

Spent fuel from nuclear power generation

The following is part three of an eight part written debate regarding nuclear power generation
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The Debaters

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After periods in Alberta industry and teaching engineering courses, he joined Atomic Energy of Canada in 1974. He worked in CANDU nuclear reactor safety analysis, environmental assessment and reactor licensing, till his retirement in 2000.

Following his retirement from AECL in 2000 he has been engaged in consulting and writing activities related to energy and greenhouse gas management. He maintains an informational [website](#) and is Chair of the Alberta Branch of the Canadian Nuclear Society.

Denis Sauvageau is a full time agricultural producer in the Smoky River area. He has been active on environmental issues since the expansion of the Confined Feeding Hog Operations near Girouxville in 2003 (50,000 hogs). Denis is a member of the Clean Air Strategic Alliance Confined Feeding Operations Project Team which was assembled in efforts to address CFO air quality issues. Denis is chair of Friends Of an Unpolluted Lifestyle Society and the Peace River Environmental Society in addition to positions with Alberta Environment Network, Society for Environmentally Responsible Livestock Operations, Peace Airshed Zone Association and member of the National Farmers Union.

Denis Sauvageau opening statement

Spent reactor fuel represents a massive inventory of highly radioactive material. No country on Earth has disposed of any high-level waste and attempts to reduce the volume through reprocessing have been utter failures.

There are 2 million spent fuel bundles stored at reactors in Canada. They are so radioactive when exiting a reactor that a person within a metre would die in minutes. The industry claims these bundles would only fill six hockey rinks. This is misleading as the casks themselves become radioactive with a volume far greater than the waste itself.

The bundles are placed in 40-foot deep cooling pools for up to twenty years. The pools contain 10-30 times more radioactive material than a reactor, yet the covering buildings for the cooling pools have virtually no airborne protection. This concern is raised by the National Academy of Sciences. If the pumps and circulation system for the water in the cooling pools were disabled, the stored spent fuel could suffer a meltdown as almost happened in England last year.

Though radioactive waste is created at every part of the nuclear fuel cycle, spent reactor fuel concerns people the most. Long term disposal of high-level waste is still a guessing game as there is no known material capable of containing it for its dangerous lifespan. In March 2009 the US cancelled the Yucca Mountain disposal site after more than 25 years and over \$14 billion in development. Since the early 1980's several American states have outlawed reactor construction until the disposal of waste is solved.

Hydro-Quebec reports eight radionuclides are emitted from stored fuel; tritium, carbon-14, manganese-54, cobalt-60, zirconium-95, niobium-95, antimony-124 and hafnium-181.

In considering our incomplete knowledge of nuclear waste, it is illogical to build more reactors. More reactors would only add to the current waste disposal dilemma.

Duane Pendergast opening statement

There is a pervasive message being broadcast to Albertans that Canada does not know what to do with used fuel and nuclear "waste". This message is far from the truth.

Nuclear fuel was designed from the beginning to trap and contain almost all of the radioactive material produced during operation. When reactor fuel is first discharged, heat and radiative energy are released from it and it must be carefully cooled and shielded. Facilities to accomplish this are built into reactor systems. Heat generation and radiation quickly decrease as time goes on and alternative means of storage, and ultimately disposal of the waste portion, are feasible.

Canada's nuclear researchers and industry have undertaken much work over the past few decades to establish the best way to fully deal with used fuel. In order to consolidate the knowledge gained, Canada established the Nuclear Waste Management Organization (NWMO) in 2002 with a mandate to assume responsibility for Canada's used nuclear fuel and evaluate public support. The NWMO undertook extensive public consultation, and recommended long term action based on "adaptive phased management". This was accepted by the federal government in 2007. The NWMO and nuclear plant operators are proceeding with the next phase to place used fuel in above ground containers at reactor sites. Readers can learn all about this and subsequent phases on the NWMO website at www.nwmo.ca.

There is another compelling reason to make haste slowly with any scheme for disposal of used fuel. Only about 1% of the energy potentially available from the uranium in CANDU reactor fuel has been recovered. Alternative reactor technology is known which can be developed to reuse and recycle uranium in used fuel to extract nearly all of its energy potential. Full development of nuclear fission technology promises inexhaustible energy for future generations.

First rebuttal by Denis Sauvageau

It is interesting to note that Mr. Pendergast uses words such as "almost", "about", "nearly", and "promises". Such words make it clear that the nuclear waste dilemma remains unsolved. Isn't science about facts?

The mandate and structure of the Nuclear Waste Management Organization (NWMO) run contrary to the recommendations of the Seaborn Panel, the (1989-1998) environmental assessment (EA) commissioned to study Canada's nuclear waste disposal options. The Panel recommended that the NWMO board be comprised of people independent of the nuclear industry. The government appointed only nuclear industry representatives.

