

# Mischief in the Making

a written submission to

The Canadian Nuclear Safety Commission

By

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Re

The Darlington New Nuclear Project (DNNP)

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## Foreward: What is the PPE?

The Plant Parameter Envelope (PPE) is a document first used in Canada in 2009-2011, when the original Darlington New Nuclear Project (DNNP) underwent an Environmental Assessment (EA).

At that time, the DNNP referred to a proposal by OPG to build up to four new large nuclear power reactors on the existing site of the Darlington NGS, based on four competing designs.

The PPE format was created by the US Nuclear Regulatory Commission to assist in the comparison of several competing nuclear reactor designs in the granting of a site preparation licence for a new reactor, even before a final choice of design has been made by the proponent.

The PPE document is essentially a numerical check list containing quantitative data on many technical aspects of the competing designs. The relevant numbers are provided by the vendors and are displayed in adjacent columns, one column reserved for each candidate reactor.

The 2009-2011 DNNP Environmental Assessment was conducted by a three-person Joint Review Panel (JRP) on the basis of 4 competing designs. A PPE was drawn up to aid them in their work.

The 2011 JRP Report gave a green light to proceed with site preparation for any one of these four candidate reactors, and accordingly OPG obtained a site preparation licence at that time.

However, the 2011 report stipulated that if OPG were to choose a reactor design that is fundamentally different from those considered by the JRP, a new EA will be required.

Ten years later, in December 2021, OPG decided to proceed with a plan to construct up to four new reactors on the Darlington site, using the GE-Hitachi BWRX-300 design.

The BWRX-300 is an innovative design – a simplified Boiling Water Reactor (BWR) housed in a subterranean reactor building and designed to fit within the category of “Small Modular Nuclear Reactors” (SMNRs), with new passive cooling systems.

JRP did not consider any reactor of the boiling water variety, let alone the innovative BWRX-300, which is fundamentally different from those previously examined by the JRP.

But OPG has already used the old “site preparation licence” granted in 2011, arguing that this action is justified by adding an extra column to the “Plant Parameter Envelope” (PPE) document.

That claim is disputed in the present intervention, and in [www.ccnr.org/DNNP Part 1 2023.pdf](http://www.ccnr.org/DNNP_Part_1_2023.pdf).

## Preamble: The Plot Outline

Fifteen years ago, in 2008, Ontario Power Generation (OPG) [wanted to build](#) 3 or 4 large new nuclear reactors on the same site as the existing Darlington Nuclear Generating Station.

In December 2009, a three-person Joint Review Panel (JRP) was appointed by the federal government to conduct an Environmental Assessment (EA) of the proposed “new build” project.

OPG asked the JRP to consider four competing candidates for the type of nuclear reactor to be built at Darlington, based on two documents – a 2009 Environmental Impact Statement (EIS) and an accompanying Plant Parameter Envelope (PPE), filled with data about the four reactors.

In 2011 the JRP published its final [Environmental Assessment Report](#) giving a green light to the project but warning that if the reactor type selected by OPG is “fundamentally different” from those studied during the assessment, a new environmental assessment will be required.

OPG obtained a Site Preparation Licence from the Canadian Nuclear Safety Association (CNSC) to lay the groundwork for the new reactors to be built. However, late in 2011, the Government of Ontario cancelled the entire project because of the enormous expense involved.

OPG kept the Site Preparation Licence for future use, making sure that it remained valid right up until 2022, whereupon OPG started preparing a site for an entirely new construction project involving a Small Modular Nuclear Reactor design called the GE-Hitachi BWRX-300 reactor.

A fly in the ointment was the JRP’s earlier warning that any reactor “fundamentally different” from those previously studied would automatically require a new environmental assessment.

OPG worked closely with CNSC staff to pressure CNSC Commissioners to declare publicly that the BWRX-300 design is sufficiently similar to the other reactor designs considered by the JRP to forego any need for a new environmental assessment, relying on the mechanism of the PPE.

In January 2024 there will be a public hearing in Ottawa in which the Commissioners will listen to arguments from OPG and CNSC staff, and will also hear from numerous intervenors, before deciding on a course of action. The deadline for written submissions is November 20, 2023.

