

WASTE STREAM	5G303	DRAGON Reactor 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	477.0		
Total future arisings:		477.0		
Total waste volume:		477.0		

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

Comment on arising rates: Decommissioning and deplanting of buildings prior to demolition and clearance of structures.

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 LLW arisings from Dragon Reactor decommissioning, including reactor components, support plant, structural components and secondary waste generated during the decommissioning project as well as small amounts of historical waste from previous operation and decommissioning activities of the Dragon Reactor.

PHYSICAL CHARACTERISTICS

General description: The waste is primarily formed of metallic wastes, concrete, grout and soft wastes such as PPE.

Changes since waste generated: -

Bulk density (t/m³): ~ 2.4

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal (25%), Concrete/rubble (64%), Plastics (6%), Rubber (1%), wood (1%), biodegradable - non putrescibles (1%), other organics including oil (1%), others including glass fibre, asbestos, graphite (1%)

Chemical state: Neutral

Sheet metal proportion / thickness: Plate thicknesses are 1" for the thermal shield plates, ~2" for the pressure vessel. Other material will be present from non-core items. It should be noted that the material will be sized reduced to allow it to be packed into the containers.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 0.31	Reactor components including Purge Gas Pre-Cooler (PGPC)	
Other ferrous metals.....	= 22.8	Mild Steel - Reactor components including Purge Gas Pre-Cooler (PGPC), rebar, structural components, filter frames	
Iron.....	= 1.2	Component of MARWE 426 (16764.71 kg of 17100 kg total)	
Aluminium.....	TR	Component of MARWE 426 (5.08kg of 17100 kg total), metal channel	
Beryllium.....	-	-	
Cobalt.....	TR	Component of MARWE 426 (2.96 kg of 17100 kg total)	
Copper.....	TR	Component of MARWE 426 (17.96 kg of 17100 kg total)	
Lead.....	~ 0.11	shielding components	
Magnox/Magnesium.....	-	-	
Nickel.....	TR	Component of MARWE 426 (7.02 kg of 17100 kg total)	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	-	-	
Zircaloy/Zirconium.....	-	-	
Other metals.....	-	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 1.0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 1.0	-	
Halogenated plastics.....	~ 2.8	PPE, wipes, polythene sheet	
Total non-halogenated plastics.....	~ 2.8	PPE, wipes, polythene sheet	
Condensation polymers.....	~ 1.4	-	
Others.....	~ 1.4	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 1.0	-	
Halogenated rubber.....	= 0.50	-	
Non-halogenated rubber.....	= 0.50	-	
Hydrocarbons.....	~ 0.11	-	
Oil or grease.....	~ 0.11	used oil, MSDS not available	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	-	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 64.0	-	
Cementitious material.....	P	-	
Sand.....	-	-	
Glass/Ceramics.....	~ 0.01	Glass fibre component of Glass Reinforced Plastic (fibreglass)	
Graphite.....	= 0.85	Graphite moderator block	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 0.02	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	~ 0.02	Chrysotile (white) lagging material	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	P	trace amounts of charcoal dust present	

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

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	= 0	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	TR	Component of MARWE 426 (3.32 kg of 17100 kg 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	2.21m2 of Reactive metal - aluminium - small amounts of trunking - LA-LLW disposal in drums with no pre-treatment
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	-
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	-	-
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	TR	Component of MARWE 426 (9.41 kg of 17100 kg total)
Molybdenum.....	TR	Component of MARWE 426 (5.13 kg of 17100 kg total)
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	TR	Component of MARWE 426 (1.71 kg of 17100 kg total)
Mercury compounds.....	-	-
Others.....	-	-

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.....	-	-
EEE Type 3.....	P	-
EEE Type 4.....	-	-
EEE Type 5.....	-	-

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

Comments on planned treatments:

Conditioning method:

-

Conditioning plants:

Likely conditioning matrix:

1

Further information on the conditioning matrix:

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Likely container type:

Range in container waste loading: -

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Other information on packaging and conditioning:

—

Conditioned density (t/m³):

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Conditioned density comment:

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Classification codes for waste expected to be consigned to a landfill facility:

17 04 07, 17 05 03*, 17 05 04

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Neutron induced activity of structural components. Fuel/ fission product contamination not yet assessed, but believed to be negligible in core components. Contamination levels in non-core plant are significant and will be quantified in the future.

Uncertainty: -

Measurement of radioactivities: -

Chemical form of radionuclides: H-3: Radionuclides are present as trace elements in the activated materials. Present through contamination.
C-14: Radionuclides are present as trace elements in the activated materials. Present through contamination.
Cl-36: Radionuclides are present as trace elements in the activated materials.
Se-79: Radionuclides are present as trace elements in the activated materials.
Tc-99: Radionuclides are present as trace elements in the activated materials.
I-129: Radionuclides are present as trace elements in the activated materials.
Ra: Radionuclides are present as trace elements in the activated materials. Possible presence through contamination.
Th: Radionuclides are present as trace elements in the activated materials. Possible presence through contamination.
U: Radionuclides are present as trace elements in the activated materials. Present through contamination.
Np: Radionuclides are present as trace elements in the activated materials. Possible presence through contamination.
Pu: Radionuclides are present as trace elements in the activated materials. Present through contamination.

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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			3.84E-04	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.18E-05	C C 2	Ho 166m			3.59E-08	C C 2
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.35E-06	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n			6.81E-08	C C 2
K 40			5.06E-08	C C 2	Hf 182				8
Ca 41			8.73E-08	C C 2	Pt 193			1.48E-08	C C 2
Mn 53				8	Ti 204			5.06E-08	C C 2
Mn 54				8	Pb 205				8
Fe 55			2.08E-06	C C 2	Pb 210				8
Co 60			3.24E-05	C C 2	Bi 208				8
Ni 59			4.83E-07	C C 2	Bi 210m				8
Ni 63			8.06E-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			3.76E-08	C C 2	Ra 228			3.55E-08	C C 2
Rb 87			4.87E-09	C C 2	Ac 227				8
Sr 90			4.15E-05	C C 2	Th 227				8
Zr 93				8	Th 228			1.48E-08	C C 2
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m			3.34E-08	C C 2	Th 232			1.14E-07	C C 2
Nb 94			1.72E-08	C C 2	Th 234			8.29E-08	C C 2
Mo 93			1.07E-08	C C 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			2.21E-09	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			4.98E-08	C C 2
Ag 108m			2.43E-08	C C 2	U 235			6.13E-08	C C 2
Ag 110m				8	U 236				8
Cd 109				8	U 238			8.29E-08	C C 2
Cd 113m			1.23E-08	C C 2	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m			8.87E-09	C C 2	Pu 238			9.76E-08	C C 2
Sn 123				8	Pu 239			5.92E-08	C C 2
Sn 126				8	Pu 240			3.02E-08	C C 2
Sb 125				8	Pu 241			1.44E-06	C C 2
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			1.95E-07	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				8
Cs 137			2.09E-04	C C 2	Cm 244				8
Ba 133			8.71E-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			5.66E-08	C C 2	Unsp a				
Eu 152			1.06E-05	C C 2	Unsp b/g				
Eu 154			4.51E-07	C C 2	Total a	0	*	7.05E-07	*
Eu 155				8	Total b/g	0	*	7.76E-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