

DOUNREAY ERICA ASSESSMENT – Summary Report

1.0 Scope

The purpose of this assessment was to assess the potential impact of gaseous and liquid radioactive discharges arising from Dounreay on Natura 2000 sites and Sites of Special Scientific Interest (SSSI). This was in support of an application for a revised authorisation for the disposal of radioactive waste. The authorised limits proposed by the applicant Dounreay Site Restoration Limited (DSRL) were used for the assessment.

2.0 Background

Natura 2000 sites are areas which are afforded special protection due to their ecological importance. These include Special Areas of Conservation (SAC), designated under the “Habitats Directive” (92/43/EEC), Special Protection Areas (SPA), designated under the “Birds Directive” (79/409/EEC) and Ramsar sites designated under the Ramsar Convention on Wetlands of International Importance.

In the UK, Natura 2000 sites are given legal protection through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and SSSI’s are protected under the Nature Conservation (Scotland) Act 2004. SEPA must consider any potential impact on these sites when determining all applications for authorisations, permissions, permits, consents and environmental licences.

In order to comply with these obligations, SEPA undertakes assessments of the potential impact of authorised radioactive discharges on these sites. The ERICA Assessment Tool (Beresford *et al*, 2007) is the method adopted by SEPA for conducting these assessments.

3.0 Method

The gaseous and liquid discharge limits were modelled using PC Cream (HPA, 2009) which provided estimations of the activity concentrations in air (Bq/m³) and water (Bq/L) as a result of the respective discharges. These data were then used as input into the ERICA Tool for assessing any impact on non-human species.

The only exception to this method is that the impact of the Kr-85 component of the gaseous discharge was assessed using the R&D 128 methodology (Copplestone *et al*, 2001) as the ERICA Tool is not yet able to assess the impact of this radionuclide.

Using the activity concentrations the ERICA Tool predicts the dose rates to a set of reference organisms and compares these to the screening dose rate of 10µGyh⁻¹. If the predicted dose rate is lower than the screening dose rate then the exposure may be considered to be of negligible radiological concern.

4.0 Results

4.1 Gaseous discharge assessment

This assessment considered the potential impact of the gaseous discharge on two of the nearest protected sites; Sandside Bay SSSI and Ushat Head SSSI. These sites are 1.2km and 5km from Dounreay respectively. The results of the assessment are presented in Tables 1 and 2.

Table 1: Gaseous discharge ERICA results

ERICA RESULTS (excl. Kr-85)		
REFERENCE ORGANISM	PREDICTED DOSE RATE ($\mu\text{Gy/hr}$)	
	1.2km	5km
Amphibian	1.81E-03	6.66E-04
Bird	1.81E-03	6.66E-04
Bird egg	1.81E-03	6.66E-04
Detritivorous invertebrate	1.81E-03	6.66E-04
Flying insects	1.69E-03	6.23E-04
Gastropod	1.81E-03	6.66E-04
Grasses & Herbs	1.81E-03	6.66E-04
Lichen & bryophytes	1.81E-03	6.66E-04
Mammal (Deer)	1.81E-03	6.66E-04
Mammal (Rat)	1.81E-03	6.66E-04
Reptile	1.81E-03	6.66E-04
Shrub	1.81E-03	6.66E-04
Soil Invertebrate (worm)	1.81E-03	6.66E-04
Tree	1.81E-03	6.66E-04

Table 2: Gaseous discharge R&D 128 results

R&D 128 RESULTS (Kr-85 only)		
REFERENCE ORGANISM	PREDICTED DOSE RATE ($\mu\text{Gy/hr}$)	
	1.2km	5km
Bacteria	1.6E-07	5.9E-08
Lichen	9.5E-05	3.5E-05
Tree	2.1E-04	7.8E-05
Shrub	2.1E-04	7.8E-05
Herb	2.1E-04	7.8E-05
Seed	3.5E-04	1.3E-04
Fungi	6.7E-04	2.5E-04
Caterpillar	1.3E-04	4.8E-05
Ant	1.2E-04	4.3E-05
Bee	7.3E-05	2.7E-05
Woodlouse	1.1E-04	4.1E-05
Earthworm	1.5E-08	5.6E-09
Herb. Mammal	4.1E-06	1.5E-06
Car. Mammal	4.5E-06	1.7E-06
Rodent	9.8E-06	3.6E-06
Bird	1.2E-05	4.5E-06
Bird egg	2.2E-05	8.2E-06
Reptile	7.1E-06	2.6E-06

In Table 1, with the exception of flying insects, the predicted dose rates for all reference organisms are the same. This is due to the H-3 concentration ratio and dose conversion coefficient being the same across all the reference organisms. This results in the predicted dose rate from H-3 being the same for all reference organisms and, since H-3 is the major contributor to dose in this assessment, results in the predicted dose rates being the same.

4.2 Liquid discharge assessment

This assessment considered the potential impact of the liquid discharge on the nearest protected site which in this case is the North Caithness Cliffs SPA. The results of the assessment are presented in Table 3.

Table 3: Liquid discharge ERICA results

ERICA RESULTS	
REFERENCE ORGANISM	PREDICTED DOSE RATE ($\mu\text{Gy/hr}$)
(Wading) bird	2.33E-03
Benthic fish	1.79E-02
Benthic mollusc	1.74E-02
Crustacean	1.51E-02
Macroalgae	2.04E-02
Mammal	1.96E-03
Pelagic fish	2.73E-03
Phytoplankton	7.93E-02
Polychaete worm	3.52E-02
Reptile	3.85E-03
Sea anemones or true corals - colony	1.88E-02
Sea anemones or true corals - polyp	2.08E-02
Vascular plant	1.91E-02
Zooplankton	5.48E-03

5.0 Conclusion

The dose rates to non-human species as a result of exposure to the gaseous and liquid discharges are all predicted (at 95% C.I.) to be less than the screening dose rate of $10\mu\text{Gy}h^{-1}$. Therefore exposure of non-human species to the discharges may be considered to be of negligible radiological concern.

6.0 References

Beresford, N., Brown, J., Copplestone, D., Garnier-Laplace, J., Howard, B.J., Larsson, C-M., Oughton, O., Pröhl, G., Zinger, I. (eds.) (2007) *D-ERICA: An integrated approach to the assessment and management of environmental risks from ionising radiation. Description of purpose, methodology and application*

HPA (2009) *The methodology for assessing the radiological consequences of routine releases of radionuclides to the environment used in PC-Cream 08*, HPA-RPD-058

Copplestone, S, Bielby, SR Jones, D Patton, P Daniel and I Gize (2001) *Impact assessment of ionising radiation on wildlife*, Environment Agency