The following submission is from Gordon Edwards, Ph.D., a nuclear safety consultant with more than 40 years experience in the nuclear field as an independent critic of the nuclear industry.

Gordon is a mathematician and a physicist, a retired professor from Vanier College in Montreal, and president and co-founder of the Canadian Coalition for Nuclear Responsibility (CCNR).

His Curriculum Vitae is at [www.ccnr.org/GE\\_CV.pdf](http://www.ccnr.org/GE_CV.pdf) . The CCNR web site is [www.ccnr.org](http://www.ccnr.org) .

The acronym DNNP stands for the “Darlington New Nuclear Project” of OPG’s.

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## Recommendation and Rationale

(1) In document CMD 24H-2, prepared by CNSC staff in September 2023, we read:

“The following actions are requested of the Commission:

- Determine, pursuant to the Government of Canada’s response to Joint Review Panel Recommendation 1, whether the DNNP Environmental Assessment is applicable to the BWRX-300 Reactor.” [DNNP = *Darlington New Nuclear Project*]

(2) The JRP Environmental Assessment Report in 2011 had stated (Recommendation 1) that “if the selected reactor technology is fundamentally different from the specific reactor technologies bounded by the plant parameter envelope [PPE], the Panel recommends that a new environmental assessment be conducted”. The Government of Canada supported this recommendation, provided that the CNSC Commissioners confirm that the selected reactor technology is fundamentally different from those bounded by the PPE.

**(3) *Recommendation*: Based on an examination of all relevant documentation the author recommends that the Commissioners declare that the 2011 Environmental Assessment Report is not applicable to the BWRX-300 reactor. Accordingly, as per Recommendation 1 and the Government of Canada’s response, a new environmental assessment for the BWRX-300 is required.**

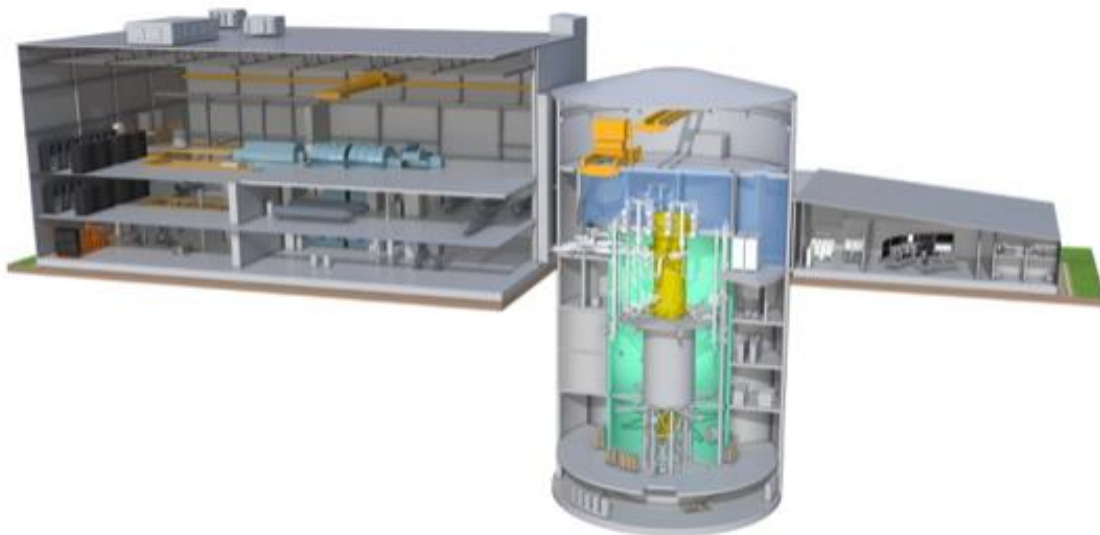
### Rationale:

- In CMD 24H-2 CNSC staff falsely suggests that PPE considered six reactor types, including two Boiling Water Reactors (the ABWR and the ESBWR, a precursor of the BWRX-300) which is simply untrue. Commissioners should not be fooled by incorrect information.
- The August 2011 DNNP Environmental Assessment Report was largely based on two documents provided by OPG, the 2009 Environmental Impact Statement (EIS) and the accompanying Plant Parameter Envelope (PPE) document. Although these two documents have been updated several times since 2011 by OPG to include data on other reactor designs, including the BWRX-300, none of these later updates were ever made available for JRP consideration and have no bearing on the JRP’s final EA Report in 2011.
- The JRP was limited to studying only four Pressurized Water Reactor designs (PWRs). Those PWRs were the only options with data listed in the PPE that was available to the three-member panel. When the PPE was modified by OPG on November 30, 2010, and the modified PPE was given to the JRP, it was only to include yet another PWR, the EC6 [Enhanced CANDU-6]. [See JRP’s EA Report p.11-12]
- OPG provided no data to the Joint Review Panel (JRP) in its PPE document that was appropriate to any Boiling Water Reactors (BWRs) despite being asked to do so by the panel in late 2010. At that time OPG told JRP that that BWR information was not available and so could not be added to the PPE. [EA Report p.11-12 ]

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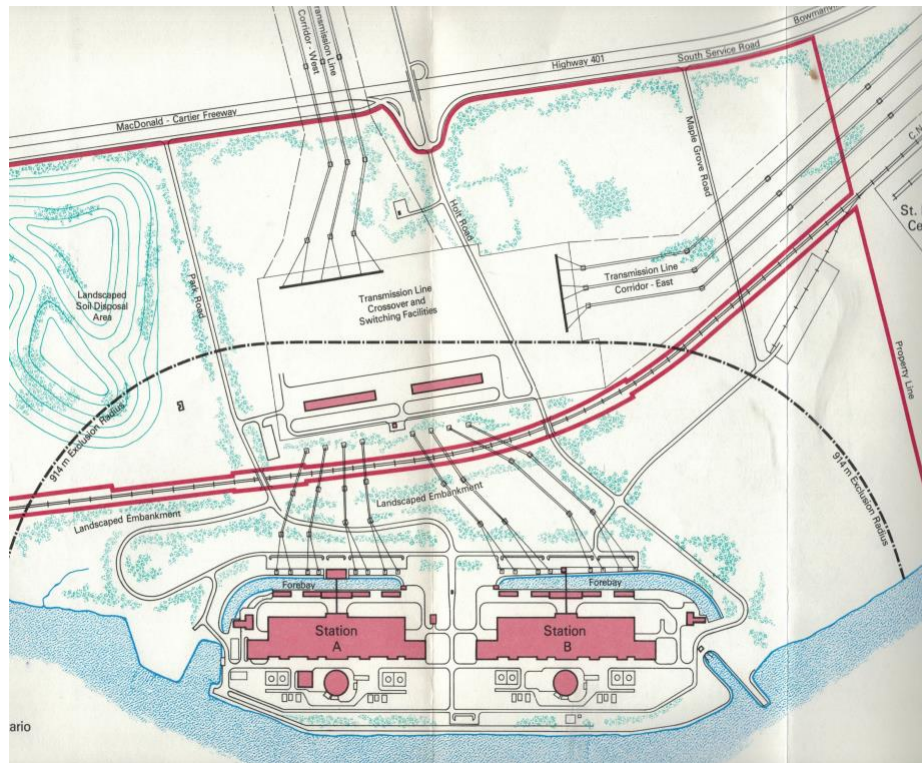
- The Boiling Water Reactor (BWR) GE-Hitachi BWRX-300 is fundamentally different from those reactors considered by the JRP, all of which were Pressurized Water Reactors (PWRs). In the universe of water-cooled reactors, nothing could be more fundamentally different than a PWR – which uses both primary and secondary cooling loops, with steam generators to send steam to the turbines – and a BWR, where steam from the core goes directly to the turbines. How could you have water-cooled reactors more different?
- Thirty percent of all the data categories utilized in the PPE and submitted to the JRP are completely inapplicable to the BWRX-300 design (60 out of 198 – see pp. 9-10 of CMD 24H-2.). All of those 60 categories are related to normal, backup and ultimate heat sinks. Since overheating of the reactor core is a leading safety concern in all nuclear reactors, any fundamental differences in heat sinks would imply that there is a fundamental difference in their reactor designs.
- There has been no effort to replace these inapplicable categories with more appropriate categories specific to the BWRX-300 design. This reinforces the view that the BWRX-300 is fundamentally different from each and every one of the four PWRs considered by the JRP.
- Of the seventy percent of all data categories utilized in the PPE and submitted to the JRP that are applicable to the BWRX-300 (138 out of 198 – see pp. 9-10 of CMD H24-2), eight parameter entries for BWRX-300 fall outside of the bounding values approved by the JRP. This is yet another indication that the BWRX-300 design is fundamentally different from the PWRs studied by the JRP. One can hardly say, in the absence of evidence, that the panel would have approved of these aberrant parameter values.
- The BWRX-300 reactor design is unlike any other reactor considered by the JRP in that the entire reactor core together with all of its reactivity control mechanisms are below ground level, in a cylindrical space whose outer walls are submerged in water. [see diagram]



