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| WASTE STREAM | 9D914 | General Reactor LLW |
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SITE Hinkley Point A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

| | | |
|---------------------------------|--|------------------------|
| | | Reported |
| Stocks: | At 1.4.2022..... | 12.2 m ³ |
| Future arisings - | 1.4.2022 - 31.3.2027..... | 1665.0 m ³ |
| Total future arisings: | | 1665.0 m ³ |
| Total waste volume: | | 1677.2 m ³ |
| Comment on volumes: | Volumes reassessed and now include 180m ³ scaffolding | |
| Uncertainty factors on volumes: | Stock (upper): x 1.1 | Arisings (upper) x 1.1 |
| | Stock (lower): x 0.9 | Arisings (lower) x 0.5 |

WASTE SOURCE This stream is waste arising from care and maintenance preparations and procedures in the pile cap (PC)/reactor areas and gas circulator (GC) areas for both Reactor 1 and Reactor 2 (four areas)

PHYSICAL CHARACTERISTICS

General description: Waste consists of general solid waste items, redundant equipment such as tooling, scaffolding, shielding, insulation and pipework; and secondary wastes such as PPE. Secondary wastes include metal, plastic, rubber, rubble, glass, cellulosic materials, asbestos, wood, bitumen and the drums that contain the waste.

Physical components (%wt): Metal (including drums) (47%wt), rubble (11%wt), soil (11%wt), biodegradable non putrescibles (14%wt), plastics/rubber (15%wt), wood (1%wt), other materials (1%wt). Other materials consist mainly of asbestos/glass fibre and rockwool (~0.4%wt) and glass (0.16%) and bitumen (0.17%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.33

Comment on density: Density is based on typical weight of 200 litre drum. Data taken from WCH mass divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): The waste contains pipework, building rubble and trash and comprises metal, mainly steel, various plastics, glass and a small quantity of cellulose. Metal (including drums) (47%wt), rubble (11%wt), soil (11%wt), biodegradable non putrescibles (14%wt), plastics/rubber (15%wt), wood (1%wt), other materials (1%wt). Other materials consist mainly of asbestos/glass fibre and rockwool (~0.4%wt) and glass (0.16%) and bitumen (0.17%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritium is present as surface contamination of waste by tritiated liquor.
C-14: Contamination in the form of graphite dust.
Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: The radium isotope content is insignificant.
Th: The thorium content is insignificant.
U: The uranium isotope content is insignificant.
Np: The neptunium content is insignificant.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Any steel drums will have a wall thickness of about 1mm. Other metals may be several mm thick.

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| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|-------------------------------------|--|--|-------------------------|
| Stainless steel..... | ~13.0 | including 66% iron, 17% chromium, 2.5% molybdenum and 12% nickel | |
| Other ferrous metals..... | ~20.0 | Mild steel components including pipework, containment structures and tooling etc | |
| Iron..... | ~13.0 | iron components including pipework, containment structures and tooling etc | |
| Aluminium..... | ~0.40 | Aluminium components including scaffolding and tooling etc | |
| Beryllium..... | 0 | | |
| Cobalt..... | | | |
| Copper..... | ~0.40 | Copper components including electrical parts and cabling etc | |
| Lead..... | ~0.04 | Lead components including sheeting and shielding etc | |
| Magnox/Magnesium..... | | | |
| Nickel..... | | | |
| Titanium..... | | | |
| Uranium..... | | | |
| Zinc..... | ~0.04 | Galvanised steel components including ducting, buckets and scaffolding etc | |
| Zircaloy/Zirconium..... | | | |
| Other metals..... | 0 | | |
| Organics (%wt): | The waste contains small amounts of cellulose, plastics and a trace of rubber. The waste contains halogenated plastics as PVC. | | |
| | (%wt) | Type(s) and comment | % of total C14 activity |
| Total cellulose..... | ~1.0 | | |
| Paper, cotton..... | ~0 | | |
| Wood..... | ~1.0 | | |
| Halogenated plastics | | | |
| Total non-halogenated plastics..... | ~13.0 | Plastic components including sheeting, duct pipe and tooling etc | |
| Condensation polymers..... | ~6.5 | | |
| Others..... | ~6.5 | | |
| Organic ion exchange materials.... | 0 | | |
| Total rubber..... | ~2.0 | | |
| Halogenated rubber | ~1.0 | | |
| Non-halogenated rubber..... | ~1.0 | | |
| Hydrocarbons..... | ~0.17 | | |
| Oil or grease | | | |
| Fuel..... | | | |
| Asphalt/Tarmac (cont.coal tar)... | | | |
| Asphalt/Tarmac (no coal tar).... | | | |
| Bitumen..... | ~0.17 | Roofing felt or linings etc | |
| Others..... | | | |

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Other organics.....

