

**WASTE STREAM****9C32****Miscellaneous Activated Components**

**SITE** Dungeness A  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Magnox Limited  
**WASTE TYPE** ILW; SPD3

**WASTE VOLUMES**

		Reported	
Stocks:	At 1.4.2019.....	8.4 m <sup>3</sup>	
Total future arisings:		0 m <sup>3</sup>	
Total waste volume:		8.4 m <sup>3</sup>	
Comment on volumes:	The station ceased generation on 31/12/2006.		
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; fuel element grabs, cables and capsules; thermocouples and bob weights removed from stand pipe assemblies. The possibility of large items which may need special handling has not been fully assessed. Items may weigh up to about 1.5 t; sizes may be up to 5 m long and approximately 250 mm diameter.

**Physical components (%vol):** Control rods, thermocouples, standpipe components, fuel element grabs, cables and capsules.

**Sealed sources:** -

**Bulk density (t/m<sup>3</sup>):** ~1

**Comment 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 is principally steel (mild steel, stainless steel, boron steel). Presence of other minor components has not been assessed.

**Chemical state:** Neutral

**Chemical form of radionuclides:**  
H-3: The tritium is likely to be incorporated into the steel.  
C-14: Carbon 14 is principally incorporated in steel. There may also be some graphite contamination.  
Cl-36: The chemical form of chlorine 36 has not been determined.  
U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.  
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

**Metals and alloys (%wt):** Metal thicknesses have not been fully assessed but bulk metal items may be present.

Stainless steel.....	~45.0	
Other ferrous metals.....	~45.0	Chromium and nickel will be present in the stainless steel.
Iron.....		
Aluminium.....	0	
Beryllium.....	0	
Cobalt.....		
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	0	
Nickel.....		

**WASTE STREAM**

**9C32**

**Miscellaneous Activated Components**

	Titanium.....	
	Uranium.....	
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	~10.0
		Not analysed.
Organics (%wt):	No organic material expected.	
	Total cellulose.....	0
	Paper, cotton.....	0
	Wood.....	0
	Halogenated plastics .....	0
		Halogenated plastics are not expected but may possibly be present in small quantities.
	Total non-halogenated plastics.....	0
	Condensation polymers.....	0
	Others.....	0
	Organic ion exchange materials....	0
	Total rubber.....	0
	Halogenated rubber .....	0
		Halogenated rubbers are not expected but may possibly be present in small quantities.
	Non-halogenated rubber.....	0
	Hydrocarbons.....	
	Oil or grease .....	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	0
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

**WASTE STREAM****9C32****Miscellaneous Activated Components**

	Free non-aqueous liquids.....	0
	Powder/Ash.....	TR
Inorganic anions (%wt):	Not fully assessed, possibly trace quantities.	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	0
	Carbonate.....	NE
	Nitrate.....	NE
	Nitrite.....	NE
	Phosphate.....	NE
	Sulphate.....	NE
	Sulphide.....	NE
Materials of interest for waste acceptance criteria:	There are no materials identified in the waste likely to represent a fire or other non-radiological hazard.	
	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:	-	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	
	Vinyl chloride.....	

**WASTE STREAM****9C32****Miscellaneous Activated Components**

Arsenic.....  
 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 will be packaged into 4m boxes (with no shielding) and encapsulated with grout.  
 Plant Name: None  
 Location: Dungeness A Site  
 Plant startup date: 2092  
 Total capacity (m<sup>3</sup>/y incoming waste): ~5000.0  
 Target start date for packaging this stream: 2092  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): ~2.0  
 Other information: The waste will be placed in baskets, then in the 4m box and grouted.

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	< 1

**WASTE STREAM****9C32****Miscellaneous Activated Components**

Likely container type comment:

-

Range in container waste volume:

Not yet determined.

Other information on containers:

The container material is expected to be stainless steel.

Likely conditioning matrix:  
Other information:

BFS/OPC and PFA/OPC

It is not yet known which grouting mix will be used when this waste is processed.

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

~3.0

Conditioned density comment:

The density assumes the waste will be conditioned with a cement based grout.

Other information on conditioning:

The waste will be placed in baskets, then in the 4m box and grouted. Baskets of other SPD3 ILW waste may be in the same package.

Opportunities for alternative disposal routing:

No

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source:

Irradiated components removed from the reactor. Control rods are likely to be components of high activity.

Uncertainty:

Specific activity is a function of Station operating history. The values quoted are indicative of the activities 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**

**9C32**

**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	<1.54E+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	3.98E-06	CD 2			Pb 205		8		
Fe 55	4.46E+00	CD 2			Pb 210		8		
Co 60	2.11E+00	CD 2			Bi 208		8		
Ni 59	4E-02	CD 2			Bi 210m		8		
Ni 63	3.68E+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	<4.50E-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	CC 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	<1E-08	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	<6.09E-09	D 3		
Ag 108m	3.92E-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	<2.73E-06	D 3		
Sn 123		8			Pu 239	<3E-06	D 3		
Sn 126		8			Pu 240	<4.00E-06	D 3		
Sb 125		8			Pu 241	<1.13E-04	D 3		
Sb 126		8			Pu 242	<2E-09	D 3		
Te 125m		8			Am 241	<1.07E-05	D 3		
Te 127m		8			Am 242m	<1.88E-08	D 3		
I 129		8			Am 243	<6.00E-09	D 3		
Cs 134	<3.84E-08	D 3			Cm 242	<1.55E-08	D 3		
Cs 135		8			Cm 243	<4.55E-09	D 3		
Cs 137	<1.51E-04	D 3			Cm 244	<5.71E-08	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	<2.21E-07	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.20E-07	D 3			Other a				
Eu 152	1.08E-05	CD 2			Other b/g				
Eu 154	7.64E-06	CD 2			<b>Total a</b>	<b>2.06E-05</b>	<b>CD 3</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>1.19E+01</b>	<b>CD 3</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