1.0 Scope

The purpose of this assessment was to assess the impact on non-human species from discharges of gaseous and liquid radioactive waste from Hunterston A. This was in support of an application for a revised authorisation for the disposal of radioactive waste. The authorised limits proposed by the applicant (Magnox Limited) were used for the assessment. The current discharge limits for Hunterston B were also included in the assessment as the discharges from both sites have the same point of entry into the environment.

2.0 Method

There are currently no statutory limits on concentrations of radionuclides in, or radiation doses to, organisms other than human beings. The International Atomic Energy Agency[1] [2] has published guideline dose rates, below which it is considered unlikely that there would be any significant effect on populations of other organisms.

These are:

- Terrestrial animal populations at chronic dose rates below 40 μGy/h;
- Terrestrial plant populations at chronic dose rates below 400 μGy/h; and
- Populations of freshwater and coastal organisms at chronic dose rates below 400 μGy/h.

The gaseous and liquid discharge limits were modelled using PC Cream[3] which provided estimations of the activity concentrations in air (Bq/m^3) and water (Bq/L) as a result of the respective discharges. These data were then used as input into the CEC funded ERICA[4] assessment tool for assessing any impact on non-human species.

The only exception to this method is that the impact of the Ar-41 component of the gaseous discharge was assessed using the R&D 128 methodology 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 $10\mu Gyh^{-1}$. If the predicted dose rate is lower than the screening dose rate then the exposure may be considered to be of negligible radiological concern.

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[1] IAEA Technical Report Series No 288 (1988) Assessing the impact of deep sea disposal of low level radioactive waste on living resources.
[2] IAEA Technical Report Series No 322 (1992) Effects of ionising radiation on plants and animals at levels implied by current radiation protection standards.
[3] PC-Cream: A PC package to assess the consequence of radioactive discharges due to normal operations. Health Protection Agency 2008.
[4] Environmental Risk from Ionising Contaminants: Assessment and Management (ERICA). www.erica-tool.com

3.0 Results

3.1 Gaseous discharge assessment

This assessment considered the potential impact of the gaseous discharge on the nearest protected site which in this case is the Portencross Coast SSSI. The assessment was run for two different stack heights, 20m and 62m, in order to represent the range of stack heights on the sites. The results of the assessment are presented in Tables 1 & 2.

Table 1: Gaseous discharge ERICA results

ERICA RESULTS (excl. Ar-41)		
REFERENCE ORGANISM	**PREDICTED DOSE RATE (μGyh^{-1})**	
	20m	**62m**
Amphibian	1.44E-01	1.41E-02
Bird	1.49E-01	1.46E-02
Bird egg	1.00E-01	9.87E-03
Detritivorous invertebrate	5.60E-02	5.50E-03
Flying insects	5.51E-02	5.42E-03
Gastropod	5.60E-02	5.50E-03
Grasses & Herbs	1.02E-01	9.97E-03
Lichen & bryophytes	1.02E-01	9.97E-03
Mammal (Deer)	1.49E-01	1.46E-02
Mammal (Rat)	1.49E-01	1.46E-02
Reptile	1.49E-01	1.46E-02
Shrub	1.02E-01	9.97E-03
Soil Invertebrate (worm)	5.60E-02	5.50E-03
Tree	1.46E-01	1.43E-02

Table 2: Gaseous discharge R&D 128 results

R&D 128 RESULTS (Ar-41 only)		
REFERENCE ORGANISM	**PREDICTED DOSE RATE (μGyh^{-1})**	
	20m	**62m**
Bacteria	1.1E-05	1.1E-06
Lichen	3.8E-02	3.7E-03
Tree	4.1E-02	4.0E-03
Shrub	4.1E-02	4.0E-03
Herb	4.1E-02	4.0E-03
Seed	4.3E-02	4.2E-03
Fungi	4.7E-02	4.5E-03
Caterpillar	7.3E-02	7.1E-03
Ant	2.8E-02	2.7E-03
Bee	6.7E-02	6.5E-03
Woodlouse	3.8E-02	3.7E-03

Earthworm	8.7E-06	8.5E-07
Herb. Mammal	1.5E-02	1.4E-03
Car. Mammal	1.7E-02	1.7E-03
Rodent	1.4E-02	1.3E-03
Bird	4.6E-02	4.5E-03
Bird egg	3.4E-02	3.3E-03
Reptile	1.9E-02	1.8E-03

3.2 Liquid discharge assessment

This assessment considered the potential impact of the liquid discharge on the nearest protected site which in this case is also the Portencross Coast SSSI. The results of the assessment are presented in Table 3.

Table 3: Liquid discharge ERICA results

ERICA RESULTS – Liquid discharge assessment	
REFERENCE ORGANISM	**PREDICTED DOSE RATE (μGyh^{-1})**
(Wading) bird	2.31E-03
Benthic fish	5.55E-02
Benthic mollusc	3.14E-02
Crustacean	1.99E-02
Macroalgae	6.34E-02
Mammal	3.56E-03
Pelagic fish	3.72E-02
Phytoplankton	1.26E+00
Polychaete worm	5.57E-02
Reptile	2.77E-03
Sea anemones or true corals - colony	4.71E-02
Sea anemones or true corals - polyp	4.87E-02
Vascular plant	6.30E-02
Zooplankton	8.26E-02

4.0 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 $10\mu Gyh^{-1}$. Therefore exposure of non-human species to the discharges may be considered to be of negligible radiological concern.