

**Friday 26<sup>th</sup> November 2010 - Freshwater and Terrestrial Assessment of a proposed new Nuclear Power Plant (NPP)**

In this practical you will undertake an assessment of, and consider the issues involved, in assessing the atmospheric and aquatic radioactive discharges from a nuclear power plant. In this scenario the NPP is located on the banks of a large lake which is used for the supply and discharge of cooling water. Radioactive discharges are released along with the heated water. The assumed discharge rates are given in Table 1.

The practical will give you experience in using the 'SRS-19' models. You will also need to decide how to address radionuclides not included in the ERICA Tool default list. The appendix presents some CR values you may find useful in your assessment.

Table 1: Discharge rates for the NPP to the atmosphere and surface waters

Radionuclide released to freshwater	Release rate (Bq s <sup>-1</sup> )
<sup>3</sup> H	1.2E5
<sup>35</sup> S	2.0E4
<sup>60</sup> Co	3.3E2
<sup>137</sup> Cs	3.1E4

Radionuclide released to atmosphere	Release rate (Bq s <sup>-1</sup> )
<sup>85</sup> Kr	1.3E7
<sup>41</sup> Ar	4.0E4
<sup>60</sup> Co	1.0E1
<sup>14</sup> C	8.6E3
<sup>134</sup> Cs	2.7E0
<sup>137</sup> Cs	4.2E0
<sup>3</sup> H	4.1E5
<sup>131</sup> I	1.4E2
<sup>133</sup> I	4.7E2
<sup>95</sup> Nb	2.9E0
<sup>89</sup> Sr	3.5E0
<sup>90</sup> Sr	1.4E0
<sup>95</sup> Zr	1.2E0

Use the default parameters (e.g. concentration ratio etc) present in the appropriate tool and compare all dose rates to the ERICA screening value of 10 μGy h<sup>-1</sup>.

*Part A: Freshwater dispersion modelling*

Using the radionuclide discharge rates to the freshwater environment, model the dispersion of the radionuclides released to estimate the activity concentrations in water at the receptor locations and calculate the dose rate to the most limiting reference organisms using Tier 1 of the ERICA Tool. Assume for this scenario that the receiving lake is large (> 400 km<sup>2</sup>).

Assume the following:

Water depth – 5m

Distance between the release point and shore (m) 100m

Lake current velocity = 0.1 m/s

Assess all of the following ‘distances between the release point and receptor’; the receptor points are in the lake (not on the shore):

- a) 100 m
- b) 5000 m

Results table – record predicted water activity concentrations and RQs for different source-receptor distances

Radionuclide	100 m		5000 m	
	Bq/l	RQ	Bq/l	RQ

Is the trend in the results between the two assessment points what you expected?

*Part B: Atmospheric dispersion modelling*

Determine which radionuclides may be included in a Tier 1 ERICA Tool dispersion modelling assessment. Identify which radionuclides cannot and determine how to include these in the assessment; note you will not be able to assess these within the ERICA Tool (you will assess these in Part D).

Using the SRS-19 air model determine the activity concentration in air or soil 500m away from the discharge point for each radionuclide identified above for the following two scenarios:

1. A ground level release
2. A 20m effective stack (release) height





*Part E – Atmospheric input to freshwater environment*

Do you need to consider inputs of radionuclides released via the atmospheric route to the freshwater lake in the assessment? The nearest part of the lake is 500 m from the aerial discharge stack.

How have you reached this decision?