<https://nuclear.gpower.com/build-a-plant/products/nuclear-power-plants-overview/bwrx-300>

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- This cylindrical configuration, which extends 38 metres below ground, containing almost the entire radioactive inventory of the BWRX-300 design, is equivalent to a 10 to 12 storey building where the different floors go deeper and deeper down. Subterranean features related to groundwater, seismicity, and soil characteristics such as potential for liquefaction, as well as the potential impacts from explosive blasts, all require a very different and more nuanced analysis for such a reactor than would be required for an above-ground reactor. The configuration is fundamentally different.
- The JRP's final EA Report was based on the assumption that the new large PWR reactors ("Darlington B") planned for the Darlington site would go right beside the existing four PHWR reactors ("Darlington A") as shown in the diagram below. The "exclusion zone" is 1000 yards in radius; it goes almost to the eastern limit of the Darlington property, beyond which is the St. Mary's cement plant. Notice the CN rail line traversing the property.



- Since 2011, space previously reserved for new reactors has been taken up by the dry storage containers holding irradiated nuclear fuel bundles from the existing CANDU reactors. Thus the new BWRX-300 reactor(s) would of necessity have to be located somewhat closer to the 401 highway and much closer to the rail line, which raises additional complications not covered in the 2011 Environmental Assessment Report. Thus the BWRX-300 is not only a fundamentally different reactor design, but it is destined to occupy a fundamentally different space on the Darlington site. Large scale traffic accidents and train wrecks will have to be reconsidered in any new environmental assessment.

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- In law the Commissioners are the sole decision-makers in regulatory matters relating to licensed nuclear facilities (except when that authority is delegated on a case-by-case basis to an officer or officers of the CNSC). It is not the prerogative of either a licensee like OPG or the CNSC staff to act on such matters without the authority of the Commissioners.
- It is a misrepresentation of fact and therefore, in the opinion of the author, dishonest to say that the GE-Hitachi BWRX-300 reactor design is covered by the 2011 DNNP Environmental Assessment Report. For CNSC Commissioners to issue a statement to the contrary, affirming that the BWRX-300 reactor has in effect passed the rigours of a legally mandated Environmental Assessment, serves only to bring dishonour on the Commissioners and on the agency itself. This author advises Commissioners to say what you will, use what powers you have, but do not invoke the JRP in support of whatever conclusion you arrive at.

## **Additional Considerations**

### **A. Misuse of the Site Preparation Licence**

The current Darlington New Nuclear Project (DNNP) is a proposal by Ontario Power Generation (OPG) to build and operate up to four Boiling Water Reactors of the first-of-a-kind (FOAK) GE-Hitachi BWRX-300 design on the same site as the existing Darlington Nuclear Generating Station.

The BWRX-300 is described as a “Small Modular Reactor” design, although it is arguably neither small nor modular as currently presented. In addition to extending 38 metres below ground, it also towers 35 metres above ground.

Site preparation work is already underway, using a Site Preparation Licence that was issued more than 12 years ago to OPG by the Canadian Nuclear Safety Commission (CNSC) in connection with a completely different scenario. At that time the BWRX-300 design did not exist. OPG was then planning to build 3 or 4 large power reactors on the Darlington site for a total of up to 4800 MWe. The DNNP Site Preparation Licence was issued in that context.

It was not the same project, conceptually, as the current DNNP.