Other materials (%wt): -

| | (%wt) | Type(s) and comment | % of total C14 activity |
|------------------------------------|-------|--|-------------------------|
| Inorganic ion exchange materials.. | 0 | | |
| Inorganic sludges and flocs..... | 0 | | |
| Soil..... | ~11.0 | | |
| Brick/Stone/Rubble..... | ~11.0 | | |
| Cementitious material..... | | | |
| Sand..... | | | |
| Glass/Ceramics..... | ~0.37 | 0.16% glass and 0.21% glass fibre and rockwool | |
| Graphite..... | TR | | |
| Desiccants/Catalysts..... | | | |
| Asbestos..... | ~0.22 | | |
| Non/low friable..... | ~0.11 | Typically, low porosity, monolithic asbestos cement blocks and mouldings and asbestos cement sheeting - Chrysotile, amosite or crocidolite | |
| Moderately friable..... | ~0.11 | Typically, ceiling tiles, insulating and asbestos cement sheeting - Chrysotile, amosite or crocidolite | |
| Highly friable..... | 0 | | |
| Free aqueous liquids..... | 0 | | |
| Free non-aqueous liquids..... | 0 | | |
| Powder/Ash..... | | | |

Inorganic anions (%wt): None expected, but possibly present in trace quantities.

| | (%wt) | Type(s) and comment |
|----------------|-------|---------------------|
| 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 will be present.

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| | (%wt) | Type(s) and comment |
|--|-------|---------------------|
| Combustible metals..... | 0 | |
| Low flash point liquids..... | 0 | |
| Explosive materials..... | 0 | |
| Phosphorus..... | 0 | |
| Hydrides..... | 0 | |
| Biological etc. materials..... | 0 | |
| Biodegradable materials..... | ~14.0 | |
| Putrescible wastes..... | | |
| Non-putrescible wastes..... | ~14.0 | |
| Corrosive materials..... | 0 | |
| Pyrophoric materials..... | 0 | |
| Generating toxic gases..... | 0 | |
| Reacting with water..... | P | 170m2 |
| Higher activity particles..... | | |
| Soluble solids as bulk chemical compounds..... | | |

Hazardous substances /
non hazardous pollutants: Asbestos.

| | (%wt) | Type(s) and comment |
|-----------------------------|-------|---------------------|
| Acrylamide..... | | |
| Benzene..... | | |
| Chlorinated solvents..... | | |
| Formaldehyde..... | | |
| Organometallics..... | | |
| Phenol..... | | |
| Styrene..... | | |
| Tri-butyl phosphate..... | | |
| Other organophosphates..... | | |
| Vinyl chloride..... | | |
| Arsenic..... | | |
| Barium..... | | |
| Boron..... | ~0.12 | Boron components |
| Boron (in Boral)..... | | |
| Boron (non-Boral)..... | 0.12 | Boron components |
| Cadmium..... | | |
| Caesium..... | | |
| Selenium..... | | |
| Chromium..... | | |
| Molybdenum..... | | |
| Thallium..... | | |
| Tin..... | | |
| Vanadium..... | | |

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Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1..... P 10 off Stripped down circuit boards

EEE Type 2..... P 10 off mixed plant items

EEE Type 3..... P 10 off mixed electrical tools

EEE Type 4.....

EEE Type 5..... P 10 off rechargeable batteries

Complexing agents (%wt): No

(%wt) Type(s) and comment

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... 0

Potential for the waste to contain discrete items: Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs. Large Concrete Items (LCIs) may be DIs; drummed (ungROUTED)/"rubbleised" wastes assumed not DIs. Soil - In & of itself not a DI

TREATMENT, PACKAGING AND DISPOSAL

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

| Treatment | On-site / Off site | Stream volume % |
|-----------------------|--------------------|-----------------|
| Low force compaction | On-site | 1.5 |
| Supercompaction (HFC) | Off-site | 1.5 |
| Incineration | Off-site | 57.2 |
| Solidification | | |
| Decontamination | | |
| Metal treatment | Off-site | 8.7 |
| Size reduction | | |
| Decay storage | | |
| Recycling / reuse | | |
| Other / various | | |
| None | | 32.6 |

Comment on planned treatments:

31% to Landfill as VLLW.

