

Water use for nuclear power plants

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

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Career progressed from designing safety and cooling systems in Canadian nuclear reactors, construction manager in USA nuclear plants in Taiwan. Then continued on to Consulting Engineering & Economics including LNG ports & plants, coal ports & plants, oil plants and hydro plants all intended for power grid stability and optimization. 12 years prior to retirement started a manufacturing company supplying control systems and equipment for Candu reactors, (sold to S, Korea and China), for the aerospace and for the defence industries.

Brenda Brochu is a past president of the Peace River Environmental Society (PRES). Through PRES, she helped organized talks on nuclear power by several speakers, including Dr. Gordon Edwards, Dr. Jim Harding and Jack Century. She also helped organize the nuclear debate in Peace River in October, 2009 between Dr. Helen Caldicott and Dr. Duane Bratt.

A mother and grandmother, she works as executive director of the Peace River Regional Women's Shelter.

Opening statement by Cosmos Voutsinos

A nuclear plant consists of: the GENERATOR that produces the electricity, a TURBINE that rotates the generator, a BOILER that produces the steam to drive the turbine and a source of HEAT to generate the steam in the boiler. The raw (river) water cooling system has no direct contact with any radioactivity even if there is a system failure (leak). Hence all the water is returned to the river slightly warmer and no pollutants.

All thermal plants, coal, oil, bio-mass, uranium or municipal trash, have the same parts to produce and convert the heat. The amount of heat discharged has to do only with the turbine which converts about 1/3 of the energy into electricity. The remaining 2/3 is discharged as heat. Increasing the operating temperature increases the overall efficiency of heat conversion to electricity. This heat is discharged to the environment by the cooling system in all power plants. It is about the same for all thermal power stations. A nuclear plant circulates 1/3 more water than it needs in order to meet stringent environmental regulations in protecting aquatic life. As a result its discharged water is cooler than in other stations.

What is important here is not how much water goes through the condenser and back to the river, but how much heat is discharged. This is because the amount of heat discharged will define how much water will evaporate from the river. As long as the rate of evaporation is small relative to the river flow there is no problem. If there is a problem with the river, a cooling tower is used. Finally if there is not enough water dry cooling by air is used. In this case the power plant does not use even one drop of river water.

Opening statement by Brenda Brochu

Nuclear power plants have a colossal need for water—more even than coal-fired plants. That's because the process of nuclear fission generates a huge amount of heat. Unless there is a constant inflow of cooling water, a catastrophic nuclear meltdown can occur.

The amount of water that is actually consumed (i.e. not returned to the water body from which it comes) depends on the method of cooling. In the once-through method, almost all the water is returned, though hotter than when it went in.

The method being proposed for the Peace River area, however, would involve the use of cooling towers. More than half the water taken from the river would go up into the air in the form of steam. For a 4,000 megawatts station, this would result in 319,680 cubic meters a day being lost in the form of steam.

This is being proposed at a time when the glaciers which feed our rivers are disappearing. According to ecologist David Schindler, the flow of Alberta's northern rivers has already declined by 40 per cent. This decline is expected to continue due to global warming.

The constant emission of steam into the air around Weberville would create a humid microclimate, making it hard for crops like grains to ripen. It would also cause problems of fog and icing on roads and runways.

That steam would contain radioactive substances. Hydro-Quebec lists 49 types of radioactive atoms that are released into the air from the Gentilly-2 reactor in Quebec. Forty-two types of radioactive atoms are routinely released into the surrounding water.

It makes no sense to develop nuclear power in a water-poor province like Alberta. There are many sustainable alternatives which use much less water and create no risk of radioactive contamination.

First rebuttal by Cosmos Voutsinos

Compare a coal and a nuclear plant. Each one produces 3000 MWth heat in the form of steam. The nuclear plant produces 1000 MWe of electricity. The coal plant produces up to 1200MWe because it operates at higher temperature. The statement that nuclear generates "relatively huge amount of heat" is incorrect. The fuel has much smaller volume but the amount of heat is the same.

This means nuclear will discharge 2000 MWth of heat and the coal will discharge 1800 MWth of heat. This 10% difference can hardly be "colossal" unless someone wants to exaggerate. Hypothetically a reactor could have a contained meltdown. In practice if the cooling water is stopped the reactor is shut down by many systems passive and active. Stating that a catastrophic meltdown will occur if we stop the water is pure fear mongering.

