

WASTE STREAM	2C920	Reactor Decommissioning Preparations
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SITE Chapelcross

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			
Future arisings:	1.4.2025 - 31.3.2040			
Total future arisings:				
Total waste volume:				

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

Comment on arising rates: -

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 1.20
Stock (lower): x - Arisings (lower): x 0.80

WASTE SOURCE Waste is from Chapelcross reactor buildings and contaminated land. The waste is likely to arise from maintenance and decommissioning operations involving the removal and replacement of plant and equipment.

PHYSICAL CHARACTERISTICS

General description: The waste is generally hard, bulky or irregular in shape and may contain any of the following; scaffolding boards and tubes, steelwork, redundant plant and equipment, structural materials and pipework, cardboard, bird droppings and bird carcasses (birds that get into the reactor buildings through open/damaged windows), plasterboard ceiling and wall tiles, rubber gaskets and seals, oils, paints and solvents, tarmac/bitumen, EEE and Hoover bags. Hoover bags will typically contain concrete dust, metal swarf, wood shavings, plastics and asbestos (asbestos enclosure work only). Approximately 230kg of Hoover bags is expected over the lifetime, with an expected average bag weight of 5-10kg. There will also be some secondary waste, and may be some contaminated soil associated with legacy operations.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.6

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~68%), concrete (~4%), Soil (5%), Biodegradable (2%), Plasterboard (1%), Wood (~1%), Plastics (~5%), Rubber (3%), other organic (5%) and others (6%) including asbestos and paints/solvents.

Chemical state: Neutral

Sheet metal proportion / thickness: This waste stream will contain metal of various sizes and thicknesses.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 3.5	Metals deplanting and legacy metals (pipework, motors, pumps, tanks, frames, benches, tools, scaffold tubes/fittings, electrical boxes, heaters, ducting, shielding, flasks)	
Other ferrous metals.....	= 62.0	Metals deplanting and legacy metals (pipework, motors, pumps, tanks, frames, benches, tools, scaffold tubes/fittings, electrical boxes, heaters, ducting, shielding, flasks)	
Iron.....	= 0.69	Cast iron reactor fittings: radiators, lights, brackets, flasks	
Aluminium.....	= 2.1	Scaffold poles, ladders and walkway sections	
Beryllium.....	-	-	
Cobalt.....	-	-	
Copper.....	-	-	
Lead.....	= 0.69	Metals deplanting and legacy metals - lead blocks (shielding), flasks	
Magnox/Magnesium.....	-	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0.07	Zinc oxide coating on galvanised scaffold tubes, floor plates/grates, handrails	
Zircaloy/Zirconium.....	0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 1.0	-	
Paper, cotton.....	0	-	
Wood.....	~ 1.0	-	
Halogenated plastics.....	0	-	
Total non-halogenated plastics.....	~ 5.4	Soft wastes. Plastics from controlled area works.	
Condensation polymers.....	0	-	
Others.....	~ 5.4	Soft wastes. Plastics from controlled area works.	
Organic ion exchange materials.....	0	-	
Total rubber.....	3.0	-	
Halogenated rubber.....	1.5	-	
Non-halogenated rubber.....	1.5	-	
Hydrocarbons.....	-	-	
Oil or grease.....	= 3.1	Mainly liquid, also small volume of oil contamination within soil/sludge	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	= 0.04	Land Remediation	
Asphalt/Tarmac (no coal tar).....	= 0.09	Land Remediation	
Bitumen.....	= 0.09	Land Remediation	
Others.....	-	-	
Other organics.....	= 0.46	Paints/solvents	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	0	-	
Inorganic sludges and flocs.....	0	-	
Soil.....	= 5.0	-	
Brick/Stone/Rubble.....	~ 4.0	-	
Cementitious material.....	0	-	
Sand.....	-	-	
Glass/Ceramics.....	= 0.48	Pipe insulation	
Graphite.....	0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	= 5.1	-	
Non/low friable.....	= 1.2	Asbestos within cement roof sheets, galbestos roof sheets, gaskets, rope window seals. bulk will be Chrysotile (white asbestos) with smaller quantities of Crocidolite (blue) and Amosite (brown)	
Moderately friable.....	-	-	
Highly friable.....	= 3.8	Pipe insulation: bulk will be Chrysotile (white asbestos) with smaller quantities of Crocidolite (blue) and Amosite (brown)	
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.....	NE	-
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.....	= 0.51	-
Putrescible wastes.....	= 0.51	Bird Droppings, small animal carcasses
Non-putrescible wastes.....	= 0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	9568m2 Reactive metals in the form of aluminium scaffold tubes and smaller quantities of galvanised metals.
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	-	-
Benzene.....	-	-
Chlorinated solvents.....	-	-
Formaldehyde.....	-	-
Organometallics.....	-	-
Phenol.....	-	-
Styrene.....	-	-
Tri-butyl phosphate.....	-	-
Other organophosphates.....	-	-
Vinyl chloride.....	-	-
Arsenic.....	-	-
Barium.....	-	-
Boron.....	0.01	-
Boron (in Boral).....	-	-
Boron (non-Boral).....	<< 0.01	Borosilicate glass
Cadmium.....	-	-
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	-	-
Molybdenum.....	-	-
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	-	-
Mercury compounds.....	-	-
Others.....	= 1.0	Plasterboard

