

**WASTE STREAM****9E32****Miscellaneous Activated Components****SITE** Oldbury**SITE OWNER** Nuclear Decommissioning Authority**WASTE CUSTODIAN** Magnox Limited**WASTE TYPE** ILW; SPD3**WASTE VOLUMES**Stocks: At 1.4.2019..... Reported  
70.1 m<sup>3</sup>Total future arisings: 0 m<sup>3</sup>Total waste volume: 70.1 m<sup>3</sup>Comment on volumes: Approximately 53m<sup>3</sup> of current stocks are 'C' tubes (stand pipe components) accumulated before 1985. 'C' tube arisings are now nil. The stock and arising volumes originate from reactors 1 and 2.Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x  
Stock (lower): x 0.8 Arisings (lower) x**WASTE SOURCE** Redundant or defective reactor components.**PHYSICAL CHARACTERISTICS**

General description: Redundant or defective components such as control rods, stand pipe components, absorber bars, fuelling machine grabs and cables and thermocouples removed from reactor cores. Most items may require special handling due to their physical and radiological characteristics.

Physical components (%vol): C' tubes (stand pipe components) (78% vol), absorbers (16% vol), control rods (2% vol), cables (1% vol) and miscellaneous (3% vol).

Sealed sources: -

Bulk density (t/m<sup>3</sup>): ~1Comment on density: The assumption of 1 t/m<sup>3</sup> as the average bulk density may be subject to revision.**CHEMICAL COMPOSITION**

General description and components (%wt): Irradiated components removed from the reactor. The material will be principally steel.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present as tritium contaminated steel.  
C-14: Present as graphite dust contamination.  
Cl-36: Present in graphite dust contamination.  
Se-79: The selenium content is insignificant.  
Tc-99: The technetium content is insignificant.  
Ra: Radium isotope content is insignificant.  
Th: Thorium isotope content is insignificant.  
U: Present in trace quantities as natural uranium metal contamination.  
Np: The neptunium content is insignificant.  
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Not fully assessed but bulk metal items are present.

Stainless steel..... NE

Other ferrous metals..... &gt;75.0

Iron.....

Aluminium..... 0

Beryllium..... TR

Cobalt.....

Copper..... 0

Lead..... 0

Magnox/Magnesium..... NE

**WASTE STREAM****9E32****Miscellaneous Activated Components**

	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	0	
	Zircaloy/Zirconium.....	NE	
	Other metals.....	NE	Not fully assessed.
Organics (%wt):	Only trace quantities may be present.		
	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.....		
	Oil or grease .....		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	TR	
Other materials (%wt):	Traces of graphite may be present.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	0	
	Sand.....		
	Glass/Ceramics.....	0	
	Graphite.....	TR	
	Desiccants/Catalysts.....		
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	TR	

**WASTE STREAM**

**9E32**

**Miscellaneous Activated Components**

	Powder/Ash.....	0
Inorganic anions (%wt):	None expected but possibly present in trace quantities.	
	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:	-	
	Combustible metals.....	0
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	0
	Biodegradable materials.....	
	Putrescible wastes.....	0
	Non-putrescible wastes.....	
	Corrosive materials.....	0
	Pyrophoric materials.....	0
	Generating toxic gases.....	0
	Reacting with water.....	0
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None expected.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	
	Vinyl chloride.....	
	Arsenic.....	

**WASTE STREAM****9E32****Miscellaneous Activated Components**

Barium.....  
 Boron.....  
 Cadmium.....  
 Caesium.....  
 Selenium.....  
 Chromium.....  
 Molybdenum.....  
 Thallium.....  
 Tin.....  
 Vanadium.....  
 Mercury compounds.....  
 Others.....  
 Electronic Electrical Equipment (EEE)  
   EEE Type 1.....  
   EEE Type 2.....  
   EEE Type 3.....  
   EEE Type 4.....  
   EEE Type 5.....

Complexing agents (%wt): No  
 EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents..... 0

**PACKAGING AND CONDITIONING**

Conditioning method: The waste is not expected to be supercompacted. The treatment envisaged is the placement of the waste in baskets followed by encapsulation.

Plant Name: None

Location: Oldbury Power Station

Plant startup date: 2096

Total capacity  
(m<sup>3</sup>/y incoming waste): ~5000.0

Target start date for  
packaging this stream: 2096

Throughput for this stream  
(m<sup>3</sup>/y incoming waste): ~18.0

Other information: The current proposal is that this waste will remain as it is until Final Site Clearance.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	4m box (no shielding)	100.0	16.2	18.9	5

**WASTE STREAM****9E32****Miscellaneous Activated Components**

Likely container type comment: The container choice may be influenced by the Transport Regulations at the time of Final Site Clearance. The waste is assumed to be in baskets in the waste package so the occupied volume in the package is greater than the original waste volume.

Range in container waste volume: Not yet determined. No significant variability is expected.

Other information on containers: The container material is expected to be stainless steel.

Likely conditioning matrix: Blast Furnace Slag / Ordinary Portland Cement

Other information: The waste is assumed to be encapsulated.

Conditioned density (t/m<sup>3</sup>): ~3.0

Conditioned density comment: The conditioned waste density assumes that the waste will be encapsulated.

Other information on conditioning: The waste will be in baskets placed in the waste packages. Baskets of different Final Site Clearance ILW wastes may be in the same waste packages. The encapsulation matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3 t/m<sup>3</sup>.

Opportunities for alternative disposal routing: No

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source: Irradiated components removed from the reactors the majority of the activity being due to activation products.

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: Estimates are based upon theoretical assessments.

Other information: -

**WASTE STREAM**

**9E32**

**Miscellaneous Activated Components**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	<1.81E+00	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	CD 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3E-05	CC 2			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			Tl 204		8		
Mn 54	1.79E-04	CD 2			Pb 205		8		
Fe 55	5.28E+00	CD 2			Pb 210		8		
Co 60	2.16E+00	CD 2			Bi 208		8		
Ni 59	4E-02	CD 2			Bi 210m		8		
Ni 63	3.76E+00	CD 2			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	<4.84E-05	D 3			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	4E-05	CD 2			Th 234	<7E-09	D 3		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	<1E-08	D 3			U 232		8		
Ru 106	<1.78E-09	D 3			U 233		8		
Pd 107		8			U 234	<7.07E-09	D 3		
Ag 108m	3.94E-05	CD 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	<7E-09	D 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	<2.79E-06	D 3		
Sn 123		8			Pu 239	<3E-06	D 3		
Sn 126		8			Pu 240	<4E-06	D 3		
Sb 125		8			Pu 241	<1.30E-04	D 3		
Sb 126		8			Pu 242	<2E-09	D 3		
Te 125m		8			Am 241	<1.21E-05	D 3		
Te 127m		8			Am 242m	<1.91E-08	D 3		
I 129		8			Am 243	<6E-09	D 3		
Cs 134	<4.42E-08	D 3			Cm 242	<1.58E-08	D 3		
Cs 135		8			Cm 243	<4.88E-09	D 3		
Cs 137	<1.63E-04	D 3			Cm 244	<1.42E-07	D 3		
Ba 133		8			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	<3.82E-07	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.39E-07	D 3			Other a				
Eu 152	1.26E-05	CD 2			Other b/g				
Eu 154	9.66E-06	CD 2			<b>Total a</b>	<b>2.21E-05</b>	<b>CD 2</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>1.31E+01</b>	<b>CD 2</b>	<b>0</b>	

**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