WASTE STREAM 5C319 Ripple Crates

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	20.2 m³
Total future arisings:		0 m³
Total waste volume:		20.2 m³

Comment on volumes: -

Uncertainty factors on volumes:

Stock (upper):	x 1.05	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE The waste stream consist of the equipment used to produce Sr-90 titanate sources for the RIPPLE (Radio Isotope Powered Prolonged Life Equipment) generators.

PHYSICAL CHARACTERISTICS

General description: 9 wooden crates and 1 metal tank containing the disassembled plant that was used to produce the RIPPLE sources during the late 60's and early 70's at Harwell. The disassembled plant is contaminated with strontium titanate.

Physical components (%vol): Steel, plastic, wood and ceramic

Sealed sources: -

Bulk density (t/m³): ~0.65

Comment on density: Based on recorded masses and volumes of outer containers.

CHEMICAL COMPOSITION

General description and components (%wt): ~95% metal, 5% other.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): Metal is typically around 3mm thick.

Stainless steel.....	~95.0	The identity of steels/other alloys is not known.
Other ferrous metals.....	P	
Iron.....		
Aluminium.....	P	
Beryllium.....		
Cobalt.....		
Copper.....	TR	
Lead.....		
Magnox/Magnesium.....	TR	
Nickel.....		
Titanium.....		
Uranium.....		
Zinc.....	TR	
Zircaloy/Zirconium.....	TR	
Other metals.....		Metal proportions unknown. Probably most is steel

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Organics (%wt):	-	
	Total cellulosics	~1.0
	Paper, cotton	
	Wood	~1.0
	Halogenated plastics	~3.0
	Total non-halogenated plastics	NE
	Condensation polymers	NE
	Others	NE
	Organic ion exchange materials	
	Total rubber	TR
	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	TR
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	
	Asbestos	
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	
	Free non-aqueous liquids	
	Powder/Ash	
Inorganic anions (%wt):	-	

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Fluoride	0
Chloride	TR
Iodide	0
Cyanide	0
Carbonate	P
Nitrate	0
Nitrite	0
Phosphate	0
Sulphate	TR
Sulphide	0

Materials of interest for waste acceptance criteria: -

- Combustible metals
- Low flash point liquids
- Explosive materials
- Phosphorus
- Hydrides
- Biological etc. materials
- Biodegradable materials
  - Putrescible wastes
  - Non-putrescible wastes
- Corrosive materials
- Pyrophoric materials
- Generating toxic gases
- Reacting with water
- 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

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		100.0

Comment on planned treatments: -

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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 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	100.0	10	3

Other information: LLWR have not yet accepted the case to dispose the RIPPLE crates at the repository. At the point when the crates are transferred to LLWR they would presumably be packaged within ISO containers.

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): -

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

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:	Sr-90 only.
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:	Legacy inventory noted at the point when the crates were transferred for storage in the early 70's.
Other information:	-

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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		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	1.06E-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		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		8			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**	**1.06E-02**	**B B 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