

## Abstract submission form

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### Abstract information

Presentation type [1]	Oral
Select one or more topic [2]	Updating handbooks, guidelines and recommendations to support decision making
Subject of the presentation	Development of CANDU-Specific Operational Intervention Levels
Participation NERIS Young Scientist Award [3]	Yes
Proceedings of the Workshop 2020 [4]	Maybe

#### [1] Copy paste:

Oral

Poster

Both (The program committee will choose oral or poster)

#### [2] Copy paste one or more subject(s):

Operational aspects: from theory to practice

Disaster management and resilience in communities

Preparedness for a sustainable recovery: including non-radiological consequences and effects

Updating handbooks, guidelines and recommendations to support decision making

Future research needs

Other

[3] To promote young researchers, the NERIS platform awards a free participation to the 7th NERIS Workshop (2021) and diploma to the winner of the prize. To participate you must be under 35 years old in May 2020. **Answer: yes / no.**

[4] You can publish a full paper in the proceedings of the Workshop 2020 to be published by the end of 2020. The full paper deadline is 31st July 2020. If you're not sure yet, tell us and we'll come back at you on this after the Workshop. **Answer: yes / no / maybe.**

⚠ Abstract submission must respect the following template and must not exceed 1 page. The completed abstract submission form has to be sent by email to the NERIS secretariat ([sec@eu-neris.net](mailto:sec@eu-neris.net)) by **January 31st, 2020**. Please name your file with an easily identifiable prefix:

## Development of CANDU-Specific Operational Intervention Levels

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### Abstract

Operational intervention levels (OILs) are simple, field-measurement criteria that allow for the prompt implementation of protective response actions, and indicate that pre-established actions (e.g., evacuation, relocation, food restrictions) should be taken. The IAEA has recently published a new set in IAEA ERP-NPP-OILs(2017) [1].

These IAEA OILs [1] were developed from a set of published source term calculations for postulated light water reactor (LWR) accidents and spent fuel pool accidents. In Canada, the 19 currently-operating nuclear reactors are all CANDU-type pressurized heavy water reactors, and the fuel burn-up and expected accident progression in CANDU-type reactors is quite different from LWRs. Both of these factors would affect the mix of radionuclides released during a postulated accident and OIL values depend quite strongly on these radionuclide ratios, as dose consequences vary quite a lot from one radioisotope to the next. There is no guarantee that LWR-based OIL values would be applicable to CANDU nuclear emergencies and, therefore, a new set of calculations is needed.

This study required the calculation of both CANDU-specific core inventories and an estimate of release fractions for postulated CANDU severe accidents. Calculations were performed for both the 700 MWe CANDU-6 reactors and the multi-unit 900 MWe CANDU stations, and the multi-unit station cases considered accidents both at a single unit at a time and simultaneously in all units. ORIGEN was employed for the inventory calculations, while MAAP-CANDU was employed for the severe accident modelling and detailed release fraction calculations. A number of different types of severe accident scenarios were considered to take into account possible differences in the release fractions, including those initiated by station blackout, loss of coolant, steam generator tube rupture, and stagnation feeder break. The effects of delaying the onset of the accident by different lengths of time (as happened during the Fukushima accident), or taking severe accident mitigation measures, were also considered. A total of 75 permutations of different reactor accidents were examined, and an additional 2 cases were included for accidents in CANDU irradiated fuel bays. The three estimates of the Chernobyl and Fukushima source terms (from IAEA ERP-NPP-OILs(2017) [1] have been kept in the study as well.

Using this new accident database, time dependent OIL(t,mix) values could be determined and compared to the recommended default OIL values in IAEA EPR-NPP-OILs(2017) [1]. For all of the OIL values considered, including those relating to evaluation and relocation (OIL<sub>1</sub> and OIL<sub>2</sub>), skin contamination (OIL<sub>4</sub>), and food restrictions (OIL<sub>3</sub> and OIL<sub>7</sub>), the CANDU OIL(t,mix) values are being calculated. The CANDU-specific OIL values that result from this study will help to inform national authorities on how to adapt OILs to the emergency response arrangements in Canada.

[1] IAEA, "Operational Intervention Levels for Reactor Emergencies and Methodology for Their Derivation", EPR-NPP-OILs, 2017.