

WASTE STREAM	9E321	Contaminated Soil LLW
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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 ³
Future arisings -	1.4.2096 - 31.3.2101.....	1000.0 m ³
Total future arisings:		1000.0 m ³
Total waste volume:		1000.0 m ³

Comment on volumes: Waste arisings are assumed to occur at a uniform rate over 5 years. Waste generation is assumed to commence in 2096. Volumes and radioactivity have been calculated for 85 years after reactor shutdown.

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

WASTE SOURCE Contaminated soil that has resulted from plant operation and maintenance.

PHYSICAL CHARACTERISTICS

General description: Based on made ground, topsoil and upper natural material descriptions: topsoil rarely described in reference, assumed to be derived largely from upper natural. Predominantly a sandy silty clay material with inclusions of limestone and siltstone and occasionally brick, concrete, peat and shale.

Physical components (%vol): Clay (60%), sand/silt (25%), others (15%) predominantly limestone and siltstone with occasional brick, concrete and shale fragments.

Sealed sources: -

Bulk density (t/m³): ~1.7

Comment on density: The bulk density is an estimate and may be subject to revision. Assumes bulkage factor (physical expansion) of 1.3 (higher for cohesive materials than granular). Available information about the soil types indicates that the bulkage factor could be 1.5 and the density would then be 1.45t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Soil, rubble, organic material and water. Percentages are not estimated.

Chemical state: Neutral

Chemical form of radionuclides: H-3: The tritium content is insignificant.
C-14: The carbon 14 content is insignificant.
Cl-36: The chlorine 36 content is insignificant.
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: The uranium isotope content is insignificant.
Np: The neptunium content is insignificant.
Pu: The plutonium isotope content is insignificant.

Metals and alloys (%wt): There are no bulk or sheet metal items present in the waste.

Stainless steel..... 0
Other ferrous metals..... 0
Iron.....
Aluminium..... 0
Beryllium..... 0
Cobalt.....
Copper..... 0

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Lead..... 0
 Magnox/Magnesium..... 0
 Nickel.....
 Titanium.....
 Uranium.....
 Zinc..... 0
 Zircaloy/Zirconium..... 0
 Other metals..... 0

Other metals are not expected
 except in their oxide form.

Organics (%wt):

Organic matter will be associated with the soil. Halogenated plastics or rubbers are not expected.

Total cellulose..... NE
 Paper, cotton..... NE
 Wood..... NE
 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..... NE

Other materials (%wt):

-
 Inorganic ion exchange materials. 0
 Inorganic sludges and flocs..... 0
 Soil..... 75.0
 Brick/Stone/Rubble..... 0
 Cementitious material..... 0
 Sand..... 25.0
 Glass/Ceramics..... 0
 Graphite..... 0
 Desiccants/Catalysts.....
 Asbestos..... 0
 Non/low friable.....
 Moderately friable.....
 Highly friable.....

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	Free aqueous liquids.....	NE
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	Anion content not fully determined. The anion content of the waste is naturally occurring oxides expected in soil.	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	NE
	Carbonate.....	NE
	Nitrate.....	NE
	Nitrite.....	NE
	Phosphate.....	NE
	Sulphate.....	NE
	Sulphide.....	NE
Materials of interest for waste acceptance criteria:	There will be water associated with the waste. There may be traces of biological material.	
	Combustible metals.....	0
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	TR
	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:	Any toxic metal content would be at the natural incidence for the type of soil.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	

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Vinyl chloride.....
 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):

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... NE

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		100.0

Comment on planned treatments:

-

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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: (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m ³	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			

Other information: It is likely that this waste will be placed in containers with other waste.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: In-accessible voidage is not expected.

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: The timing of consignment of the waste for disposal cannot be determined at present.

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: -

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RADIOACTIVITY

Source:	Contamination that has resulted from plant maintenance and operation. Cs-137 is expected to dominate.
Uncertainty:	Only approximate estimates have been made of the total specific activities. The estimates are typical of measurements at other sites, the activity may vary either way by a factor of 10. The activities quoted are those at the time of final site decommissioning.
Definition of total alpha and total beta/gamma:	Beta/gamma activities have not been quantified and the total beta/gamma activity is therefore an estimate. All alpha emitter activities are insignificant.
Measurement of radioactivities:	Provision of detailed data will have to await detailed site characterisation.
Other information:	No radionuclides other than those listed are expected to be significant.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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				8	Gd 153				8
Be 10				8	Ho 163				8
C 14				8	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36				8	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				8	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				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90				6	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				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				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				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			1E-05	CC 2	Cm 244				8
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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152				8	Other b/g				
Eu 154				8	Total a	0		0	
Eu 155				8	Total b/g	0		1E-05	CC 2

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