

WASTE STREAM	5G301	SGHWR Decommissioning LLW
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SITE Winfrith

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:	1.4.2025 - 31.3.2037	3801.2		
Total future arisings:		3801.2		
Total waste volume:		3801.2		

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

Comment on arising rates: Volume of arising updated to reflect SMART Inventory

Additional information on quantities: Volume updated for 2016 RWI to reflect SMART Inventory review.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 1.50
Stock (lower):	x -	Arisings (lower):	x 0.50

WASTE SOURCE The waste consists of all arisings from the Steam Generating Heavy Water Reactor (SGHWR) decommissioning operations.

PHYSICAL CHARACTERISTICS

General description: The waste is primarily formed of metallic waste, concrete, grout and soft wastes such as PPE. Waste arisings from the Primary Containment decommissioning operations is asbestos contaminated material. A small volume of sludge residue is expected to fall within the VLLW route, subject to BAT review. The waste detailed in this characterisation form originates from the SGHWR reactor only, and excludes any waste from other facilities or legacy projects (detailed under 5G308).

Changes since waste generated: -

Bulk density (t/m³): = 0.81

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metals (74%), Rubble (17%), Plastic/Rubber (3%), Wood (1%), biodegradable (non-putrescibles) (1%), others (4%) including sludge residue (heels) and asbestos

Chemical state: Neutral

Sheet metal proportion / thickness: The raw waste contains many varied large items, and a range of metal thicknesses

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 7.0	Pipework, plate work	
Other ferrous metals.....	~ 65.0	Pipework, hand rails, grating, plate, RSJ's (includes 28504.31kg steel of 30000kg galvanised steel)	
Iron.....	~ 0.92	Pipework, gratings, plates	
Aluminium.....	~ 0.06	Electrical boxes, ventilation work.	
Beryllium.....	TR	Contaminant in grout (1.035kg of 6413.215kg total)	
Cobalt.....	TR	As a metal additive	
Copper.....	~ 0.11	Associated with electrical systems and contaminant in sludge (1.06kg of 10.67827kg total).	
Lead.....	~ 0.74	Shielding, contaminant in paint (498.09kg of 7115.62kg total paint), contaminant in grout (12kg of 6413.215kg total), contaminant in sludge (0.763kg of 10.67827kg total).	
Magnox/Magnesium.....	= 0	-	
Nickel.....	TR	Contaminant in sludge (2kg of 10.67827kg total).	
Titanium.....	TR	As a metal additive	
Uranium.....	-	-	
Zinc.....	~ 0.27	Galvanic coating (1495.69kg of 30000kg total galvanised steel), contaminant in sludge (1.6kg of 10.67827kg total)	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	-	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 1.0	-	
Paper, cotton.....	~ 0	-	
Wood.....	~ 1.0	-	
Halogenated plastics.....	~ 1.0	Halogenated plastics - PVC. Soft waste / PPE	
Total non-halogenated plastics.....	~ 1.0	-	
Condensation polymers.....	~ 1.0	Soft waste / PPE, HEPA filter frames	
Others.....	-	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	~ 1.0	-	
Halogenated rubber.....	~ 1.0	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	-	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	= 0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	-	-	
Soil.....	-	-	
Brick/Stone/Rubble.....	~ 17.0	-	
Cementitious material.....	-	-	
Sand.....	-	-	
Glass/Ceramics.....	~ 0.11	Man Made Mineral Fibre bulk lagging	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 0.24	Asbestos includes bulk friable chrysotile from lagging boxes. Asbestos also present in cladding and as a contaminant on soft wastes for incineration.	
Non/low friable.....	= 0	-	
Moderately friable.....	~ 0.16	lagging and cladding, Asbestos includes bulk friable chrysotile from lagging boxes. Asbestos also present in cladding and as a contaminant on soft wastes for incineration.	
Highly friable.....	~ 0.08	lagging and cladding, Asbestos includes bulk friable chrysotile from lagging boxes. Asbestos also present in cladding and as a contaminant on soft wastes for incineration.	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 1.0	-	

