WASTE STREAM 9R113 Redundant Radioactive Sources

SITE	Berkeley
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW

WASTE VOLUMES

		Reported		
Stocks:	At 1.4.2019.....	<< 0.1 m³		
Total future arisings:		0 m³		
Total waste volume:		<< 0.1 m³		
Comment on volumes:	Actual volume 0.0002 m3.			
Uncertainty factors on volumes:	Stock (upper): x 1.1		Arisings (upper)	x
	Stock (lower): x 0.5		Arisings (lower)	x

WASTE SOURCE Decommissioning of former laboratory facilities.

PHYSICAL CHARACTERISTICS

General description:	Radioactive sources that have been used for instrument calibrations and laboratory purposes. These items are now surplus to requirements and cannot be recycled. There are no large items.
Physical components (%wt):	Metal (95%), Plastic (5%).
Sealed sources:	-
Bulk density (t/m³):	~1
Comment on density:	-

CHEMICAL COMPOSITION

General description and components (%wt):	Metal (95%), Plastic (5%).		
Chemical state:	Neutral		
Chemical form of radionuclides:	-		
Metals and alloys (%wt):	-		
	Stainless steel.....		
	Other ferrous metals.....		
	Iron.....		
	Aluminium.....		
	Beryllium.....		
	Cobalt.....		
	Copper.....		
	Lead.....		
	Magnox/Magnesium.....		
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....	95.0	Unsure what metal type.
Organics (%wt):	-		

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	Total cellulosics.....	0
	Paper, cotton.....	
	Wood.....	
	Halogenated plastics	
	Total non-halogenated plastics.....	5.0
	Condensation polymers.....	
	Others.....	5.0
	Organic ion exchange materials....	
	Total rubber.....	0
	Halogenated rubber	
	Non-halogenated rubber.....	
	Hydrocarbons.....	
	Oil or grease	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar).....	
	Bitumen.....	
	Others.....	
	Other organics.....	
Other materials (%wt):	-	
	Inorganic ion exchange materials.	
	Inorganic sludges and flocs.....	
	Soil.....	
	Brick/Stone/Rubble.....	
	Cementitious material.....	
	Sand.....	
	Glass/Ceramics.....	
	Graphite.....	
	Desiccants/Catalysts.....	
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	-	

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Fluoride.....

Chloride.....

Iodide.....

Cyanide.....

Carbonate.....

Nitrate.....

Nitrite.....

Phosphate.....

Sulphate.....

Sulphide.....

Materials of interest for waste acceptance criteria: -

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.....

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 Recyling / reuse Other / various None	Off-site	100.0

Comment on planned treatments: The waste will be encapsulated in a 10 litre container prior to being placed in either a THISO or a HHISO prior to disposal.

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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 m³	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO	50.0	~0.04	< 1
1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	50.0	~0.07	< 1

Other information: Other solid LLW will be added to the THISO.

Waste Planned for Disposal at the LLW Repository:

Container voidage: No inaccessible voidage is present.

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

The waste will be conditioned to meet the WAC.

Waste consigned for disposal to LLWR in year of generation: No. The waste will be conditioned and placed in either a THISO or a HHISO pending disposal. The waste was not consigned in the year of generation, as treatment facilities were not available.

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:	A mixture of Alpha, Beta and Gamma emitting sources.
Uncertainty:	Activities derived from source calibration certificates.
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:	Activities stimated from decay correction of source activities that were certificated on particular reference dates.
Other information:	The values quoted are indicative of the activities that might be expected.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ 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	2.00E-03	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	4E-06	C C 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		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	5.65E-07	C C 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		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	4.94E-04	C C 2		
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	8.13E-05	C C 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**	**4.94E-04**	**C C 2**	**0**	
Eu 155		8			**Total b/g**	**2.09E-03**	**C C 2**	**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