WASTE STREAM 9J319 Reactor and Auxiliary Building LLW

SITE	Hunterston A
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2072 - 31.3.2080.....	469.7 m³
Total future arisings:		469.7 m³
Total waste volume:		469.7 m³

Comment on volumes: Waste volumes include a proportion of secondary waste arisings.

Uncertainty factors on volumes:				
	Stock (upper):	x	Arisings (upper)	x 1.2
	Stock (lower):	x	Arisings (lower)	x 0.8

WASTE SOURCE Waste arising from the reactor and auxiliary buildings during Final Site Clearance.

PHYSICAL CHARACTERISTICS

General description: The waste includes general plant items. e.g. 14m high service machine inclusive of motors, Cooling Pond/Miscellaneous contaminated sand filters, precipitators, redundant steel plant e.g. doors, pond furniture, transfer carriages, piping, tanks, structural waste (concrete etc). Includes some secondary waste.

Physical components (%vol): Mild Steel Items [Motors, duct, machine parts] (73%), stainless steel (4%) plastic (4%), paper/cotton (4%) contaminated concrete/soil (7%), wood (~2%), aluminium (<1%), Asbestos Contaminated Items (6%).

Sealed sources: -

Bulk density (t/m³): ~0.4

Comment on density: The average waste density is approximately 0.4 t/m3. However some items within the waste are likely to be of higher density, 0.6-1.0 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~78%), organic material (<10%), inorganic material (<13%)

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritium may be present as tritiated water.
C-14: The chemical form of carbon 14 may be graphite.
Cl-36: The chemical form of chlorine 36 has not been determined.
Se-79: The chemical form of selenium has not been determined.
Tc-99: The chemical form of technetium has not been determined.
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The uranium isotope content is insignificant.
Np: Neptunium isotope content is expected to be insignificant.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): This waste stream will contain waste of various sizes and thicknesses.

Stainless steel.....	~4.0	
Other ferrous metals.....	~73.0	Nickel and chromium are present as alloying metals in steel.
Iron.....		
Aluminium.....	<1.0	
Beryllium.....	0	
Cobalt.....		
Copper.....	TR	

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	Lead	NE	
	Magnox/Magnesium	0	
	Nickel	NE	Nickel and chromium are present as alloying metals in steel.
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	NE	"Other" metals have not been estimated. Nickel and chromium are present as alloying metals in steel.
Organics (%wt):	-		
	Total cellulosics	~6.0	
	Paper, cotton	4.0	
	Wood	~2.0	
	Halogenated plastics	0	
	Total non-halogenated plastics	~4.0	
	Condensation polymers	0	
	Others	~4.0	
	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	~3.5	
	Brick/Stone/Rubble	~3.5	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	0	
	Graphite	0	
	Desiccants/Catalysts		
	Asbestos	6.0	
	Non/low friable		

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Moderately friable.....

Highly friable.....

Free aqueous liquids..... 0

Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): No cyanides are expected, otherwise the inorganic anion content of the waste is not estimated.

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: None expected as efforts are made to remove all hazardous materials during sorting, however some asbestos is expected to 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: -

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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... NE

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		8.0
Solidification		
Decontamination		
Metal treatment		68.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		7.0
None		17.0

Comment on planned treatments: 7% to Landfill as VLLW.

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Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	17.0
Expected to be consigned to a Landfill Facility	7.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	8.0
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			
1/2 Height IP-2 Disposal/Re-usable ISO	~17.0	7	12
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: Data have been presented as though the waste will be in dedicated containers. It is likely that this waste will be placed in containers with other LLW.

Waste Planned for Disposal at the LLW Repository:

Container voidage: Significant in-accessible voidage is not expected.

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

Waste consigned for disposal to LLWR in year of generation: Yes.

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:	-
Uncertainty:	Activity values are current best estimates. 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:	Total beta/gamma is defined as the sum of the listed activities of all nuclides other than alpha emitters. Activity values for the individual alpha emitters are insignificant.
Measurement of radioactivities:	The specific activities have been estimated from the waste stream fingerprint for 9J948 decayed by 56 years.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			2.55E-08	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			9.93E-08	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4E-08	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			3.97E-08	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				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
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**	**0**		**2.05E-07**	**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