The EA determined that the safety and suitability of deep geological disposal had not been demonstrated, yet this is the only option the NWMO is pursuing. The Seaborn EA recommended a further EA be held to explore ALL disposal options with funding for interveners to present independent technical expertise. The NWMO has prevented this from occurring.

The findings of the nine-year long EA were dismissed by the federal government. This is a caution to those depending on the upcoming Bruce Power EA to protect us.

Refuting Mr. Pendergast's final paragraph on reprocessing waste would require a full page. Reprocessing has caused massive contamination resulting in four times as much high-level waste as the process starts with. The British Nuclear Decommissioning Authority estimates it will cost \$67 billion and take 100 years to clean up the Sellafield reprocessing site. The West Valley, New York reprocessing site will cost up to \$27 billion to clean up after only six years of operation.

First rebuttal by Duane Pendergast

Mr. Sauvageau suggests my use of qualifying words such as "almost", "nearly", and "promises" imply uncertainty. I used them to avoid claiming false absolutes with respect to the nature of used fuel and energy extraction. Perhaps that care with the truth is partly due to my many years with the nuclear industry. The focus there is on the use of scientific methodology to establish factual information and to understand and manage uncertainty.

On the other hand, has Mr. Sauvageau thrown caution to the wind with statements seemingly based on hearsay? Did he study the NWMO work? For example, he indicates that the NWMO study is contrary to the recommendations of the earlier Seaborn Panel environmental assessment and that the NWMO has ignored all options but deep geological disposal.

Following extensive scientific studies of deep geological disposal, the environmental assessment undertaken by the Seaborn Panel found that option to be technically sound but lacking in broad public support. The NWMO was subsequently established following the recommendations of the Panel. Initial members of the NWMO Board of Directors and an Advisory Council are all identified in Appendix 1 of the NWMO report "Choosing a Way Forward". The Chair of the BOD and most members of the Advisory Council were independent of the nuclear industry. Fourteen options for used fuel management were considered by the NWMO. Dissenting opinion and public

input was obtained. Three were chosen, including deep geological disposal, as the basis for the used fuel management methodology developed by NWMO.

Second rebuttal by Denis Sauvageau

“Managing uncertainty,” what a wonderful way of saying we’re not sure what we are doing. Mr. Pendergast goes on to say that deep burial is lacking in public support. Can anyone blame the public for not trusting the nuclear industry with the seemingly never ending public dollars going into the nuclear money pit? In Aug-2009 the CBC reported that storing Canada’s nuclear waste could cost upwards of \$24 billion.

Several countries including Germany and the USA have been experimenting with deep burial for over 25 years with no firm results. It remains to be seen if in fact deep burial will actually work.

Rather than focus on more NWMO commentary I would like to offer readers some factual information. In 2005 the Kincardine News publisher pointed out that the nuclear industry’s sales pitch to Bruce area residents implied that the community owed it to Ontarians to store nuclear waste. He questioned why deep burial was being promoted in “no-mans land” and added; “an underground nuclear waste facility would be greeted with absolute outrage in Toronto.”

According to a Jan-15-2010 Spiegel article, Germany’s Gorleben site has been in the works for over 30 years. The article also states “This permanent repository will still have to be impervious in the year 8010, not to mention the year 308,010.”

One does not need a degree to realize that deep burial plans are questionable. Mr. Pendergast’s qualifying words accurately reflect the state of affairs as the science has not withstood the test of time.

Second rebuttal by Duane Pendergast

What have we accomplished with this debate? Mr. Sauvageau has made it clear that he does not believe the risks associated with nuclear energy are worth taking. I am convinced that the enormous benefits to future generations of an inexhaustible energy supply should be considered in balance with risks which I believe can be effectively countered. Neither of us is inclined to listen to the other.

The ground between these two poles of opinion has been examined in considerable depth. The studies undertaken by the NWMO to date cover it well with respect to used fuel. Sure! There is more to learn. The NWMO acknowledges that with the approach they have established to take into account new knowledge as time goes on and to adapt. In the meantime Canada does have wastes associated with used nuclear fuel and has committed to actions to safely take care of it.

I participated in public consultation undertaken by the NWMO to establish “The Way Forward”. It was a satisfying experience. The town of Ignace in Ontario has expressed interest in learning more about NWMO plans with a tentative goal to host a facility. The NWMO encourages interaction through their “Learn More” program as well as public consultation on projects. Please take advantage of these opportunities to learn more and have your voices heard.

In closing, I urge readers to keep their minds open to carefully consider the local and global benefits of energy from nuclear energy in balance with the risks involved.