WASTE STREAM 3J20 Catalysts ILW

SITE Dungeness B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	1.0 m³
Future arisings -	1.4.2022 - 31.3.2030.....	0 m³
	1.4.2030 - 31.3.2031.....	1.2 m³
Total future arisings:		1.2 m³
Total waste volume:		2.2 m³

Comment on volumes: Waste volumes will be variable depending on station operating conditions. Current stock volumes are known. The volume of catalyst in each recombination unit 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 monoxide within carbon dioxide reactor coolant.

PHYSICAL CHARACTERISTICS

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

Physical components (%vol): Catalyst. Steel drums with high density polythene liners containing the waste. No other components anticipated.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.8

Comment on density: Density deduced from manufacturers information.

CHEMICAL COMPOSITION

General description and components (%wt): Alumina-platinum catalyst, no other materials anticipated. The platinum is an "active" form deposited onto an alumina base granule.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritiated water
C-14: Contamination by activated graphite
Cl-36: Activation of sulphide components within the gas stream.
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): -

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

WASTE STREAM 3J20 Catalysts ILW

Cobalt	NE	
Copper	NE	
Lead	TR	
Magnox/Magnesium	0	
Nickel	NE	
Titanium	NE	
Uranium	NE	
Zinc	NE	
Zircaloy/Zirconium	0	
Other metals	~0.30	Noble metal (platinum) component of catalyst 0.3 % by weight.

Organics (%wt): To be further assessed. High density polythene bags will be present

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	0		
Paper, cotton	0		
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	P		
Condensation polymers	0		
Others	P		
Organic ion exchange materials	0		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	NE		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	NE		

Other materials (%wt): Approximately 80wt% alumina base granule.

	(%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			
Graphite	0		

WASTE STREAM 3J20 Catalysts ILW

Desiccants/Catalysts	~80.0
Asbestos	0
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	0
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): None of the listed inorganic anions are expected to be present at greater than 10%.

	(%wt)	Type(s) and comment
Fluoride	<10.0	
Chloride	<10.0	
Iodide	<10.0	
Cyanide	NE	
Carbonate	<10.0	
Nitrate	<10.0	
Nitrite	NE	
Phosphate	<10.0	
Sulphate	<10.0	
Sulphide	<10.0	

Materials of interest for waste acceptance criteria: There are no materials identified in the waste likely to present a fire or other non-radiological hazard.

	(%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	

WASTE STREAM 3J20 Catalysts ILW

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	Expect only trace quantities, if any.
Total complexing agents	TR	

WASTE STREAM 3J20 Catalysts ILW

Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

Waste that is currently ILW: This waste is ILW at the time of arising. The waste is stored temporarily to allow decay of short lived radionuclides. Following this, the waste is sent for decontamination to LLW. Waste will be consigned as ILW prior to decontamination and therefore a decay period to LLW is not known.

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification	Off-site	100.0
Decontamination	Off-site	100.0
Metal treatment		
Size reduction		
Decay storage	On-site	100.0
Recyling / reuse		
Other / various		
None		

Comment on planned treatments: Current waste treatment is to decontaminated to LLW and then encapsulated. However, trials are ongoing to consider a change in strategy to wash and incinerate, or to use direct incinerate.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	100.0	NE
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

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

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at LLWR	Incineration	-	-	Medium	-

WASTE STREAM 3J20 Catalysts ILW

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m^3	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	100.0	~6.09	< 1

Other information: Waste loading is based on 18.27m^3 per half-height ISO.

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

The waste does not meet the LLWR's Waste Acceptance Criteria (WAC).

Does not meet WAC until catalyst is decontaminated.

Waste consigned for disposal to LLWR in year of generation: No. Waste is ILW when generated and needs decontaminating to LLW .Waste quantities are small and arisings usually occur at the same time as desiccants are changed.

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Contamination by tritiated water within in the reactor gas and activation products will be the main sources of activity.

Uncertainty: The values given (except for H-3) are from analysis of catalyst samples from 2012, so give a good indication of activities present but may not be bounding. Samples will LLW, so pre-exiting estimate used for ILW H-3. Specific activity is a function of operating history.

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: Analysis by Tradebe Inutec of DNB catalyst samples from 2012.

Other information: -

WASTE STREAM 3J20 Catalysts ILW

Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	2E-02	C C 2	2E-02	C C 2	Gd 153				
Be 10					Ho 163				
C 14	5.84E-06	C C 1	5.84E-06	C C 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	2.53E-05	C C 1	2.53E-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	1.12E-09	C C 1	1.12E-09	C C 1	Pb 205				
Fe 55		8		8	Pb 210				
Co 60	1.53E-06	C C 1	1.53E-06	C C 1	Bi 208				
Ni 59					Bi 210m				
Ni 63		8		8	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	3.76E-09	C C 1	3.76E-09	C C 1	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241		8		8
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	7.52E-10	C C 1	7.52E-10	C C 1	Cm 242				
Cs 135					Cm 243				
Cs 137	5.84E-07	C C 1	5.84E-07	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					Other a		8		8
Eu 152		8		8	Other b/g		6		6
Eu 154		8		8	**Total a**	**0**	**8**	**0**	**8**
Eu 155		8		8	**Total b/g**	**2E-02**	**C C 1**	**2E-02**	**C C 1**

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