Cooling towers are cooled by a combination of evaporation and air flow. The Environmental Assessment will define ratios that the site can handle. It could decide to have a once through flow, or to cool only with air. Hence the numbers quoted are irrelevant and meaningless.

The steam does not contain any excess radioactivity, as there is no excess radioactivity in the turbine/condenser, the cooling water, or the steam. The alleged excess radioactivity in the cooling water is a misunderstanding. The normal amount of radioactivity in the cooling water is no more than our food, our water or the houses in PR. This is called Background Radiation.

First rebuttal by Brenda Brochu

The facts about nuclear power can be uncomfortable for those who have made a good living working for the nuclear industry, but they are facts nonetheless. It seems to me that a method of producing power which requires the used fuel to stay in ponds for seven to 10 years with a constant flow of cooling water produces a lot of heat.

Mr. Voutsinos may regard it as "meaningless" that Bruce Power's proposed nuclear plant for the Peace River area would take in 189,216,000 cubic meters a year of water from the Peace River. But that come straight from the company's own literature and is more than the City of Edmonton treats in a year. I think the word "colossal" is a pretty accurate one when it comes to describing that amount of water.

To suggest that nuclear power creates no radioactive emissions flies in the face of well-established facts. The Pembina Institute has produced tables which show the specific amounts of tritium oxide, iodine-131, carbon-14, noble gases and radioactive particulates given off at each of the nuclear generating stations in Canada.

There can also be leaks, contrary to what Mr. Voutsinos suggests. In July 1997, it was revealed that Ontario Hydro had failed to report tritium contamination of groundwater near the Pickering nuclear station in Ontario for 20 years. In 1997, 2,150,000 becquerels per litre were found in the groundwater, compared to the Canadian standard of no more than 7,000.

Is this what we want for our region?

Second rebuttal by Cosmos Voutsinos

As a retired engineer, I am very comfortable dealing with facts. One of the intents of this debate is to make PR citizens skeptical of where they get their facts, and to show that facts can be manipulated. So lets talk about "facts".

1)To release radioactive materials into the water from a nuclear plant, three massive failures have to occur all at the same time in: (a) the cladding of the fuel (b) the Primary Heat Transport system and (c) the Turbine steam condenser. All these 3 fully enclosed cooling loops have monitors that will stop the reactor if contaminants are detected. So all the radioactivity releases mentioned in reports refer to other type of releases within background

radiation levels, a fact that antinuclear activists conveniently ignore. These releases don't belong to the topic we discuss. Nevertheless all the accidental radioactivity quoted was contained on site.

2) When quoting Pembina Institute be aware that their nuclear study was discredited in its totality by the [Canadian Energy Research Institute](#).

3) The Environmental Assessment will examine local conditions in detail. If "once through cooling" is chosen, the same volume of water will be returned to the river, a little warmer. If they decide on "cooling tower", the water evaporation will only be a very small percentage of the lowest (summer) river flow. Relative to other types of power plants, the difference is not colossal.

4) The statement that "fission products (substances) are given off routinely to the environment" is absolutely wrong.

Second rebuttal by Brenda Brochu

We residents of the Peace River area are blessed with a beautiful river basin and clean drinking water. It is our sacred duty to preserve these for future generations.

The 4,000 megawatt nuclear plant being proposed for this area would remove a large amount of water from our river system. The cooling towers would also ice up in our cold climate. If the ice prevented the heat from escaping, the result would be catastrophic.

A once-through cooling system would also pose problems. Although more water would be returned to the river, it would be sufficiently hotter than the intake water to threaten aquatic life.

Mr. Voutsinos is mistaken when he says that three separate systems have to fail before radioactive substances can enter the water from a nuclear plant. For information about routine releases of radioactive substances into water, check the websites of the Canadian Nuclear Safety Commission and Hydro-Quebec.

The critique of the Pembina Institute's report on nuclear power which Mr. Voutsinos mentions was commissioned by the Canadian Nuclear Association (CNA), which represents the nuclear industry. The CNA seeks to promote nuclear power.

It is not true that nuclear power is expanding internationally. A study by the Centre for International Governance Innovation reports that nuclear power fell from 16.7 per cent of world electricity production in 2000 to 13.5 per cent in 2008. This trend is expected to continue.

Here in Canada, Ontario has scrapped plans to build two new reactors because the price came in at \$26 billion.