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The Site Preparation Licence was granted in conjunction with an Environmental Assessment (EA) conducted by a three-person Joint Review Panel (JRP) from 2009 to 2011, based on four competing large reactor designs having very little in common with the BWRX-300. That EA was mandated by the [1992 Canadian Environmental Assessment Act \(CEAA\)](#) which stipulated that:

5.2 (a) “an environmental assessment of a project is required before the Governor in Council . . . issues a permit or licence, grants an approval or takes any other action for the purpose of enabling the project to be carried out in whole or in part.”

The law makes it clear that an environmental assessment is not optional but mandatory.

OPG’s original DNNP plan never saw the light of day, as the Ontario government found it far too expensive. Nevertheless, OPG took steps to ensure the validity of the Site Preparation Licence was extended until 2022 when the current site preparation work began. By then OPG had selected the GE-Hitachi BWRX-300 in lieu of the larger reactors it had previously envisaged.

Unfortunately, this use of the 12-year-old Site Preparation Licence conflicted with Recommendation 1 of the 2011 EA Report, as well as the 1992 CEAA, unless OPG could somehow argue that the BWRX-300 design was in some generic manner covered by the 2009-2011 Environmental Assessment. Because both the EA and the Site Preparation Licence fell under the 1992 Environmental Assessment Act, it became necessary to try to persuade the Commission to state, contrary to fact, that BWRX-300 is covered by the JRP’s final EA Report.

The author sees no merit in the Commission playing along with OPG’s effort to rewrite history.

### **B. Misuse of the PPE**

The Plant Parameter Envelope approach was used by OPG for the first time during the original 2009-2011 DNNP EA. The technique was borrowed from the US Nuclear Regulatory Commission as a tool to assist in granting an Early Site Permit (ESP) when a particular reactor design has not yet been selected.



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[The idea](#), according to Jack Vecchiarelli, OPG's section manager for Safety Analysis of the DNNP, is to provide "a bounding envelope of plant design and site parameter values for use in the *Licence To Prepare Site* (LTPS) application and Environmental Assessment (EA). The data are derived from available vendor information for multiple reactor designs." (December 9 2009)

However, this approach is only to be used when a specific design has not yet been selected. In such a case, multiple candidates can be compared via the PPE. In fact, for the original DNNP back in 2009, OPG used the PPE to compare various PWRs under consideration at the time.

Once a reactor design has been chosen, however, the PPE becomes relatively pointless. As stated in a [2019 US NRC](#) document, "the PPE serves as a surrogate for reactor design information that is not available or for a reactor design that is not final." From the moment when OPG decided to go with the BWRX-300 model, all further licensing work should be based on the precise characteristics of the chosen design. To date, OPG has not done this with the BWRX-300.

## **C. Co-Location of Many Reactors on a Single Site**

Back in 2011, the JRP held a series of public hearings from March 21, 2011 until April 8, 2011 in the Municipality of Clarington, Ontario. These hearings were held just weeks after the nearly simultaneous meltdowns of three Boiling Water Reactors at the Fukushima Daiichi Nuclear Power Plant in Japan following the events of March 11, 2011.

Two of the three reactors that melted down (units 1 and 2) were built by General Electric. Unit 1 was a 439 MWe "Mark I" reactor, a bit more powerful (by 46%) than the proposed BWRX-300.

Neither the JRP nor the public had sufficient time or opportunity to absorb the full impact of the Fukushima disaster in terms of what lessons it might have for the site preparation and subsequent construction of new reactors at the Darlington site.

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It is a sobering thought that the population density within 20 kilometres of the Darlington site is greater than that surrounding the Fukushima Daiichi reactors. Within 20 kilometres of those Japanese reactors, 160,000 people were evacuated from the stricken area. In the vicinity of Darlington, the population of Oshawa alone (19 kilometres away) is in excess of 170,000.

One of the conclusions drawn from the Fukushima disaster is that we must prepare for the worst, no matter how small the probability may seem. The practice of co-locating large nuclear reactors on a single site raises concerns about possible interactions that might result in far larger radioactive releases and much greater property damage than previously thought possible.

If the BWRX-300 DNNP project is to be subjected to an environmental assessment this aspect of co-location should be a significant component of the assessment.

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