Disposal Routes:

| Disposal Route | Stream volume % | Disposal density t/m3 |
|--|-----------------|-----------------------|
| Expected to be consigned to the LLW Repository | 3.1 | 0.33 |
| Expected to be consigned to a Landfill Facility | 31.0 | 0.33 |
| Expected to be consigned to an On-Site Disposal Facility | | |
| Expected to be consigned to an Incineration Facility | 57.2 | 0.40 |
| Expected to be consigned to a Metal Treatment Facility | 8.7 | 1.4 |
| Expected to be consigned as Out of Scope | | |
| Expected to be recycled / reused | | |
| Disposal route not known | | |

Classification codes for waste expected to be consigned to a landfill facility: 17 04 07, 17 05 03*/04, 17 06 03*, 17 06 01*, 17 02 03

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

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| Disposal Route | Stream volume % | | |
|---|-----------------|---------|---------|
| | 2022/23 | 2023/24 | 2024/25 |
| 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 | | | |

Opportunities for alternative disposal routing: -

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Estimated Date that Opportunity will be realised | Opportunity Confidence | Comment |
|------------------------------|---------------------------------|----------------------|---|---------------------------|---------|
| - | - | - | - | - | - |

Waste Packaging for Disposal:

| Container | Stream volume % | Waste loading m ³ | 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 | 1.5 1.6 | 43.2 10 | < 1 3 |

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. 43.2m³ loading volume 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: Significant inaccessible voidage is not expected.

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

Waste consigned for disposal to LLWR in year of generation: No. The timing of consignment of the waste for disposal cannot be determined at present.

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: | Activation and contamination of materials. |
| Uncertainty: | All wastes described by this waste stream are expected to be in the LLW category. The values quoted 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: | The specific activities have been estimated from the equivalent operational waste stream with an allowance for decay to current date. Data taken from WCH - 1MXN-3HIA-0-WCH-4592 V5 decayed three years to 01/04/2022 |
| Other information: | Activity estimates are as shown in the table. |

