

<b>WASTE STREAM</b>	<b>9E50</b>	<b>Contaminated Gravel</b>
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**SITE** Oldbury  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Magnox Limited  
**WASTE TYPE** ILW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	4.0 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		4.0 m <sup>3</sup>
Comment on volumes:	Gravel will be removed from the vaults when the wastes accumulated in the vault are retrieved, probably in 2023.	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

**WASTE SOURCE** Contaminated gravel (stone chippings) on the floor of a vault. The gravel was applied before any waste was discharged to the facility.

**PHYSICAL CHARACTERISTICS**

General description: Contaminated gravel. There are no large items.  
 Physical components (%vol): 100% contaminated gravel. Likely to be either limestone or silica based.  
 Sealed sources: -  
 Bulk density (t/m<sup>3</sup>): ~1.5  
 Comment on density: The gravel is assumed to be either limestone or silica based. The density range has not been estimated.

**CHEMICAL COMPOSITION**

General description and components (%wt): The chemical composition of the chippings is not known. It is likely that either silica or limestone based material has been used. Fission products, actinides and other activation products will be present as contaminants.

Chemical state: Neutral

Chemical form of radionuclides:  
 H-3: Tritium will be present in the form of tritiated water.  
 C-14: Carbon 14 will be present in the form of graphite dust contamination.  
 Cl-36: Chlorine 36 will be present in graphite dust contamination.  
 Se-79: The selenium content is insignificant.  
 Tc-99: The technetium content is insignificant.  
 Ra: The radium isotope content is insignificant.  
 Th: The thorium isotope content is insignificant.  
 U: Uranium may be present as natural uranium metal contamination.  
 Np: The neptunium content is insignificant.  
 Pu: Plutonium may be present as metal or oxide.

Metals and alloys (%wt): No bulk or sheet metal items present.

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	0
Beryllium.....	NE
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	NE

Only trace metallic content would be expected to be associated with the original gravel, but there may be contamination from the

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wastes resting on the gravel.

Nickel.....

Titanium.....

Uranium.....

Zinc..... 0

Zircaloy/Zirconium..... NE

Other metals..... 0

No "other" metals are expected.

## Organics (%wt):

Organics may be present in trace quantities. Halogenated plastics and rubbers will not 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 ..... 0

Fuel..... 0

Asphalt/Tarmac (cont.coal tar)... 0

Asphalt/Tarmac (no coal tar).... 0

Bitumen..... 0

Others..... 0

Other organics..... TR

## Other materials (%wt):

Some graphite contamination.

Inorganic ion exchange materials. 0

Inorganic sludges and flocs..... 0

Soil..... 0

Brick/Stone/Rubble..... 100.0

Cementitious material..... 0

Sand..... 0

Glass/Ceramics..... 0

Graphite..... TR

Desiccants/Catalysts..... 0

Asbestos..... 0

Non/low friable..... 0

Moderately friable..... 0

Highly friable..... 0

Free aqueous liquids..... TR

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	Free non-aqueous liquids.....	0
	Powder/Ash.....	TR
Inorganic anions (%wt):	The inorganic anion content of the gravel has not been fully assessed. Carbonates and silicates may be present.	
	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 may be some Magnox mixed with the gravel. This could ignite under appropriate conditions.	
	Combustible metals.....	NE
	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.....	NE
	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.....	

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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): Yes  
     EDTA.....  
     DPTA.....  
     NTA.....  
     Polycarboxylic acids.....  
     Other organic complexants.....  
     Total complexing agents..... TR

**PACKAGING AND CONDITIONING**

Conditioning method: The gravel will be retrieved when the rest of the vault contents are retrieved. It might be washed and any LLW material subsequently separated from ILW but in view of the small volume of this stream all of the waste is expected to be managed as ILW.

Plant Name: None

Location: Oldbury Power Station

Plant startup date: 2023

Total capacity (m<sup>3</sup>/y incoming waste): ~500.0

Target start date for packaging this stream: 2023

Throughput for this stream (m<sup>3</sup>/y incoming waste): 4.0

Other information: The waste will be retrieved and packaged after retrieval of Magnox FED from the vault has been completed.

