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File # OCE-00000-002-000

March 15, 2011

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Dear Chad Oliver,

Re: Health Effects of Wildfire in the Irradiated Forests of the Chernobyl Exclusion Zone: Request for Review of Report

As per your request to review the report on the health effects of a highly likely catastrophic fire in the irradiated forests adjacent to the ill-fated Chernobyl Nuclear Reactor, Ukraine, I am pleased to provide you with the detailed comments listed in Attachment 1 to this letter.

My general findings are:

- **Source Model:** The methodology for estimating the amount of radionuclides expected to be in the soil in 2010 from the amount of radionuclides that were expected to be in the soil in 2000 is technically sound and appropriate for a worst-case estimate. I recommend that consideration be given to providing quantification of the conservatisms in the assumptions in the source model.
- **Transport Model:** The transport model uses a dispersion methodology that is consistent with the methodology described in Canadian Standards Association N288.2, and therefore, the methodology is technically sound. I recommend that consideration be given to providing a calculation using a more realistic representation of a broad swath which is characteristic of a forest fire to give the readers an understanding of the range of the estimate.

- **Exposure Model:** The dose coefficients and the inhalation rates are reasonable and consistent with the stated references.
- **Results:** My main concern is that the text does not acknowledge that at the low levels of dose exposure calculated using the worst-case assumptions in this report, there is a large uncertainty regarding the additional lifetime cancer risk. In particular, I note that UNSCEAR reports that for a limited number of people living in known high background radiation areas of the world, doses can exceed 20 mSv per year, and there is no evidence to indicate this poses a health risk.
- **Discussion:** On page 20, although the worldwide average background dose rate is 2.4 mSv/a, the typical average background dose rate for the Ukraine should be provided to put the significance of the impact of a forest fire in the area around Chernobyl in better perspective.

Also, as per your request, please find my CV in Attachment 2 to this letter.

If you require any clarification on my comments, please feel free to contact me.

Regards,

Albert Lee

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Attachment 1

Review of Report on Health Effects of Wildfire in the Irradiated Forests of the Chernobyl Exclusion Zone

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Based on my area of expertise, I am providing comments on the following models in the analysis:

- **Source Model**
- **Transport Model**
- **Exposure Model**

While my expertise is not in the **Cancer Incidence and Mortality Model,** I offer a recommendation for improvement in the discussion of the results. This recommendation is based on my comments on the models where I have provided comments.

Comments

Source Model:
The methodology for estimating the amount of radionuclides expected to be in the soil in 2010 from the amount of radionuclides that were expected to be in the soil in 2000 is technically sound and appropriate for a worst-case estimate. The assumptions for the concentration factors for the soil, vegetation, and litter appear to be appropriate for a worst-case estimate. The assumptions for 32% of the CEZ classified as deforested/agricultural areas and 38% of the CEZ classified as pine forest for the burn appear to be reasonable.

> ***Recommendation:*** *The assumptions in the source model have unquantified conservatisms. It would be beneficial to provide some statement about the magnitude of the conservatisms to give the readers a better understanding of the significance of the estimated health effects. If possible, the source model should include a statement of the estimated range for the stock of radionuclides, e.g., the degree of conservatism associated with the assumption that the ratio of soil to wood activity is a constant in Equation [2]. If this cannot be done in this report, it could be provided in a future report.*

Transport Model:
The transport model uses a dispersion methodology that is consistent with the methodology described in Canadian Standards Association N288.2. Therefore, I am confident that the methodology is

technically sound. The plume centreline concentration is based on the assumption of a point source, rather than a broad swath which would be characteristic of a forest fire with an average concentration. This assumption is conservative because it gives an unrealistically high ground-level concentration at the downwind locations. However, this assumption may not give a realistic indication of the width of the area that would be impacted by a forest fire.

> ***Recommendation:*** *If possible, a calculation using a more realistic representation of a broad swath which is characteristic of a forest fire should also be provided to give the readers an understanding of the range of the estimate. If this cannot be done in this report, it could be provided in a future report.*

Exposure Model:

The dose coefficients and the inhalation rates are reasonable and consistent with the stated references.

Results:

The discussion about the additional lifetime risk of dying from cancer should include a statement that these are worst-case estimates. Also, in the last paragraph of the Results section, it should be stated that the calculated cancer risk is based on the Linear No-Threshold model. At the low levels of dose exposure calculated using the worst-case assumptions in this report, there is a large uncertainty regarding the additional lifetime cancer risk. In particular, I note that UNSCEAR reports that for a limited number of people living in known high background radiation areas of the world, doses can exceed 20 mSv per year, and there is no evidence to indicate this poses a health risk.

Discussion:

On page 20, although the worldwide average background dose rate is 2.4 mSv/a, this report should also provide some information about the average background dose rate for the Ukraine to put the increased dose exposure from a forest fire into better context.

Attachment 2

CURRICULUM VITAE

Dr. Albert Garland Lee

Director, Nuclear Studies & Analysis

In his role as the Director of Nuclear Studies & Analysis, Albert fulfills the mandate and responsibilities of the Office of the Chief Engineer in the areas of safety analysis, physics, thermalhydraulics, fuel design, safety philosophy and requirements, dose assessments and safety and licensing issues.

Albert has served over 28 years with AECL in many fields from reactor physics, thermalhydaulics, design, safety, commissioning, operation and decommissioning to management.

His most recent roles in reverse order include: Director of Nuclear Studies & Analysis, Manager, Safety and Licensing for MDS Nordion Medical Isotopes Reactor Project, Section Head, Physics, for Research-Reactor Technology Branch, Section Head, Nuclear Engineering, for Reactor Technology, Manager of Technology Development for the Small Reactor technology, Physicist in the Reactor Physics Analysis Group, and Physicist in the Nuclear Technology Branch.

Albert holds a B.Sc in Physics, M.SC in Laser Physics and his Ph.D in Nuclear Physics.

Albert was the recipient of the AECL Award of Excellence for 1999.

March 2011