

WASTE STREAM	9F324	Reactor Area LLW/VLLW
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SITE Sizewell 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:	1.4.2060 - 31.3.2079	949.4		
Total future arisings:		949.4		
Total waste volume:		949.4		

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: Final Dismantling & Site Clearance is assumed to commence in 2060 and last for 20 years. Volumes and radioactivity have been calculated for 54 years after reactor shutdown, i.e. 2060.

Uncertainty factors on volumes:

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

WASTE SOURCE Reactor Dismantling and Site Clearance processes and procedures.

PHYSICAL CHARACTERISTICS

General description: Hard and soft trash. All large items which cannot be cut to fit standard packages are disposed of in half height ISO containers.

Changes since waste generated: -

Bulk density (t/m³): ~ 0.80

Comment on density: Bulk density has been based on the assumed density of concrete as 2.4 t/m³, lead 11 t/m³, metal 7.9 t/m³, plastic 1.3 t/m³, and wood 0.5 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises metals, mainly steel, various plastics including polythene, rubber, paper and components: Metal (~40%), plastic (30%), rubber/paper/wood (11%), concrete/rubble (7%), soil (1%), organics (10%) and other materials (1%).

Chemical state: Neutral

Sheet metal proportion / thickness: 200 litre steel drums have a wall thickness of about 1mm.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 20.0	Generally 300 series stainless steels.	
Other ferrous metals.....	~ 20.0	Generally carbon steel	
Iron.....	-	-	
Aluminium.....	~ 0.17	-	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	-	-	
Lead.....	~ 0.15	-	
Magnox/Magnesium.....	-	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0.17	-	
Zircaloy/Zirconium.....	-	-	
Other metals.....		"Other" metals have not been identified.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 1.0	-	
Paper, cotton.....		-	
Wood.....	~ 1.0	-	
Halogenated plastics.....	~ 10.0	-	
Total non-halogenated plastics.....	~ 20.0	-	
Condensation polymers.....		-	
Others.....	= 20.0	-	
Organic ion exchange materials.....		-	
Total rubber.....	= 10.0	-	
Halogenated rubber.....		-	
Non-halogenated rubber.....	~ 10.0	-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....	= 0.04	-	
Others.....		-	
Other organics.....	= 10.0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....		-	
Inorganic sludges and flocs.....		-	
Soil.....	= 1.0	-	
Brick/Stone/Rubble.....	= 3.5	-	
Cementitious material.....	= 3.5	-	
Sand.....		-	
Glass/Ceramics.....		-	
Graphite.....		-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	unknown what type at this stage	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....		-	
Free non-aqueous liquids.....		-	
Powder/Ash.....		-	

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.....	= 0	-
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	0.17	-
Putrescible wastes.....	= 0.17	-
Non-putrescible wastes.....		-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	-
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):

No		
	(%wt)	Type(s) and comment
EDTA.....	= 0	-
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	Off-site	= 81.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	= 8.0
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		= 11.0
Treatment not yet determined		
None		

Comments on planned treatments:

-

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
	-	-	-	-	-	-

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			
Expected to be consigned to a Landfill Facility	= 11.0	0.80	2060
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	= 81.0	0.80	2060
Expected to be consigned to a Metal Treatment Facility	= 8.0	1.4	2060
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 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: All of the waste will fall into the LLW category. The activity values quoted are the current best estimates.

Measurement of radioactivities: The specific activities have been estimated from the equivalent operational waste stream and decayed until the arising date. The activities quoted are those at 54 years after reactor shutdown, i.e. in 2060. There may be some contamination by Cs137.

Chemical form of radionuclides: H-3: Tritium may be present as surface contamination of waste by tritiated liquor.
C-14: Chemical form of carbon 14 may be contamination in the form of graphite dust.
Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
Se-79: The selenium 79 content is insignificant.
Tc-99: The technetium-99 content is insignificant.
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: The neptunium isotope content is insignificant.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM 9F324 Reactor Area LLW/VLLW									
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			2.46E-05	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.99E-05	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.37E-05	C C 1	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				8	Pb 210				8
Co 60			1.79E-08	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			5.25E-06	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			2.37E-06	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			2.56E-07	C C 2	Th 234			3.95E-07	C C 2
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			4.04E-07	C C 2
Ag 108m			1.97E-07	C C 2	U 235			2.48E-08	C C 2
Ag 110m				8	U 236			1.25E-07	C C 2
Cd 109				8	U 238			3.95E-07	C C 2
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			4.59E-08	C C 1
Sn 123				8	Pu 239			7.16E-08	C C 1
Sn 126				8	Pu 240			9.28E-08	C C 1
Sb 125				8	Pu 241			7.50E-07	C C 1
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			3.76E-07	C C 1
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243			1.72E-09	C C 1
Cs 137			8.15E-07	C C 2	Cm 244			1.98E-08	C C 1
Ba 133			1.08E-08	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				8
Eu 152			5.35E-08	C C 2	Unsp b/g				8
Eu 154			1.69E-08	C C 2	Total a	0	*	1.56E-06	*
Eu 155				8	Total b/g	0	*	6.83E-05	*

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