A simple assessment scheme for severe accident consequences using source term parameters

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Correlation between the Nuclear Accident Consequence Index (NACI) and the amount of released cesium-137 is investigated in order to use the amount of released cesium-137 for the assessment of severe accident consequences. The correlation follows power function, and the exponent of the function can be used to explain the correlation.

Keywords: severe accident, accident consequence, consequence assessment, source term

1. Introduction

Nuclear Accident Consequence Index (NACI) [1] is an index for consequence assessment which can cover various consequences of a severe accident in a nuclear power plant to people and the environment. This is in line with the Fundamental Safety Principles of the IAEA [2]. However, at reactor design approval stage, most information of the construction site and the reactor, as well as the resources for the assessment may be limitedly available. Correlation between the NACI and the amount of released cesium-137 is thus investigated, in order to enable a simpler assessment of severe accident consequences using the amount of released cesium-137.

2. Methodology

HotSpot Ver. 2.07.2 is used to evaluate the land contamination and radiation exposure dose resulted from the released cesium-137. Outputs from the code are used to calculate the NACI which consists of three main indices: radiation effect index, relocation index and decontamination index. The amount of released cesium-137 are then varied to investigate the correlation of the NACI and its components with the amount of released cesium-137.

3. Results and Discussion

The correlations of the NACI and its components with the amount of released cesium-137 are shown in Figure 1. All correlations follow a simple power function ($y = ax^b$). The exponent b seems to be the key of the correlations. When the amount of released cesium-137 is smaller than 100 TBq, there are no relocation and decontamination. The radiation effect index determines the exponent of the NACI (b = 0.8 – 1.0). On the other hand, the decontamination index of which the exponent is between 1.4 and 1.5 dominates the NACI, thus the exponent of the NACI in this range is around 1.3 to 1.4.
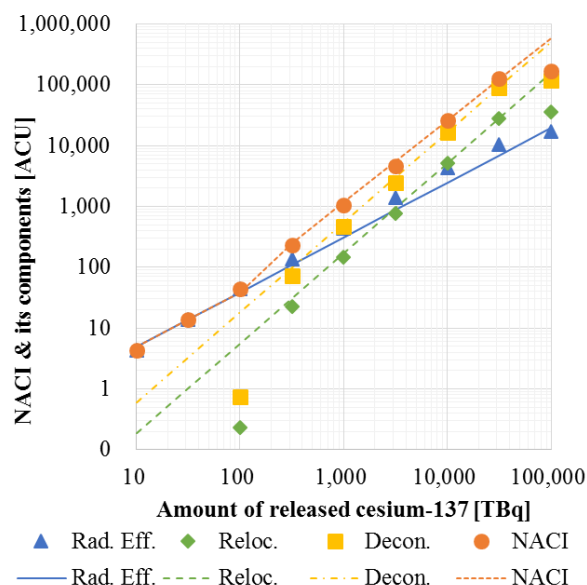

Figure 1. Correlation between NACI and amount of released cesium-137.

References

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