WASTE STREAM 9A920 Reactor LLW

SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	~0.2 m³
Total future arisings:		0 m³
Total waste volume:		0.2 m³

Comment on volumes: Volumes include a contingency of 5% by vol secondary wastes (handling / decontamination).

Uncertainty factors on volumes:				
	Stock (upper):	x 1.5	Arisings (upper)	x
	Stock (lower):	x 0.5	Arisings (lower)	x

WASTE SOURCE 9A920 currently consists of soft and hard trash resulting from safestore preparations, as we;;a s on going inspections and maintenance of the reactor buildings. this waste includes steel work, cables, rubble, wood, where such work has been carried out, as well as secondary wastes (eg; used PPE, plastic sheeting etc.) Some of the waste is likely to be contaminated by asbestos(<1% wt) from past use of this substance in lagging and other building materials.

PHYSICAL CHARACTERISTICS

General description: Hard and soft trash and redundant equipment.

Physical components (%vol): Metal: 45%, Concrete 15%, Cellulosic 10%, Plastic / rubber 20% and wood 10%

Sealed sources: -

Bulk density (t/m³): ~0.85

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal: 45%, Concrete 15%, Cellulosic 10%, Plastic / rubber 20% and wood 10%.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Most tritium is expected to be present as water but some may be in the form of other inorganic compounds or as organic compounds.
C-14: Chemical form of carbon 14 has not been determined but may be graphite.
Cl-36: Chemical form of chlorine 36 has not been determined.
U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Steel brackets, cable tray conduit and ducting, frames handrails, piping and boxes. Some items will have to be cut for packaging.

Stainless steel.....	TR	
Other ferrous metals.....	45.0	miscellaneous steelwork (e.g. cable trays, pipes, handrails)
Iron.....		
Aluminium.....	TR	
Beryllium.....	0	
Cobalt.....		
Copper.....	TR	
Lead.....	0	
Magnox/Magnesium.....	0	

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	Nickel		
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	NE	The waste may include a small volume of palladium.
Organics (%wt):	The waste may contain cellulose and cloth as secondary waste, halogenated plastic as PVC and non-halogenated plastic as polythene.		
	Total cellulosics	20.0	
	Paper, cotton	10.0	
	Wood	10.0	
	Halogenated plastics	NE	Halogenated plastic may be present as PVC.
	Total non-halogenated plastics	10.0	
	Condensation polymers	0	
	Others	10.0	polythene
	Organic ion exchange materials	0	
	Total rubber	10.0	
	Halogenated rubber	0	
	Non-halogenated rubber	10.0	
	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.	NE	
	Inorganic sludges and flocs	NE	
	Soil	NE	
	Brick/Stone/Rubble	15.0	
	Cementitious material	NE	
	Sand		
	Glass/Ceramics	NE	
	Graphite	NE	
	Desiccants/Catalysts		
	Asbestos	~0.01	
	Non/low friable	0	
	Moderately friable	0	
	Highly friable	~0.01	Mixture
	Free aqueous liquids	0	

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Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): No significant anion content is expected in the waste.

Fluoride..... 0

Chloride..... 0

Iodide..... 0

Cyanide..... 0

Carbonate..... 0

Nitrate..... 0

Nitrite..... 0

Phosphate..... 0

Sulphate..... 0

Sulphide..... 0

Materials of interest for waste acceptance criteria: Asbestos may be present.

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: Some of the waste is likely to be contaminated by asbestos(<1% wt) from past use of this substance in lagging and other building materials.

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	On-site	34.3
Supercompaction (HFC)	Off-site	34.3
Incineration	Off-site	~34.3
Solidification		
Decontamination		
Metal treatment	Off-site	~24.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		~7.5

Comment on planned treatments: 34.25% expected to be consigned to incineration, 24% to metallic treatment, 5% of waste is expected to be consigned to Landfill as VLLW, 34.25% to Supercompaction and 2.5% direct to LLWR.

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Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	36.8
Expected to be consigned to a Landfill Facility	5.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	34.3
Expected to be consigned to a Metal Treatment Facility	24.0
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	~34.3	~43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	~2.5	~10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: It is likely that this waste will be placed in containers with other LLW. 43.2m3 loading volume for 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.

Waste consigned for disposal to LLWR in year of generation: No. Maximum holding period 1 year. The timing of consignments is under review.

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: -

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Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source:	Activity is mainly from materials contaminated by activation products.
Uncertainty:	Specific activity is a function of Station operating history. The values quoted are indicative of the activities that would be 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:	The specific activities have been estimated from waste stream fingerprint data 1MXN-1BNL-0-WCH-0-3917 v1.2 decayed by two 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	1.31E-04	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	4.90E-05	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.39E-05	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	1.99E-06	C C 2			Pb 210		8		
Co 60	1.39E-05	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	1.12E-05	C C 2			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	3.52E-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	3.60E-09	C C 2		
Sn 123		8			Pu 239	6.25E-09	C C 2		
Sn 126		8			Pu 240	1.25E-08	C C 2		
Sb 125		8			Pu 241	7.38E-08	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	1.27E-08	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	5.20E-07	C C 2			Cm 244		8		
Ba 133	5.48E-08	C C 2			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	9.57E-08	C C 2			Other b/g				
Eu 154	9.62E-08	C C 2			**Total a**	**3.51E-08**	**C C 2**	**0**	
Eu 155	9.39E-09	C C 2			**Total b/g**	**2.22E-04**	**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