside specifically for nuclear reactors and nothing else. If the reactors are going to melt down, let them do so there, far away from the population centres.

7. Alvin Weinberg's proposals may strike some of us as extreme, but perhaps it's only because we have not taken the trouble to educate ourselves about the science behind core melting accidents and the possible consequences of such events. In 1978, one full year before the Three Mile Island Accident, the Ontario Royal Commission on Electric Power Planning spent months on this question and found that if there were 100 reactors operating in Canada at some future date, then under the worst assumptions, there could be a core

meltdown here in Canada once every 40 years. In his report, Arthur Porter – a professor of Engineering from the University of Toronto – wrote that serious consideration should be given to building any new reactors underground, so that the radioactive releases from an uncontained core meltdown could be largely trapped in subterranean caverns and prevented from spreading over vast land areas.

8. Another way of limiting the nuclear liability of the Crown and of the Canadian population is to invest in other energy technologies which can reduce greenhouse gases faster and more efficiently than nuclear power can possibly do, without posing the same risks of catastrophic impact. According to a report issued in May 2007 by the Intergovernmental Panel on Climate Change, nuclear power currently provides about 16 percent of the world's electricity (which amounts to about 2.7 percent of total energy use). In the next quarter century, the IPCC estimates that nuclear power could increase its contribution from 16% to 18% of electricity use. This is far from solving the climate change problem. Meanwhile, the same IPCC report states that renewable electricity currently accounts for 18% of electrical supply, and that in the next 25 years it could account for 35% of all electricity. That's twice as much as nuclear can provide in the same time frame. Evidently, renewables are a better bet than nuclear, at least for the next 25 years. Nuclear is not a good investment; it doesn't do the job.

9. Germany decided about 10 years ago to phase out of nuclear power. They have shut down 2 of their 17 reactors and will soon shut down a third. In that same 10-year period, Germany has installed 20,000 megawatts of wind power. That's more than the entire Canadian nuclear program. Meanwhile, Germany is leading all other European countries in reducing greenhouse gas emissions. So perhaps instead of passing Bill C-5, the Committee members should be recommending that a comprehensive inquiry into the risks and benefits of nuclear energy in comparison with other energy technologies be undertaken in the public interest. Such an inquiry is long overdue.

10. It would be a shame for this Committee to approve a piece of legislation that is so peripheral to the larger issues. While Parliament is asked to rubber-stamp legislation such as this, which merely shifts financial liability from the nuclear industry to the taxpayer, multi-billion dollar decisions are being made behind closed doors without any Parliamentary debate. I refer in particular to the recent decision by the Minister of Natural Resources to approve a 25-billion dollar proposal of the nuclear industry to centralize its inventory of irradiated nuclear fuel at some location within Canada, yet to be determined. If Parliament votes for Bill C-5 that vote will be interpreted as a green light for nuclear expansion, even though such a question is never phrased in a forthright and honest manner. Is the government afraid to ask an honest question of Parliament: "Do you approve of this government embarking on a vast expansion of nuclear power both here and abroad?"

11. CCNR believes that Bill C-5 is based on misinformation and a profound misunderstanding of the nature of the energy choices that we all must confront. We believe Bill C-5 should not be passed unless it is radically revised to include stringent measures to limit the financial liability of the Crown and to dramatically reduce the potential risks to Canadian citizens.

Exhibit: Findings on CANDU reactor accidents, prepared by Gordon Edwards in 1996.

CORE MELTDOWNS IN CANDU REACTORS – KNOWN FACTS

compiled by G. Edwards Ph.D., President, Canadian Coalition for Nuclear Responsibility

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QUOTATIONS FROM:
The Safety of Ontario's Nuclear Reactors (1980)
by the Select Committee on Ontario Hydro Affairs (Ont. Legislature)

"It is not right to say that a catastrophic accident is impossible . . . . The worst possible accident . . . could involve the spread of radioactive poisons over large areas, killing thousands immediately, killing others through increasing susceptibility to cancer, risking genetic defects that could affect future generations, and possibly contaminating large land areas for future habitation or cultivation."

"The AECB should commission a study to analyze the likelihood and consequences of a catastrophic accident in a CANDU reactor . . . directed by recognized experts outside the AECB, AECL and Ontario Hydro*." [NOTE: this study has never been done]*

QUOTATIONS FROM:
A Race Against Time – Report on Nuclear Power in Ontario (1978)
by the Ontario Royal Commission on Electric Power Planning

"When we talk about the safety of a nuclear reactor, we are referring essentially to how effectively the fantastic amount of radioactivity contained in the reactor core can be prevented from escaping into the ground and atmosphere in the event of major malfunctions."

"Clearly, if a major release of this accumulated radioactivity occurred, as discussed in the previous section, the consequences would be extremely serious and could involve several thousand immediate fatalities and many more delayed fatalities."