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Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	3m <sup>3</sup> RS box	100.0	2	2.5	2

Likely container type comment: No volume reduction or increase is anticipated.

Range in container waste volume: No significant variability is expected.

Other information on containers: The package material is expected to be stainless steel or mild steel if applicable.

Likely conditioning matrix: None

Other information: -

Conditioned density (t/m<sup>3</sup>): ~1.5

Conditioned density comment: This density is expected to vary by not more than 10% from the average.

Other information on conditioning: Appropriate plant will be provided at the Station in accordance with Company strategy. ILW will be placed in a Type VI DCIC and dried, if applicable, any LLW will be placed in a mild steel half height ISO container.

Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source: Contamination may have been transferred to the chippings via direct contact with waste materials and this may have been enhanced by moisture from the waste. The ability of the chippings to absorb soluble active materials depends on the chemical composition of the chippings themselves.

Uncertainty: The waste is assumed to be ILW. This can be confirmed only when the waste is retrieved. The waste may be rendered LLW by washing.

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: Levels of contamination have been estimated from the activity of the Magnox debris in the vault.

Other information: -

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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	1.21E-04	CC 2			Gd 153			8	
Be 10	2E-08	CC 2			Ho 163			8	
C 14	1.00E-05	CC 2			Ho 166m			8	
Na 22		8			Tm 170			8	
Al 26	1E-07	CC 2			Tm 171			8	
Cl 36	2E-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	<2E-06	C 3			Pt 193			8	
Mn 53		8			Tl 204			8	
Mn 54		8			Pb 205			8	
Fe 55	4.04E-07	CC 2			Pb 210			8	
Co 60	<6.13E-03	C 3			Bi 208			8	
Ni 59	3E-03	CC 2			Bi 210m			8	
Ni 63	3.76E-01	CC 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	2.42E-06	CC 2			Th 227			8	
Zr 93	1E-06	CC 2			Th 228			8	
Nb 91		8			Th 229			8	
Nb 92		8			Th 230			8	
Nb 93m	5.87E-07	CC 2			Th 232			8	
Nb 94		8			Th 234	3E-09	CC 2		
Mo 93		8			Pa 231			8	
Tc 97		8			Pa 233			8	
Tc 99		8			U 232			8	
Ru 106		8			U 233			8	
Pd 107		8			U 234	3.06E-09	CC 2		
Ag 108m	3.94E-07	CC 2			U 235			8	
Ag 110m		8			U 236			8	
Cd 109		8			U 238	3E-09	CC 2		
Cd 113m	<3.82E-06	C 3			Np 237			8	
Sn 119m		8			Pu 236			8	
Sn 121m	<1.78E-05	C 3			Pu 238	1.86E-06	CC 2		
Sn 123		8			Pu 239	1.00E-06	CC 2		
Sn 126		8			Pu 240	2.00E-06	CC 2		
Sb 125	4.14E-09	CC 2			Pu 241	1.95E-05	CC 2		
Sb 126		8			Pu 242			8	
Te 125m	1.04E-09	CC 2			Am 241	5.28E-06	CC 2		
Te 127m		8			Am 242m	8.61E-09	CC 2		
I 129		8			Am 243	3.00E-09	CC 2		
Cs 134		8			Cm 242	7.11E-09	CC 2		
Cs 135		8			Cm 243	1.62E-09	CC 2		
Cs 137	4.07E-06	CC 2			Cm 244	2.12E-08	CC 2		
Ba 133	<2.21E-06	C 3			Cm 245			8	
La 137	<5E-07	C 3			Cm 246			8	
La 138		8			Cm 248			8	
Ce 144		8			Cf 249			8	
Pm 145		8			Cf 250			8	
Pm 147	<3.71E-07	C 3			Cf 251			8	
Sm 147		8			Cf 252			8	
Sm 151	7.46E-09	CC 2			Other a				
Eu 152		8			Other b/g				
Eu 154	9.66E-09	CC 2			<b>Total a</b>	<b>1.02E-05</b>	<b>CC 2</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>3.85E-01</b>	<b>CC 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