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| Nuclide | Mean radioactivity, TBq/m ³ | | | | Nuclide | Mean radioactivity, TBq/m ³ | | | |
|---------|--|----------------|-----------------|----------------|------------------|--|----------------|-----------------|----------------|
| | Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code | | Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code |
| H 3 | 9.46E-05 | CC 1 | 9.46E-05 | CC 1 | Gd 153 | | 8 | | 8 |
| Be 10 | | 8 | | 8 | Ho 163 | | 8 | | 8 |
| C 14 | 9.18E-06 | CC 1 | 9.18E-06 | CC 1 | Ho 166m | | 8 | | 8 |
| Na 22 | | 8 | | 8 | Tm 170 | | 8 | | 8 |
| Al 26 | | 8 | | 8 | Tm 171 | | 8 | | 8 |
| Cl 36 | 4.87E-06 | CC 1 | 4.87E-06 | CC 1 | Lu 174 | | 8 | | 8 |
| Ar 39 | | 8 | | 8 | Lu 176 | | 8 | | 8 |
| Ar 42 | | 8 | | 8 | Hf 178n | | 8 | | 8 |
| K 40 | | 8 | | 8 | Hf 182 | | 8 | | 8 |
| Ca 41 | | 8 | | 8 | Pt 193 | | 8 | | 8 |
| Mn 53 | | 8 | | 8 | Tl 204 | | 8 | | 8 |
| Mn 54 | | 8 | | 8 | Pb 205 | | 8 | | 8 |
| Fe 55 | 9.52E-08 | CC 1 | 9.52E-08 | CC 1 | Pb 210 | | 8 | | 8 |
| Co 60 | 6.26E-07 | CC 2 | 6.26E-07 | CC 2 | Bi 208 | | 8 | | 8 |
| Ni 59 | | 8 | | 8 | Bi 210m | | 8 | | 8 |
| Ni 63 | 4.31E-06 | CC 1 | 4.31E-06 | CC 1 | Po 210 | | 8 | | 8 |
| Zn 65 | | 8 | | 8 | Ra 223 | | 8 | | 8 |
| Se 79 | | 8 | | 8 | Ra 225 | | 8 | | 8 |
| Kr 81 | | 8 | | 8 | Ra 226 | | 8 | | 8 |
| Kr 85 | | 8 | | 8 | Ra 228 | | 8 | | 8 |
| Rb 87 | | 8 | | 8 | Ac 227 | | 8 | | 8 |
| Sr 90 | 4.01E-08 | CC 1 | 4.01E-08 | CC 1 | Th 227 | | 8 | | 8 |
| Zr 93 | | 8 | | 8 | Th 228 | | 8 | | 8 |
| Nb 91 | | 8 | | 8 | Th 229 | | 8 | | 8 |
| Nb 92 | | 8 | | 8 | Th 230 | | 8 | | 8 |
| Nb 93m | | 8 | | 8 | Th 232 | | 8 | | 8 |
| Nb 94 | 1.26E-08 | CC 2 | 1.26E-08 | CC 2 | Th 234 | | 8 | | 8 |
| Mo 93 | | 8 | | 8 | Pa 231 | | 8 | | 8 |
| Tc 97 | | 8 | | 8 | Pa 233 | | 8 | | 8 |
| Tc 99 | | 8 | | 8 | U 232 | | 8 | | 8 |
| Ru 106 | | 8 | | 8 | U 233 | | 8 | | 8 |
| Pd 107 | | 8 | | 8 | U 234 | | 8 | | 8 |
| Ag 108m | 1.55E-08 | CC 2 | 1.55E-08 | CC 2 | U 235 | | 8 | | 8 |
| Ag 110m | | 8 | | 8 | U 236 | | 8 | | 8 |
| Cd 109 | | 8 | | 8 | U 238 | | 8 | | 8 |
| Cd 113m | | 8 | | 8 | Np 237 | | 8 | | 8 |
| Sn 119m | | 8 | | 8 | Pu 236 | | 8 | | 8 |
| Sn 121m | | 8 | | 8 | Pu 238 | | 8 | | 8 |
| Sn 123 | | 8 | | 8 | Pu 239 | 2.73E-09 | CC 1 | 2.73E-09 | CC 1 |
| Sn 126 | | 8 | | 8 | Pu 240 | | 8 | | 8 |
| Sb 125 | | 8 | | 8 | Pu 241 | 2.64E-08 | CC 1 | 2.64E-08 | CC 1 |
| Sb 126 | | 8 | | 8 | Pu 242 | | 8 | | 8 |
| Te 125m | | 8 | | 8 | Am 241 | 7.25E-09 | CC 1 | 7.25E-09 | CC 1 |
| Te 127m | | 8 | | 8 | Am 242m | | 8 | | 8 |
| I 129 | | 8 | | 8 | Am 243 | | 8 | | 8 |
| Cs 134 | | 8 | | 8 | Cm 242 | | 8 | | 8 |
| Cs 135 | | 8 | | 8 | Cm 243 | | 8 | | 8 |
| Cs 137 | 1.49E-07 | CC 2 | 1.49E-07 | CC 2 | Cm 244 | | 8 | | 8 |
| Ba 133 | 2.5E-09 | CC 2 | 2.5E-09 | CC 2 | Cm 245 | | 8 | | 8 |
| La 137 | | 8 | | 8 | Cm 246 | | 8 | | 8 |
| La 138 | | 8 | | 8 | Cm 248 | | 8 | | 8 |
| Ce 144 | | 8 | | 8 | Cf 249 | | 8 | | 8 |
| Pm 145 | | 8 | | 8 | Cf 250 | | 8 | | 8 |
| Pm 147 | | 8 | | 8 | Cf 251 | | 8 | | 8 |
| Sm 147 | | 8 | | 8 | Cf 252 | | 8 | | 8 |
| Sm 151 | | 8 | | 8 | Other a | | | | |
| Eu 152 | 6.59E-09 | CC 2 | 6.59E-09 | CC 2 | Other b/g | | | | |
| Eu 154 | 2.83E-09 | CC 2 | 2.83E-09 | CC 2 | Total a | 9.98E-09 | CC 2 | 9.98E-09 | CC 2 |
| Eu 155 | | 8 | | 8 | Total b/g | 1.14E-04 | CC 2 | 1.14E-04 | CC 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