"Assuming, for the sake of argument, that within the next forty years Canada will have 100 operating reactors, the probability of a core meltdown might be in the order of 1 in 40 years, if the most pessimistic estimate of probability is assumed."

CORE MELTDOWNS IN CANDU REACTORS – KNOWN FACTS

QUOTATIONS FROM:
Submission to the Treasury Board of Canada (1989)
by the Atomic Energy Control Board (predecessor of the CNSC)

"When modern nuclear power plants were being designed in Canada two decades ago, their complexity and potential for catastrophic consequences were recognized. . . ."

". . . through the combination of a series of comparatively common failures which, on their own, are of little consequence, accidents can develop in a myriad of ways (as demonstrated most vividly at Three Mile Island and Chernobyl). This makes the calculation of consequences of potential accidents very difficult."

"The consequences of a severe accident can be very high. The accident at Chernobyl has cost the Soviet economy about $ 16 billion including replacement power costs. The accident has generated anti-nuclear sentiment in the USSR and throughout the world. Three Mile Island has cost the USA $ 4.8 billion . . . ."

"The likelihood of serious accidents cannot be judged from statistics . . . and CANDU plants cannot be said to be either more or less safe than other types."

QUOTATIONS FROM:
Nuclear Policy Review Background Papers (1982, Report ER81-2E)
by the Dept of Energy Mines and Resources, Government of Canada

"Core meltdown accidents of the type to be described here have never occurred in any commercial power reactor, although the sequence of events at Three Mile Island went partway along the path. Nor has any study on core meltdown accidents been done for the CANDU reactor. . . ."

". . . if the ECCS *[EMERGENCY CORE COOLING SYSTEM]* failed to act, melting of metallic components of the core and eventually

CORE MELTDOWNS IN CANDU REACTORS – KNOWN FACTS

of the uranium oxide fuel itself would probably occur. . . . [or] if the reactor fails to shut down or the decay heat removal systems fail, melting of the core would ensue."

"Much larger consequences could be associated with core meltdowns which also cause failures in the containment structure above ground. If the containment sprays malfunction or are damaged by flying debris (generated by a LOCA *[LOSS OF COOLANT ACCIDENT]* or transient) the steam being released from the reactor core would not be condensed."

"This steam, along with various vapours and noncondensible gases, could cause failure of the containment structure due to overpressurization. Hot zircaloy from the fuel sheaths and steel would also react with water to produce large volumes of hydrogen. Detonation of this hydrogen (reacting with oxygen) might damage the containment or, if not, the heat of combustion combined with high steam pressure would at least add to the pressure loads on the structure."

"A further contributor to containment pressurization would be the large quantities of carbon dioxide generated as the molten core melts through the concrete base slabs. Another possibility is one in which the molten fuel falls into the pool of water in the bottom of the reactor vessel with the formation of flying debris which could, in turn, damage the containment structure. All post-meltdown occurrences which threaten to damage or breach the containment structure can result in the release of substantial amounts of radioactive material to the environment."

"The Reactor Safety Study *[by the U.S. NRC]* calculated the health effects and the probability of occurrence for many possible combinations of radioactive material release magnitude, weather conditions, and population exposure *[see the next page]* . . . . In addition to these health effects, a nuclear accident may contaminate the surrounding area and require relocation of the populace."

CORE MELTDOWNS IN CANDU REACTORS – KNOWN FACTS

SOME BACKGROUND ON:
The Rasmussen Report (1974, "Reactor Safety Study", WASH-1400) by the U.S. Nuclear Regulatory Commission

G.A. Pon, Vice President of AECL Power Projects, said of WASH-1400:

> **"Although the study was prepared in the U.S. assessing the risks associated with their light water nuclear power plants, the findings should not be significantly different for the CANDU reactor."** ***Porter Commission, Exhibit 28 (1977), p.5***

In sworn testimony before the Cluff Lake Board of Inquiry into Uranium Mining in Saskatchewan, Dr. Norman Rasmussen -- the principal author of WASH-1400 -- commented about CANDU meltdown possibilities:

> **"although the Canadian design philosophy differs in some of its approaches . . . it achieves, in my judgment, about the same safety level as far as I can tell."** ***Transcript, Cluff Lake Inquiry, (1977)***

Worst case consequences as reported in WASH-1400 (1974):

> ***45,000 cases of radiation sickness (requiring hospitalization)***
> ***3,300 prompt deaths (due to acute radiation sickness)***
> ***45,000 fatal cancers (over 50 years)***
> ***250,000 non-fatal cancers (over 50 years)***
> ***190 defective children born per year after the accident***
> ***$14 billion in property damage (1974 dollars; not insurable)***

FOR MORE INFORMATION SEE http://ccnr.org