

WASTE STREAM	9B13	Desiccant
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SITE Bradwell
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	11.4 m ³
Total future arisings:		0 m ³
Total waste volume:		11.4 m ³
Comment on volumes:	Potential for legacy desiccant remaining from retrieval operations and in residue in vessels.	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE Reactor gas driers (humidriers) - desiccant renewal.

PHYSICAL CHARACTERISTICS

General description: Desiccant pellets were stored in steel drums with plastic liners. Desiccant has been transferred to DCIC's for interim storage, pending availability of a national disposal facility. This volume accounts for any potential residue remaining in vessels and pipework, There are no large items. Bulk desiccant has been transferred to DCIC' s for storage.

Physical components (%wt): Desiccant pellets (Alumina Oxide).

Sealed sources: -

Bulk density (t/m³): 0.8

Comment on density: Density based on typical weight of a 200 litre drum of stored material.

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium oxide (~95% wt), and plastic (~5% wt).

Chemical state: Neutral

Chemical form of radionuclides: H-3: The tritium will be present as tritiated water.
Cl-36: Chlorine 36 will probably be present as inorganic chloride.

Metals and alloys (%wt): There are steel drums containing the waste, but these will be reused.

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): The only organic material is the high density polythene drum liners.

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	Total cellulotics.....	0	
	Paper, cotton.....	0	
	Wood.....	0	
	Halogenated plastics	0	
	Total non-halogenated plastics.....	~5.0	
	Condensation polymers.....	0	
	Others.....	~5.0	polythene drum liners
	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.....	0	
Other materials (%wt):	-		
	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.....	95.0	Aluminium oxide
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	TR	
Inorganic anions (%wt):	The inorganic anion content has not been fully assessed.		

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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:

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:

None expected

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

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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

LAW TREATMENT, PACKAGING AND DISPOSAL

Waste that is currently ILW: The waste has been placed in 5 off DCIC Type VI's for on-site decay storage until such time as it is suitable for disposal as LLW when it will be repackaged into HHISO's.

Planned on-site / off-site treatments(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:

Waste will be decay stored until such time as it meets LLWR WAC for disposal.

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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:

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	100.0	~6	2

Other information:

Once decayed to LLW, the waste will be transferred into 200 litre drums and placed inside a HHISO. Expect between 30 and 36 drums per HHISO. For this Inventory a loading of 30 drums per HHISO has been assumed.

Waste Consigned to the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation:

No. Waste will be decay stored on-site in 5 off type VI DCICs until such time as it can be disposed as LLW.

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: -

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Other information: -

RADIOACTIVITY

Source: Contamination by tritium.

Uncertainty: -

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: The activity values are derived from sampling results.

Other information: Specific activity is a function of operating history.

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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		Waste at 1.4.2019	Bands and Code	Future arisings
H 3	1.17E-01	BB 1		Gd 153		8	
Be 10		8		Ho 163		8	
C 14	1.28E-03	BB 1		Ho 166m		8	
Na 22		8		Tm 170		8	
Al 26		8		Tm 171		8	
Cl 36	3.26E-04	BB 1		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		6		Pb 205		8	
Fe 55	2.02E-04	BB 1		Pb 210		8	
Co 60	3.06E-02	BB 1		Bi 208		8	
Ni 59		8		Bi 210m		8	
Ni 63	1.41E-04	BB 1		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		8		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	8.47E-06	BB 1	
Sb 126		8		Pu 242		8	
Te 125m		8		Am 241	1.51E-07	BB 1	
Te 127m		8		Am 242m		8	
I 129		8		Am 243		8	
Cs 134		6		Cm 242		8	
Cs 135		8		Cm 243		8	
Cs 137	3.99E-06	BB 1		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	9.19E-07	BB 1		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	1.51E-07	BB 1	0
Eu 155		8		Total b/g	1.5E-01	BB 1	0

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