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WITHDRAWN Defence in Depth and the Source Terms in Nuclear Reactor Safety

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'Source term' is an estimate of a particular type of radioactivity release following complete nuclear-reactor core meltdown. It is utilized to devise remedial actions to protect the public during such extreme emergency conditions. The source terms are classified by the time of release of radioactivity to the atmosphere due to reactor-containment failure after an accident. Specifically, S1 refers to release within hours, S2 corresponds to release within days, and S3 defines delayed (indirect) release. Minimization of the magnitude of these source terms are of paramount concern to reactor designers, operators, accident-scenario modellers and experimentalists, and emergency planners and responders.

The designer starts with the concept of defence-in-depth, which aims at establishing cascading barriers against the release of radioactivity. The operator ensures that the reactor functions within bounds that do not jeopardize the integrity of the defence barriers, and continually inspects and maintains the reactor functions, components and structures. Accident analysts, via modelling and experimentation, investigate potential accident scenarios, which can influence the operation and refurbishment of current reactors and the design of future units. Accident planners predict the behaviour and transport of radioactive material once released from a reactor following an accident, and devise corrective actions to protect the public. Emergency responders also take into account the source terms, when dealing with such extreme accident conditions.

This presentation will explore these aspects in the context of CANDU reactors; from conservative (bounding), probabilistic and best-knowledge perspectives. It will be shown that improvement of our knowledge and understanding of the physics behind the associated phenomena will ultimately lead to more realistic estimates of the source terms for operating reactors, and optimized designs for future systems with enhanced protection against release of radioactivity to the atmosphere.

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