Complexing agents (%wt):

No	(%wt)	Type(s) and comment
EDTA.....	-	-
DPTA.....	-	-
NTA.....	-	-
Polycarboxylic acids.....	-	-
Other organic complexants.....	-	-
Total complexing agents.....	= 0	-

Physical components:

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

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	Off-site	= 29.8
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	= 17.2
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		= 53.0

Comments on planned treatments:

It is expected that 51.4% of this waste stream will be sent to Landfill as VLLW and 1.6% to LLWR for disposal.

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)	1.6	10.0	18.3	7	-

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)	= 1.6 = 51.4	1.6 1.6	
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	= 29.8 = 17.2	0.40 1.4	
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
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 07, 17 05 03*, 17 05 04, 17 06 03*, 17 06 01*, 17 02 03

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Activation and contamination of materials.

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

Measurement of radioactivities: -

Chemical form of radionuclides: H-3: The chemical form of tritium has not been determined.
C-14: The chemical form of carbon 14 has not been determined.
Cl-36: -
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: Radium isotope content is expected to be insignificant.
Th: The thorium content is insignificant.
U: Uranium isotope content is expected to be insignificant.
Np: Neptunium isotope content is expected to be insignificant.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM 2C920 Reactor Decommissioning Preparations									
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			9.65E-05	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.08E-05	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			6.32E-06	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
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			5.22E-05	C C 2	Pb 210				8
Co 60			6.08E-05	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			6.60E-05	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			8.59E-08	C C 2
Rb 87				8	Ac 227				8
Sr 90			1.03E-05	C C 2	Th 227				8
Zr 93				8	Th 228			7.99E-08	C C 2
Nb 91				8	Th 229				8
Nb 92				8	Th 230			9.35E-08	C C 2
Nb 93m				8	Th 232			9.86E-08	C C 2
Nb 94				8	Th 234			9.66E-08	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			1.31E-07	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			1.27E-07	C C 2
Ag 108m				8	U 235			4.53E-09	C C 2
Ag 110m				8	U 236				8
Cd 109				8	U 238			9.66E-08	C C 2
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			3.71E-07	C C 2
Sn 123				8	Pu 239			2.97E-07	C C 2
Sn 126				8	Pu 240			3.89E-07	C C 2
Sb 125			9.96E-09	C C 2	Pu 241			4.58E-06	C C 2
Sb 126				8	Pu 242			1.39E-08	C C 2
Te 125m			2.49E-09	C C 2	Am 241			9.20E-07	C C 2
Te 127m				8	Am 242m				8
I 129				8	Am 243			3.68E-08	C C 2
Cs 134			1.57E-09	C C 2	Cm 242				8
Cs 135				8	Cm 243			1.80E-08	C C 2
Cs 137			2.17E-05	C C 2	Cm 244			3.50E-07	C C 2
Ba 133			2.29E-07	C C 2	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			5.17E-09	C C 2	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			3.15E-07	C C 2	Unsp a				
Eu 152			2.05E-07	C C 2	Unsp b/g				
Eu 154			1.54E-07	C C 2	Total a	0	*	2.90E-06	*
Eu 155			3.59E-08	C C 2	Total b/g	0	*	3.30E-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