

**WASTE STREAM****9C33****Miscellaneous Activated Components**

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

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	58.0 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		58.0 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 absorber bars, charge chutes and stand pipe assemblies. The possibility of large items which may need special handling has not been fully assessed. Items may weigh up to about 1.5t; sizes may be up to 5 m long and approximately 250 mm diameter.

Physical components (%vol): Absorber bars, charge chutes and standpipe assemblies. Volume breakdown has been estimated.

Sealed sources: The waste does not contain 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) and there is also graphite and concrete (graphite in absorber bars, concrete in standpipe assemblies). Presence of other minor components is not 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.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~59.0		
Other ferrous metals.....	~36.0		
Iron.....			
Aluminium.....			
Beryllium.....	0		
Cobalt.....			
Copper.....			
Lead.....			

**WASTE STREAM**

**9C33**

**Miscellaneous Activated Components**

Magnox/Magnesium.....	0	
Nickel.....	NE	Chromium and nickel will be present as alloys.
Titanium.....		
Uranium.....		
Zinc.....		
Zircaloy/Zirconium.....	0	
Other metals.....	0	

Organics (%wt): No organic material expected.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	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.

	(%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.....	NE	maybe present in SPAs, quantity not estimated	
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	~5.0	in absorber bars	

<b>WASTE STREAM</b>	<b>9C33</b>	<b>Miscellaneous Activated Components</b>
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Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	TR

Inorganic anions (%wt):           Not fully assessed, possibly trace quantities.

	(%wt)	Type(s) and comment
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.

	(%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.....		
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances /  
non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....		
Boron (in Boral).....		
Boron (non-Boral).....		
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

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	0	

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Potential for the waste to contain discrete items:

Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs.

**PACKAGING AND CONDITIONING**

Conditioning method: The waste will be packaged into 4m boxes (with no shielding) and encapsulated.

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): ~12.0

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	4

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: BFS/OPC and PFA/OPC

Other information: 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 conditioning 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: -

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

**RADIOACTIVITY**

Source: Irradiated components removed from the reactor. Absorber bars and 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'.

**WASTE STREAM**

**9C33**

**Miscellaneous Activated Components**

Measurement of  
radioactivities:

Estimates are based upon theoretical assessments.

Other information:

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9C33

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	<1.30E+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	3.52E-07	CD 2			Pb 205		8		
Fe 55	2.09E+00	CD 2			Pb 210		8		
Co 60	1.42E+00	CD 2			Bi 208		8		
Ni 59	4E-02	CD 2			Bi 210m		8		
Ni 63	3.61E+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	<4.19E-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	<6.12E-09	D 3		
Ag 108m	3.90E-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	<2.66E-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	<9.74E-05	D 3		
Sb 126		8			Pu 242	<2E-09	D 3		
Te 125m		8			Am 241	<1.12E-05	D 3		
Te 127m		8			Am 242m	<1.85E-08	D 3		
I 129		8			Am 243	<6.00E-09	D 3		
Cs 134	<1.42E-08	D 3			Cm 242	<1.53E-08	D 3		
Cs 135		8			Cm 243	<4.25E-09	D 3		
Cs 137	<1.41E-04	D 3			Cm 244	<5.09E-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	<1.00E-07	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.01E-07	D 3			Other a				
Eu 152	9.26E-06	CD 2			Other b/g				
Eu 154	6.00E-06	CD 2			<b>Total a</b>	<b>&lt;2.09E-05</b>	<b>D 3</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>8.47E+00</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