REGULATORY ADMISSIONS OF SCIENTIFIC INSUFFICIENCY: WHY THE CNSC FRAMEWORK CANNOT SUPPORT A DEFINITIVE SAFETY DETERMINATION FOR NEW NUCLEAR PROJECTS

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1.. Background

Nuclear project licensing in Canada requires the Canadian Nuclear Safety Commission (CNSC) to determine that a proposed facility will not pose an unreasonable risk to the health and safety of persons and the environment. This determination relies on dose models, epidemiological studies, and health effect estimates that the CNSC presents to the public, to interveners, and to the Impact Assessment Agency of Canada as conclusions supported by the weight of scientific evidence.

This paper does not argue that nuclear power is unsafe. It argues something more precise: that the CNSC's own published documents contain explicit admissions that the scientific foundations of its safety determinations are inadequate for the purpose for which they are used. These admissions appear not in submissions by critics but in CNSC technical reports, regulatory publications, and health studies. Taken together, they constitute an institutional acknowledgment that the evidentiary basis for definitive safety determinations does not yet exist — an acknowledgment absent from the licensing conclusions those same documents support.

Seven categories of CNSC-sourced admission are catalogued below. Their logical incompatibility with the safety determinations they underpin is then examined, and four framework corrections proposed.

2.. Seven categories of CNSC-sourced admission of scientific insufficiency

2.1 Radiation weighting factor for tritium

CNSC technical report INFO-0799 (*Health Effects of Tritium*, 2010) states that a radiation weighting factor (wR) of 2.2 “would best reflect radiation risk for tritium” for fetal tissue endpoints [1]. The CNSC applies wR = 1.0 in all regulatory dose calculations. No technical rebuttal of this finding has been published. Every dose assessment used to support a safety determination involving CANDU tritium releases therefore systematically underestimates biological risk at the fetal tissue level by a factor the CNSC itself has quantified.

2.2 Biokinetic models not validated for fetal tissue

INFO-0799 acknowledges that the biokinetic models used to derive tritium dose estimates “have not been validated for fetal tissue” and that model parameters carry “substantial uncertainty” for this subpopulation [1]. The fetal subpopulation is the most radiobiologically sensitive group in the perimeter of a CANDU facility. A safety determination made using unvalidated models for the most at-risk subgroup has not established that the facility is safe for that subgroup. It has established that the models have not detected a risk. These are not the same statement.

2.3 ODWAC recommendation: seventeen years without resolution

In 2009 the Ontario Drinking Water Advisory Committee (ODWAC) recommended reducing Canada's tritium drinking water guideline 350-fold — from 7,000 Bq/L to 20 Bq/L — on grounds that the existing standard was insufficiently protective for the developing fetus [2]. INFO-0799 acknowledges the recommendation. The CNSC has neither implemented it nor published a technical rebuttal. The 7,000 Bq/L guideline remains in force. A safety determination relying on a guideline its own advisory process recommended reducing 350-fold, without resolution of that recommendation, does not rest on settled science.

2.4 KiKK: CNSC contradicts itself in a single document

The CNSC KiKK fact sheet states in its body: "The reason for the increased childhood leukemia rate around German NPPs is *unclear*." The same document requires that "more extensive, interdisciplinary research *is required*." [3] Its Conclusion then states: "Any claims of a link between childhood leukemia and radiation from nuclear power plants are *unfounded*." [3] "Unclear" and "research is required" describe an unresolved question. "Unfounded" asserts the question is closed. These are logically incompatible positions. Germany's own Radiological Protection Commission (SSK), which reviewed its own national study, concluded only that the causes "remain unclear" — declining to use the stronger dismissal the CNSC applied to the German data [4]. The fact sheet was last modified October 24, 2025; the contradiction stands.

2.5 RADICON: 8% statistical power

The CNSC's RADICON study is the Commission's principal epidemiological investigation of cancer incidence near Ontario's nuclear power plants. The study's own power calculations establish that it achieved approximately 8% statistical power to detect a doubling of childhood leukemia risk in the study population [5].

A study with 8% power cannot confirm anything.

This is arithmetic, not advocacy — and it is sourced from the CNSC's own study.

A study with 8% statistical power has a 92% probability of returning a null result *regardless of whether a true effect exists*. RADICON's null finding for childhood leukemia is therefore arithmetically consistent with a true doubling of risk in the study population. The CNSC has characterised RADICON as confirming the safety of Ontario nuclear power plants. It has done so using a study that, by its own design parameters, would fail to detect a doubled cancer risk nine times out of ten.

2.6 RADICON radioiodine: a false statement acknowledged and uncorrected

Section 5.2 of RADICON states: "Radioactive iodine — the primary cause of radiation-related thyroid cancer — was below detection limits at all three NPPs for the entire study period." [5] Two other CNSC publications — INFO-0210/REV.10 and INFO-0210/REV.13 — report maximum annual radioiodine releases during the identical study period: Pickering A released 0.32 GBq in 1990, thirty-two times the calculated detection threshold of ≈0.01 GBq/year [6, 7]. The CNSC's own emission data directly contradicts CNSC's own epidemiological study covering the same stations and the same years.

