WASTE STREAM 9A980 Caesium Removal Plant Decommissioning.

SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2019 - 31.3.2023.....	33.1 m³
Total future arisings:		33.1 m³
Total waste volume:		33.1 m³

Comment on volumes: Arisings are predicted by quantity survey and contamination levels advised by health physics. Volumes include a contingency of 5% by vol secondary wastes from handling / decontamination. The demolition will not start until all the tanks have been emptied.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.1
Stock (lower):	x	Arisings (lower)	x 0.9

WASTE SOURCE Plant arisings from Caesium Removal Plant & mobile waste building. Steel components from dismantling plant and pipework in the caesium removal plant and concrete from the structure. Given volume includes a contingency of up to 5% secondary waste from both handling and decontamination and assumes decontamination of some items.

PHYSICAL CHARACTERISTICS

General description: Mainly pipework and tanks that had been in contact with ion exchange material and sludge, and contaminated building rubble. If necessary items will be reduced in size to fit containers. Includes some secondary waste.

Physical components (%wt): 64.3% Steel and Ferrous (Tanks from Caesium Removal Plant (CRP) Post Operational Clean Out (POCO), Deplanting Platforms, General Waste (Deplant & demolish Buildings), Light Iron Duct Work (Ventilation Plant ducting and cable trays), General Scrap (Ventilation equipment etc.), 20% Concrete (Covers etc), 12% Cable-Cu, 1% Fibre Insulation, 1% plastic, 1% biodegradable non-putrescible, 1% rubber.

Sealed sources: -

Bulk density (t/m³): ~1.45

Comment on density: based on WCH data

CHEMICAL COMPOSITION

General description and components (%wt): 64.3% Steel & Ferrous, 12% copper, 20% concrete, 1% plastic, 1% biodegradable non-putrescible, 1% rubber, 1% insulation.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Any tritium is expected to be present as water, but some may be in the form of other inorganic compounds or as organic compounds.
Cl-36: The chlorine 36 content is insignificant.
Pu: Chemical form of plutonium has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Items will have been cut for packaging. Thicknesses are likely to vary from a few mm to about 25 mm.

Stainless steel.....	~53.0	Tanks, pumps, deplanting material
Other ferrous metals.....	~11.0	Ventilation equipment, deplanting materials, drums, valves, couplings
Iron.....	~0.30	
Aluminium.....	~0.01	Surface Area = 1 m2, Sheets, hoover body
Beryllium.....	0	
Cobalt.....		
Copper.....	~12.0	Cabling

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	Lead	0	
	Magnox/Magnesium	0	
	Nickel		
	Titanium		
	Uranium	0	
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	NE	"Other" metals not identified
Organics (%wt):	Trace amounts of ion exchange resin on tank components could be present.		
	Total cellulosics	~0	
	Paper, cotton		
	Wood		
	Halogenated plastics	NE	
	Total non-halogenated plastics	~1.0	
	Condensation polymers	~0	
	Others	~1.0	
	Organic ion exchange materials	TR	
	Total rubber	~1.0	
	Halogenated rubber	~0.50	
	Non-halogenated rubber	~0.50	
	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.	NE	
	Inorganic sludges and flocs	NE	
	Soil	NE	
	Brick/Stone/Rubble	NE	
	Cementitious material	~20.0	
	Sand		
	Glass/Ceramics	~1.0	man made mineral fibre insulation
	Graphite	NE	
	Desiccants/Catalysts		
	Asbestos		
	Non/low friable		
	Moderately friable		
	Highly friable		

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Free aqueous liquids.....	TR
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): There may be traces of inorganic ions from ion exchange materials.

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: -

Combustible metals.....	0
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0
Hydrides.....	0
Biological etc. materials.....	0
Biodegradable materials.....	1.0
Putrescible wastes.....	0
Non-putrescible wastes.....	~1.0
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. Whilst there is no known evidence of asbestos in CRP waste, there remains the possibility for some asbestos in gaskets, etc. This will be assessed for each item prior to disposal.

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..... P	5 off Hoover motors
	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	On-site	~0.50
Supercompaction (HFC)	Off-site	~0.50
Incineration	Off-site	~9.0
Solidification		
Decontamination		
Metal treatment	Off-site	~68.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		~22.5

Comment on planned treatments: 14% to go as VLLW.

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Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	9.0
Expected to be consigned to a Landfill Facility	14.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	9.0
Expected to be consigned to a Metal Treatment Facility	68.0
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	
Disposal route not known	

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	~0.50	~43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	~8.5	~10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: It is likely that this waste will be placed in a container with other LLW. 43.2m3 loading volume (in the WAMAC container) is calculated based on the fact that you can low force compact two times the normal volume of waste into a 200 litre/0.2m3 drum (400 litres/0.4m3), you can then fit 36 drums (14.4m3) into a ½ height ISO, each drum can be super-compacted to a 1/3 of its original volume so therefore we can get 3 x the amount of un-compacted drums into the final disposal container (43.2m3).

Waste Planned for Disposal at the LLW Repository:

Container voidage: No significant inaccessible voidage is expected.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste has a current WCH.

Reassessment of the volume of arisings since publication of the WCF has led to an increase in the volume of this waste stream.

Waste consigned for disposal to LLWR in year of generation: Yes. 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 (%): -

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Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source:	Contamination of steel pipework, vessels and concrete structure.
Uncertainty:	The values quoted were derived by calculation and are indicative of the activities that are expected.
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:	data taken from WCH and decayed by 6 years
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			4.63E-06	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			5.92E-07	C C 1	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			1.06E-08	C C 1	Pb 210				8
Co 60			8.8E-08	C C 1	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			5.11E-07	C C 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			2.99E-04	C C 1	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			2.08E-06	C C 1
Sn 123				8	Pu 239			4.18E-06	C C 1
Sn 126				8	Pu 240			5.52E-06	C C 1
Sb 125				8	Pu 241			4.86E-05	C C 1
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			1.94E-05	C C 1
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			1.65E-03	C C 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			6.29E-09	C C 2	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152				8	Other b/g				
Eu 154			2.82E-07	C C 2	**Total a**	**0**		**3.12E-05**	**C C 2**
Eu 155				8	**Total b/g**	**0**		**2.00E-03**	**C C 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