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.....	P	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	TR	Contaminant in grout (15kg of 6413.215kg total).
Sulphate.....	NE	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	NE	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	TR	Contaminant in grout (17.25kg of 6413.215kg total).
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	~ 1.0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	~ 1.0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	3945.28m2 Reactive surface area of zinc coating of galvanised steel has been added assuming 2mm thick steel plate (3811.9440m2 of 3945.2774m2 total). This represents a conservative estimate as many components will exceed 2mm thickness. The remaining 133.3333m2 reactive surface area is associated with aluminium, likewise assumed at a 2mm thickness. It is anticipated that the majority of this material will be diverted away from the LLW Repository. Any reactive metal for disposal at the LLW Reposit
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.....	TR	Contaminant in sludge (0.855kg of 10.67827kg total)
Barium.....	-	-
Boron.....	TR	Contaminant in grout (0.77kg of 6413.215kg total)
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	TR	Contaminant in grout (0.12kg of 6413.215kg total) and sludge (0.00027kg of 10.67827kg total)
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	TR	Contaminant in sludge (4.4kg of 10.67827kg total).
Molybdenum.....	~ 0.02	Contaminant in grout (90kg of 6413.215kg total).
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	-	-
Mercury compounds.....	-	-
Others.....	~ 2.3	Paint (1.18%) - Coatings on mild steel items. Carbon (0.03%), Manganese (0.95%), Silicon (0.13%), Sulphur (0.01%), Nitrogen (0.02%), Trace amounts of phosphorus and TPH (C8-C35) - All present as contaminants in grout.

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.....	-	-
EEE Type 5.....	-	-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	Off-site	~ 12.7
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
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		~ 87.3

Comments on planned treatments:

it is expected that 61.47% of this stream will be disposed of as VLLW to landfill.

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)	25.9	10.0	18.3	99	-

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/m ³	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	~ 25.9	0.81	
Expected to be consigned to a Landfill Facility	~ 61.5	0.81	
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	~ 12.7	0.40	
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, 16 03 03*, 17 05 03*, 16 03 04, 17 05 04, 17 06 03*, 17 06 01*, 13 02 08*

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Activation of core components (where not ILW). Contamination of primary circuit components with corrosion products. Miscellaneous contamination.

Uncertainty: -

Measurement of radioactivities: -

Chemical form of radionuclides: H-3: Tritium due to activation of concrete.
C-14: Carbon 14 due to activation of concrete and metals.
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: -

WASTE STREAM 5G301 SGHWR Decommissioning LLW									
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			2.59E-05	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			9.17E-06	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36				8	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			3.30E-06	C C 1	Pb 210				8
Co 60			2.72E-05	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			1.22E-04	C C 1	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			1.30E-05	C C 1	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			4.93E-08	C C 2	Th 234			1.06E-08	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			3.13E-09	C C 1	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			1.44E-08	C C 1
Ag 108m				8	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238			1.06E-08	C C 1
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			2.78E-07	C C 1
Sn 123				8	Pu 239			2.32E-07	C C 1
Sn 126				8	Pu 240			2.02E-07	C C 1
Sb 125			6.29E-08	C C 2	Pu 241			4.96E-06	C C 1
Sb 126				8	Pu 242			1.20E-09	C C 1
Te 125m			1.58E-08	C C 2	Am 241			7.65E-07	C C 1
Te 127m				8	Am 242m				8
I 129			2.13E-09	C C 1	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243			2.97E-09	C C 1
Cs 137			6.14E-05	C C 2	Cm 244			1.17E-07	C C 1
Ba 133			2.25E-09	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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Unsp a				
Eu 152			6.04E-08	C C 2	Unsp b/g				
Eu 154			5.42E-08	C C 2	Total a	0	*	1.62E-06	*
Eu 155			1.76E-09	C C 2	Total b/g	0	*	2.67E-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