

WASTE STREAM	9J320	Pond and Effluent Treatment Plant LLW
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SITE Hunterston A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0		
Future arisings:	1.4.2040 - 31.3.2059	611.1		
Total future arisings:		611.1		
Total waste volume:		611.1		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: For inventory purposes the arisings are assumed to arise at a uniform rate over 20 years

Additional information on quantities: Reactor Dismantling and Site Clearance is assumed to commence in 2040 and last for 20 years. The volumes and radioactivity have been calculated for 50 years after reactor shutdown, i.e. 2040. Waste volumes include a proportion of secondary waste arisings and contaminated soil.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 1.20
Stock (lower):	x -	Arisings (lower):	x 0.80

WASTE SOURCE Waste arisings from RDC of the ponds and Active Effluent Treatment Plant areas, also some contaminated soil.

PHYSICAL CHARACTERISTICS

General description: The waste includes pond wall scabbling waste, small redundant plant and tools and associated secondary waste, there is also some contaminated soil. There are no large items present which require special treatment. Includes some secondary waste.

Changes since waste generated: -

Bulk density (t/m³): ~ 0.60

Comment on density: The mean waste density is approximately 0.6 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises metals, soil, soft organic e.g. paper, cloth, plastic/rubber, wood and tarmac. Drum material is mild steel.

Chemical state: Neutral

Sheet metal proportion / thickness: Not fully assessed.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 3.0	Nickel and chromium are present as alloying metals in steel.	
Other ferrous metals.....	~ 23.0	Nickel and chromium are present as alloying metals in steel.	
Iron.....	P	-	
Aluminium.....	P	-	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	NE	-	
Lead.....	~ 1.0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	P	Nickel is present as alloying metal in steel.	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	P	"Other" metals have not been fully assessed. Chromium is present as alloying metal in steel.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 13.0	-	
Paper, cotton.....	~ 10.0	-	
Wood.....	~ 3.0	-	
Halogenated plastics.....	NE	-	
Total non-halogenated plastics.....	~ 38.0	-	
Condensation polymers.....	NE	-	
Others.....	~ 38.0	Polythene, tanks, pipework, IBCs etc	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	NE	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	-	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	NE	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	~ 11.0	-	
Brick/Stone/Rubble.....	= 11.0	-	
Cementitious material.....	= 0	-	
Sand.....	-	-	
Glass/Ceramics.....	NE	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 0	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	-	-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	NE	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	= 0	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	= 0	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	-	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	NE	-
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....		-
Vinyl chloride.....		-
Arsenic.....		-
Barium.....		-
Boron.....		-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....		-
Caesium.....		-
Selenium.....		-
Chromium.....		-
Molybdenum.....		-
Thallium.....		-
Tin.....		-
Vanadium.....		-
Mercury compounds.....		-
Others.....		-

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....		-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction		= 9.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		= 17.0
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		= 74.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

47% of this waste stream is expected to be sent to Landfill as VLLW and 17% for Metal Recycle.

Conditioning method:

-

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	27.0	7.0	18.3	24	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m³): -
Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	= 27.0		2040
Expected to be consigned to a Landfill Facility	= 47.0		2040
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	= 9.0		2040
Expected to be consigned to a Metal Treatment Facility	= 17.0		2040
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility: 17 04 05, 17 05 03*, 17 05 04, 17 06 01*, 20 01 01, 17 02 03

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The activity is principally Fe-55, Co-60, Sr-90, Cs-137 and Pu-241.

Uncertainty: Activity values are current best estimates. Specific activity is a function of Station operating history. The values quoted are indicative of the activities that would be expected.

Measurement of radioactivities: The specific activities have been estimated from the equivalent operational waste stream and appropriately decayed for RDC.

Chemical form of radionuclides:

- H-3: Tritium may be present as tritiated water.
- C-14: Chemical form of carbon 14 may be graphite.
- Cl-36: The chemical form of chlorine 36 has not been determined.
- Se-79: The chemical form of selenium has not been determined.
- Tc-99: The chemical form of technetium has not been determined.
- I-129: -
- Ra: The radium isotope content is insignificant.
- Th: The thorium content is insignificant.
- U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
- Np: Neptunium isotope content is expected to be insignificant.
- Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			1.39E-07	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			8.97E-08	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			3.00E-07	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Ti 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			9.25E-09	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			8.18E-08	C C 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			3.51E-05	C C 2	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94			4.00E-09	C C 2	Th 234				8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			5.21E-09	C C 2
Ag 108m			5.72E-09	C C 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			2.39E-06	C C 2
Sn 123				8	Pu 239			2.00E-06	C C 2
Sn 126				8	Pu 240			2.99E-06	C C 2
Sb 125				8	Pu 241			2.01E-05	C C 2
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			1.15E-05	C C 2
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243			1.03E-08	C C 2
Cs 137			5.16E-05	C C 2	Cm 244			9.97E-08	C C 2
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Unsp a				8
Eu 152			2.29E-09	C C 2	Unsp b/g				8
Eu 154			9.87E-09	C C 2	Total a	0	*	1.90E-05	*
Eu 155				8	Total b/g	0	*	1.07E-04	*

Bands (Upper and Lower)

A a factor of 1.5
B a factor of 3
C a factor of 10
D a factor of 100
E a factor of 1000

Note: Bands quantify uncertainty in the mean radioactivity.

Code

1 Measured activity
2 Derived activity (best estimate)
3 Derived activity (upper limit)
4 Not present
5 Present but not significant
6 Likely to be present but not assessed
7 Present in significant quantities but not determined
8 Not expected to be present in significant quantity
* Total calculated from the 114 declared radionuclides