CNSC Executive Vice-President Ramzi Jammal personally acknowledged the error in 2017 and gave assurance it would be corrected. As of early 2026, the false statement remains published and uncorrected — nine years later.

An epidemiological study that falsely excludes the primary cause of radiation-related thyroid cancer from its assessment cannot support the conclusion that NPP emissions are not associated with thyroid cancer.

2.7 Unresolved knowledge gaps in CNSC's own technical literature

INFO-0799 identifies seven unresolved gaps directly relevant to health risk assessment from CANDU tritium: the causal mechanism linking NPP proximity to childhood leukemia is unidentified; dose-risk relationships are unvalidated for fetal tissue; biokinetic models are unvalidated for the most sensitive subpopulation; population mixing effects are unassessed; post-shutdown natural experiment outcomes are unresolved; no validated biomarker for tritium exposure exists; and no pre-construction epidemiological baseline exists for children under five near proposed new sites [1]. These gaps were identified by the CNSC in 2010. None has been closed in sixteen years.

3.. The logical incompatibility between admission and determination

A safety determination is a conclusion that requires premises. The premises underlying CNSC safety determinations include: that dose models accurately characterise risk to the most sensitive subpopulation; that cited epidemiological studies have sufficient power to detect the effects of concern; that health-based guidelines reflect current science; and that the research base adequately characterises the relationship between routine releases and health outcomes.

Each premise is contradicted by the CNSC's own technical literature. The dose models use a weighting factor the CNSC's own scientists have identified as too low by a factor of 2.2. The biokinetic models are explicitly unvalidated for the most sensitive subpopulation. The principal epidemiological study had 8% power — structurally incapable of confirming the absence of the effect it was designed to detect. The flagship study excluded the primary thyroid carcinogen on a factual basis the CNSC's own executive leadership acknowledged was false. The drinking water guideline has an unimplemented and unrefuted recommendation for 350-fold reduction. Seven knowledge gaps identified in 2010 remain open in 2026.

A determination made on this evidentiary foundation is not a scientific safety conclusion. It is a regulatory judgment that existing evidence, despite acknowledged limitations, is sufficient to proceed. That judgment may be defensible on policy grounds. Presenting it to assessment panels and the public as a scientific determination supported by the weight of evidence — while the CNSC's own technical literature describes the foundations as uncertain, unvalidated, underpowered, and in one case factually incorrect — is not defensible.

4.. Proposed framework corrections

First: all safety determinations involving CANDU tritium releases should disclose both wR = 1.0 and wR = 2.2 calculations with a documented technical rationale for the factor applied. This is a transparency requirement, not a standard change.

Second: power calculations should accompany all epidemiological studies cited in support of safety determinations. Studies achieving less than 50% power to detect the effect of concern should not be characterised as confirming the absence of that effect.

Third: the ODWAC 2009 recommendation and the seven knowledge gaps from INFO-0799 should be resolved — by implementation or documented technical rebuttal — before being relied upon in new project licensing proceedings.

Fourth: the RADICON radioiodine section should be corrected to reflect INFO-0210/REV.10 and INFO-0210/REV.13 before RADICON is cited in any licensing proceeding as evidence that NPP emissions do not pose a thyroid cancer risk.

5.. Conclusion

The CNSC's own published technical literature contains explicit admissions that its dose models, epidemiological studies, and health research programmes are insufficient for the purposes for which they are used. As Canada advances new large-scale nuclear deployment — including the MONARK next-generation CANDU and proposed CANDU-derived facilities in regions with no existing nuclear epidemiological baseline — this insufficiency becomes acute. The four corrections proposed above would not impede deployment. They would produce safety determinations whose stated certainty matches the evidence on which they rest. That alignment is the minimum required for informed public consent and for the long-term credibility of Canadian nuclear regulation.

6.. References

[1] Canadian Nuclear Safety Commission, Health Effects of Tritium, INFO-0799, CNSC, Ottawa, 2010.

[2] Ontario Drinking Water Advisory Committee, Advice on Ontario's Drinking Water Quality Standard for Tritium, ODWAC, Toronto, 2009.

[3] Canadian Nuclear Safety Commission, "Fact Sheet: The KiKK Study Explained," cnsc-ccsn.gc.ca, last modified October 24, 2025.

[4] SSK (German Radiological Protection Commission), "Assessment of the KiKK Study," Commission on Radiological Protection, 2008.

[5] Canadian Nuclear Safety Commission, Radiation and Incidence of Cancer around Ontario Nuclear Power Plants from 1990 to 2008 (RADICON), CNSC, Ottawa, 2013.

[6] Canadian Nuclear Safety Commission, Radioactive Release Data from Canadian Nuclear Generating Stations 1990 to 1999, INFO-0210/REV.10, CNSC, Ottawa.

[7] Canadian Nuclear Safety Commission, Radioactive Release Data from Canadian Nuclear Generating Stations 1999 to 2008, INFO-0210/REV.13, CNSC, Ottawa.

[8] F.R. Greening, correspondence with CNSC Executive VP Ramzi Jammal (2017) and CNSC President Tremblay (2026), personal communication.