

WASTE STREAM	3K22	Catalyst
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SITE Hartlepool

SITE OWNER EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE CUSTODIAN EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 2.6		
Future arisings:	1.4.2025 - 31.3.2026	= 0		
	1.4.2026 - 31.3.2027	= 1.6		
Total future arisings:		1.6		
Total waste volume:		4.2		

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

Comment on arising rates: Waste volumes will be variable depending on station operating conditions.

Additional information on quantities: Current stock volumes are known. The volume of catalyst in the recombination units is known and so future arising volumes are predictable.

Uncertainty factors on volumes:

Stock (upper):	x 1.25	Arisings (upper):	x 1.75
Stock (lower):	x 0.75	Arisings (lower):	x 0.25

WASTE SOURCE Exhausted catalysts that have been used for the recombination of carbon dioxide reactor coolant.

PHYSICAL CHARACTERISTICS

General description: Catalyst materials. There will be no large items in the waste which may require special handling.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.1

Comment on density: The bulk density of the recombination unit catalyst is 1.06 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Pelletised alumina-platinum catalyst (cylinders ~5mm long). No other materials anticipated. Polythene lined steel drums containing the waste (~10%wt).

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	P	-	
Iron.....	NE	-	
Aluminium.....	NE	-	
Beryllium.....	NE	-	
Cobalt.....	NE	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	NE	-	
Titanium.....	NE	-	
Uranium.....	NE	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	~ 0.30	~0.3%wt Platinum on alumina.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	< 10.0	-	
Condensation polymers.....	= 0	-	
Others.....	< 10.0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	-	
Halogenated rubber.....	= 0	-	
Non-halogenated rubber.....	= 0	-	
Hydrocarbons.....	= 0	-	
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.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 89.7	-	
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.....	TR	-
Chloride.....	TR	-
Iodide.....	TR	-
Cyanide.....	NE	-
Carbonate.....	TR	-
Nitrate.....	= 0	-
Nitrite.....	= 0	-
Phosphate.....	= 0	-
Sulphate.....	TR	-
Sulphide.....	TR	-

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.....	= 0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	= 0	Not expected
Soluble solids as bulk chemical compounds.....	= 0	-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	Expect only trace quantities, if any.
Total complexing agents.....	NE	-

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
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	On-site	= 100.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	= 100.0
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification	Off-site	= 100.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

Current waste treatment is to decontaminated to LLW and then encapsulated. However, trials are ongoing into both washing and incineration, and direct incineration.

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)	100.0	6.1	18.3	1	-

Range in container waste loading:

Other information on packaging and conditioning: Waste loading is based on 18.27m³ per half-height ISO.

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)	= 100.0	NE	
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			
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:

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
LLWR	Incineration facility	-	AMBER	-

RADIOACTIVITY

Source: Contamination by activation products will be the main sources of activity.

Uncertainty: The values given are from analysis of catalyst samples from 2016, so give a good indication of activities present but may not be bounding. Specific activity is a function of both operating history and also the period of radioactive decay, given some catalyst waste has been stored on site for decades.

Measurement of radioactivities: Analysis by Tradebe Inutec of HAR catalyst samples from 2016.

Chemical form of radionuclides:

- H-3: Diffused into catalyst
- C-14: Contamination by graphite particulate
- Cl-36: Activation of sulphide components within the gas stream.
- Se-79: Not expected to be present in significant quantities.
- Tc-99: Not expected to be present in significant quantities.
- I-129: Not expected to be present in significant quantities.
- Ra: Not expected to be present in significant quantities.
- Th: Not expected to be present in significant quantities.
- U: Not expected to be present in significant quantities.
- Np: Not expected to be present in significant quantities.
- Pu: Not expected to be present in significant quantities.

WASTE STREAM				3K22				Catalyst			
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	1.89E-01	C C 1	1.89E-01	C C 1	Gd 153						
Be 10					Ho 163						
C 14	8.69E-06	C C 1	8.69E-06	C C 1	Ho 166m						
Na 22					Tm 170						
Al 26					Tm 171						
Cl 36	6.15E-05	C C 1	6.15E-05	C C 1	Lu 174						
Ar 39					Lu 176						
Ar 42					Hf 178n						
K 40		8		8	Hf 182						
Ca 41					Pt 193						
Mn 53					Tl 204						
Mn 54	1.52E-04	C C 1	1.52E-04	C C 1	Pb 205						
Fe 55	8.16E-05	C C 1	8.16E-05	C C 1	Pb 210						
Co 60	1.24E-04	C C 1	1.24E-04	C C 1	Bi 208						
Ni 59					Bi 210m						
Ni 63	3.77E-05	C C 1	3.77E-05	C C 1	Po 210						
Zn 65		8		8	Ra 223						
Se 79					Ra 225						
Kr 81					Ra 226						
Kr 85					Ra 228						
Rb 87					Ac 227						
Sr 90					Th 227						
Zr 93					Th 228						
Nb 91					Th 229						
Nb 92					Th 230						
Nb 93m					Th 232						
Nb 94		8		8	Th 234		8		8		
Mo 93					Pa 231						
Tc 97					Pa 233						
Tc 99					U 232						
Ru 106		8		8	U 233						
Pd 107					U 234						
Ag 108m		8		8	U 235		8		8		
Ag 110m		8		8	U 236						
Cd 109		8		8	U 238						
Cd 113m					Np 237		8		8		
Sn 119m					Pu 236						
Sn 121m					Pu 238						
Sn 123					Pu 239						
Sn 126					Pu 240						
Sb 125		8		8	Pu 241						
Sb 126					Pu 242						
Te 125m					Am 241		8		8		
Te 127m					Am 242m						
I 129					Am 243						
Cs 134		8		8	Cm 242						
Cs 135					Cm 243						
Cs 137	1.72E-06	C C 1	1.72E-06	C C 1	Cm 244						
Ba 133		8		8	Cm 245						
La 137					Cm 246						
La 138					Cm 248						
Ce 144		8		8	Cf 249						
Pm 145					Cf 250						
Pm 147					Cf 251						
Sm 147					Cf 252						
Sm 151					Unsp a	2.12E-07	C C 1	2.12E-07	C C 1		
Eu 152		8		8	Unsp b/g	3.39E-03	C C 1	3.39E-03	C C 1		
Eu 154		8		8	Total a	2.12E-07	*	2.12E-07	*		
Eu 155		8		8	Total b/g	1.93E-01	*	1.93E-01	*		

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