

<b>WASTE STREAM</b>	<b>9E63</b>	<b>Redundant Sources</b>
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**SITE** Oldbury  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Magnox Limited  
**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2026 - 31.3.2027.....	< 0.1 m <sup>3</sup>
Total future arisings:		< 0.1 m <sup>3</sup>
Total waste volume:		< 0.1 m <sup>3</sup>

Comment on volumes: A small number of sources maybe disposed of prior to 2026. Common volume assumption of 0.0002m<sup>3</sup> per source (10cm x 10cm x 2cm) has been applied. Data from site source register shows 78 sources forecast to arise as waste in the future.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.2  
 Stock (lower): x Arisings (lower) x 0.8

**WASTE SOURCE** The redundant sources have been used for various purposes during the lifetime of the power station.

**PHYSICAL CHARACTERISTICS**

General description: Various redundant sealed sources. The sources are to be grouted in cementitious matrix into a suitable container before being placed in disposal containers.  
 Physical components (%wt): Plastic (60%), Paper (30%), Metal (10%)  
 Sealed sources: The waste contains sealed sources. 78  
 Bulk density (t/m<sup>3</sup>): 1  
 Comment on density: Density refers to sources on bases only, when they have been stripped of all extraneous materials, which are disposed of as non-active material. Redundant sources will then be encapsulated for disposal as LLW.

**CHEMICAL COMPOSITION**

General description and components (%wt): Plastic bases for sources are mainly PVC. Metal bases mainly Stainless Steel. Plastic (60%), Paper (30%), Metal (10%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not present.  
 C-14: The chemical form of carbon in the sources has not been determined.  
 Se-79: Not present.  
 Tc-99: Not present.  
 Ra: Not present.  
 Th: Not present.  
 U: Present as both natural Uranium sources and as enriched uranium sources.  
 Np: Not present.  
 Pu: Not present.

Metals and alloys (%wt): Small source capsules and thin mild steel.  
 Stainless steel..... 10.0  
 Other ferrous metals..... NE  
 Iron.....  
 Aluminium..... 0  
 Beryllium..... NE  
 Cobalt.....  
 Copper..... 0  
 Lead..... TR  
 Magnox/Magnesium..... 0

**WASTE STREAM****9E63****Redundant Sources**

	Nickel.....	
	Titanium.....	
	Uranium.....	NE
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	NE
Organics (%wt):	-	
	Total cellulose.....	~30.0
	Paper, cotton.....	~30.0
	Wood.....	0
	Halogenated plastics .....	~60.0
	Total non-halogenated plastics.....	0
	Condensation polymers.....	0
	Others.....	0
	Organic ion exchange materials....	0
	Total rubber.....	~0
	Halogenated rubber .....	NE
	Non-halogenated rubber.....	NE
	Hydrocarbons.....	
	Oil or grease .....	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	0
Other materials (%wt):	Sealed Sources	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	
	Glass/Ceramics.....	0
	Graphite.....	0
	Desiccants/Catalysts.....	
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0

**WASTE STREAM****9E63****Redundant Sources**

Inorganic anions (%wt):

-	
Fluoride.....	NE
Chloride.....	NE
Iodide.....	0
Cyanide.....	0
Carbonate.....	NE
Nitrate.....	0
Nitrite.....	0
Phosphate.....	0
Sulphate.....	NE
Sulphide.....	0

Materials of interest for waste acceptance criteria:

No materials likely to pose a fire or other non-radiological hazard have been identified.

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:

Very small quantities of lead may be present

Acrylamide.....	
Benzene.....	
Chlorinated solvents.....	
Formaldehyde.....	
Organometallics.....	
Phenol.....	
Styrene.....	
Tri-butyl phosphate.....	
Other organophosphates.....	
Vinyl chloride.....	
Arsenic.....	
Barium.....	

**WASTE STREAM****9E63****Redundant Sources**

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

**TREATMENT, PACKAGING AND DISPOSAL**

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

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

Comment on planned treatments:

Sources will be stripped of all extraneous material and encapsulated in grout in "paint-tin" type containers.

**WASTE STREAM****9E63****Redundant Sources****Disposal Routes:**

Disposal Route	Stream volume %
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	100.0

**Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	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	15.5	< 1

**Other information:**

Only one paint-tin type container is allowed per disposal container for sealed sources. It is expected that this stream will be disposed with other LLW streams.

**Waste Planned for Disposal at the LLW Repository:****Container voidage:**

Significant inaccessible voidage is not expected.

**Waste Characterisation Form (WCH):**

The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

**Waste consigned for disposal to LLWR in year of generation:**

No. Disposal may be phased since only one container of sources may be included in each Half-height ISO.

**Potential for the waste to contain discrete items:**

-

**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:	Redundant sealed sources used for a variety of purposes around the power station site
Uncertainty:	Data taken from site source register and decayed to common stock reference date/start date of first arising
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:	Based on manufacturers' specifications.
Other information:	-

**WASTE STREAM**

**9E63**

**Redundant Sources**

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			1.23E-04	B B 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			3.44E-04	B B 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			5.18E-06	B B 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				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			3.99E-05	B B 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63				8	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226		6.37E-01	B B 2	8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			1.22E-02	B B 2	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				8	Th 234				8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			1.63E-05	B B 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235		2.35E-03	B B 2	8
Ag 110m				8	U 236				8
Cd 109				8	U 238		1.1E-05	B B 2	8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		2.34E-06	B B 2	8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			6.11E-01	B B 2	Cm 244				8
Ba 133			3.65E-04	B B 2	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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152				8	Other b/g		1.33E-09	B B 2	
Eu 154				8	<b>Total a</b>	<b>0</b>	<b>6.39E-01</b>	<b>B B 2</b>	
Eu 155				8	<b>Total b/g</b>	<b>0</b>	<b>6.24E-01</b>	<b>B B 2</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