WASTE STREAM 3K23 Miscellaneous Activated Components - Debris Vault 3

SITE	Hartlepool
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	ILW; SPD3

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0.5 m³
Total future arisings:		0 m³
Total waste volume:		0.5 m³

Comment on volumes: Future arisings unpredictable depending on operational failures.

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

WASTE SOURCE Irradiated reactor control rods, control rod chains and graphite specimen assemblies.

PHYSICAL CHARACTERISTICS

General description:	Redundant or defective control rods and control rod chains and graphite specimen assemblies. The possibility of large items which may need special handling is not assessed.
Physical components (%vol):	Not assessed.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	>1
Comment on density:	-

CHEMICAL COMPOSITION

General description and components (%wt): Irradiated components principally steel (>50% wt) removed from the reactor. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Diffused into components
C-14: Activated graphite contamination, activation of carbon within components
Cl-36: Not Accessed
Se-79: Not Accessed
Tc-99: Not Accessed
I-129: Not Accessed
Ra: Not Accessed
Th: Not Accessed
U: Not Accessed
Np: Not Accessed
Pu: Not Accessed

Metals and alloys (%wt): Majority of the waste is stainless steel cylinders, of varying thickness

Stainless steel.....	P	321, 316 and boronated stainless streel.
Other ferrous metals.....	P	
Iron.....	NE	
Aluminium.....	NE	
Beryllium.....	NE	
Cobalt.....	NE	
Copper.....	NE	
Lead.....	NE	
Magnox/Magnesium.....	NE	
Nickel.....	NE	

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	Titanium	NE
	Uranium	NE
	Zinc	NE
	Zircaloy/Zirconium	NE
	Other metals	NE
Organics (%wt):	To be further assessed following further operating experience.	
	Total cellulosics	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):	-	
	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	NE
	Desiccants/Catalysts	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):	Not assessed.	

Fluoride	NE
Chloride	NE
Iodide	NE
Cyanide	NE
Carbonate	NE
Nitrate	NE
Nitrite	NE
Phosphate	NE
Sulphate	NE
Sulphide	NE

Materials of interest for waste acceptance criteria: No materials that might give rise to a fire or other non-radioactive hazard has been identified.

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
Active particles	P
Soluble solids as bulk chemical compounds	0

Hazardous substances / non hazardous pollutants: -

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	P	as Boronated Stainless Steel

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

EDTA..... NE

DPTA..... NE

NTA..... NE

Polycarboxylic acids…… NE

Other organic complexants..... NE

Total complexing agents..... NE

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: Hartlepool Power Station.

Plant startup date: ~ 2109

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/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

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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

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Irradiated components removed from the reactor. 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.
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:	-
Other information:	Estimates are based upon theoretical assessments.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3		6			Gd 153				
Be 10		8			Ho 163				
C 14	5E-02	D E 2			Ho 166m				
Na 22		4			Tm 170				
Al 26		4			Tm 171				
Cl 36		6			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8			Pt 193				
Mn 53					Tl 204				
Mn 54	7.04E-03	D E 2			Pb 205				
Fe 55	2.31E+01	D E 2			Pb 210		8		
Co 60	3.37E+01	D E 2			Bi 208				
Ni 59	2E-01	D E 2			Bi 210m				
Ni 63	9.79E+00	D E 2			Po 210		8		
Zn 65	1.79E-09	D E 2			Ra 223				
Se 79		8			Ra 225				
Kr 81					Ra 226		8		
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8			Th 227				
Zr 93		8			Th 228				
Nb 91					Th 229		8		
Nb 92					Th 230		8		
Nb 93m	3.25E-05	D E 2			Th 232		8		
Nb 94	1E-03	D E 2			Th 234				
Mo 93	5E-04	D E 2			Pa 231		8		
Tc 97					Pa 233				
Tc 99		8			U 232				
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m	3.98E-03	D E 2			U 235		8		
Ag 110m					U 236		8		
Cd 109					U 238		8		
Cd 113m					Np 237		8		
Sn 119m					Pu 236				
Sn 121m		8			Pu 238		8		
Sn 123					Pu 239		8		
Sn 126		8			Pu 240		8		
Sb 125					Pu 241		8		
Sb 126					Pu 242		8		
Te 125m					Am 241		8		
Te 127m					Am 242m		8		
I 129		8			Am 243		8		
Cs 134		6			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137		6			Cm 244		8		
Ba 133					Cm 245		8		
La 137					Cm 246		8		
La 138					Cm 248				
Ce 144		8			Cf 249				
Pm 145					Cf 250				
Pm 147		8			Cf 251				
Sm 147					Cf 252				
Sm 151		8			Other a		8		
Eu 152		8			Other b/g	4.37E-08	D E 2		
Eu 154		8			**Total a**	**0**	**8**	**0**	
Eu 155		8			**Total b/g**	**6.69E+01**	**D E 2**	**0**	

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