

WASTE STREAM	3L21	Miscellaneous Activated Components - Spalled Oxide and Dust
---------------------	-------------	--

SITE Heysham 1

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW; SPD3

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.2 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	< 0.1 m ³
	1.4.2023 - 31.3.2024.....	< 0.1 m ³
	1.4.2024 - 31.3.2025.....	0.4 m ³
	1.4.2025 - 31.3.2026.....	0.4 m ³
Total future arisings:		0.8 m ³
Total waste volume:		1.0 m ³

Comment on volumes: Waste volumes arisings variable depending on station operating conditions. Existing stock volume revised down from 2013 following video inspection of tanks which showed only small amounts of dust. Earlier figures based on station design estimates.

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.5
 Stock (lower): x 0.75 Arisings (lower) x 0.5

WASTE SOURCE Irradiated dusts and spalled oxide.

PHYSICAL CHARACTERISTICS

General description: Active dust held in dust tanks. No large items expected.

Physical components (%vol): Not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~2.5

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Irradiated dust in dust tanks could include spalled fuel can oxide and graphite dust, and abraded drier desiccant. Principally iron oxide with some graphite. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not expected to be significant
 C-14: Graphite
 Cl-36: Not expected to be significant
 Se-79: Not expected to be significant
 Tc-99: Not expected to be significant
 I-129: Not expected to be significant
 Ra: Not expected to be significant
 Th: Not expected to be significant
 U: Not expected to be significant
 Np: Not expected to be significant
 Pu: Not expected to be significant

Metals and alloys (%wt): Not expected to be present.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P		
Other ferrous metals.....	P		
Iron.....	P		
Aluminium.....	TR		

WASTE STREAM

3L21

Miscellaneous Activated Components - Spalled Oxide and Dust

Beryllium.....	NE
Cobalt.....	NE
Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	0
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	TR
Zircaloy/Zirconium.....	0
Other metals.....	NE

Organics (%wt): To be further assessed following further operating experience.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	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.....			

WASTE STREAM	3L21	Miscellaneous Activated Components - Spalled Oxide and Dust
---------------------	-------------	--

Graphite.....	NE
Desiccants/Catalysts.....	NE
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Only trace quantities anticipated.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	NE	
Carbonate.....	TR	
Nitrate.....	TR	
Nitrite.....	NE	
Phosphate.....	TR	
Sulphate.....	TR	
Sulphide.....	TR	

Materials of interest for waste acceptance criteria: There may be finely divided metals present in the dust tanks.

	(%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.....	P	May be present
Soluble solids as bulk chemical compounds.....	0	

WASTE STREAM**3L21****Miscellaneous Activated Components - Spalled Oxide and Dust**

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	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	
EEE Type 5.....	0	

Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	May be present in trace quantities.
Total complexing agents.....	TR	

WASTE STREAM**3L21****Miscellaneous Activated Components - Spalled Oxide and Dust**

Potential for the waste to contain discrete items: Yes.

PACKAGING AND CONDITIONING

Conditioning method: The waste will be conditioned to satisfy the disposal requirements which are effective at the time of retrieval/conditioning. It is currently assumed that the waste will be placed in "baskets" in the waste packages and will be encapsulated.

Plant Name: None.

Location: Heysham 1 Power Station.

Plant startup date: ~2105.

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m³/y incoming waste): -

Other information: All of the waste is expected to be retrieved and conditioned when a conditioning campaign is undertaken. The total plant process rate is not estimated.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	4m box (100mm concrete shielding)	100.0	~12.2	~14.3	< 1

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless steel.

Likely conditioning matrix: BFS/OPC

Other information: -

Conditioned density (t/m³): ~3.0

Conditioned density comment: The density of the encapsulated waste is expected to be approximately 3 t/m³.

Other information on conditioning: Waste will be retained on site pending Final Site Clearance, to let nuclides such as Co-60 undergo considerable radioactive decay. Baskets of different Final Site Clearance ILW wastes may be in the same waste package.

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: Irradiated dust and spalled oxide collected in appropriate tanks. Activated material removed from the reactor core is likely to be of high specific activity.

Uncertainty: Specific activity is a function of station operating history. The values quoted are indicative of the activities that might be expected.

WASTE STREAM**3L21****Miscellaneous Activated Components - Spalled Oxide and Dust**

Definition of total alpha and total beta/gamma:

Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

Measurement of radioactivities:

Theoretical estimates.

Other information:

Estimates are based upon theoretical assessments. Other beta/gamma nuclides of arisings and stocks (in TBq/m³) include Cr51 (7E+2, 1E-11); Co58 (2E+2, 1E-4); Nb95 (6E-1, 4E-12) and Ru103 (4E-4, 3E-14). Other beta/gamma nuclides also include Fe59.

WASTE STREAM

3L21

Miscellaneous Activated Components - Spalled Oxide and Dust

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3		6		6	Gd 153				
Be 10		8		8	Ho 163				
C 14	1E-01	CC 2	1E-01	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		6		6	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	3E-02	CC 2	2E+01	CC 2	Pb 205				
Fe 55	4E+01	CC 2	5E+02	CC 2	Pb 210	8			8
Co 60	5E+01	CC 2	2E+02	CC 2	Bi 208				
Ni 59	3E-01	CC 2	3E-01	CC 2	Bi 210m				
Ni 63	2E+01	CC 2	2E+01	CC 2	Po 210	8			8
Zn 65	9E-09	CC 2	5E-05	CC 2	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226	8			8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8		8	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229	8			8
Nb 92					Th 230	8			8
Nb 93m	6E-05	CC 2	1E-04	CC 2	Th 232	8			8
Nb 94	2E-03	CC 2	2E-03	CC 2	Th 234				
Mo 93	1E-03	CC 2	1E-03	CC 2	Pa 231	8			8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106		8		8	U 233	8			8
Pd 107		8		8	U 234	8			8
Ag 108m	8E-03	CC 2	8E-03	CC 2	U 235	8			8
Ag 110m					U 236	8			8
Cd 109					U 238	8			8
Cd 113m					Np 237	8			8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	8			8
Sn 123					Pu 239	8			8
Sn 126		8		8	Pu 240	8			8
Sb 125					Pu 241	8			8
Sb 126					Pu 242	8			8
Te 125m					Am 241	8			8
Te 127m					Am 242m	8			8
I 129		8		8	Am 243	8			8
Cs 134		6		6	Cm 242	8			8
Cs 135		8		8	Cm 243	8			8
Cs 137		6		6	Cm 244	8			8
Ba 133					Cm 245	8			8
La 137					Cm 246	8			8
La 138					Cm 248				
Ce 144		8		8	Cf 249				
Pm 145					Cf 250				
Pm 147		8		8	Cf 251				
Sm 147					Cf 252				
Sm 151		8		8	Other a	8			8
Eu 152		8		8	Other b/g	1E-04	CC 2	9E+02	CC 2
Eu 154		8		8	Total a	<1E-09	8	<1E-09	8
Eu 155		8		8	Total b/g	1.10E+02	CC 2	1.64E+03	CC 2

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 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