## WASTE STREAM 9D913 Pond & Effluent Treatment Plant LLW

| | |
|---|---|
| **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..... | 0 $m^3$ |
| Future arisings - | 1.4.2022 - 31.3.2024..... | 763.8 $m^3$ |
| Total future arisings: | | 763.8 $m^3$ |
| Total waste volume: | | 763.8 $m^3$ |

| | | | | |
|---|---|---|---|---|
| Comment on volumes: | 0.7m3 added to the waste from the degasser tower. | | | |
| Uncertainty factors on volumes: | Stock (upper): | x | Arisings (upper) | x 1.1 |
| | Stock (lower): | x | Arisings (lower) | x 0.5 |

**WASTE SOURCE** This stream represents decommissioning waste arising from areas associated with fuel handling including the pond areas, pond treatment plants and flask handling facilities.

### PHYSICAL CHARACTERISTICS

| | |
|---|---|
| General description: | Waste consists of decommissioned plant and equipment (e.g. pumps, pipework, shielding and cranes); tooling (including electrical/electronic and batteries); structural materials (e.g. gantries, scaffolding and ducting); soil sludge; bitumen and concrete (roofing, flooring), asbestos insulation; and secondary wastes such as wood, coveralls, sheeting, plastic and rubber. |
| Physical components (%wt): | Metal items and general wastes including laboratory trash. Metal (including drums) (47%wt), rubble (11%wt), plastics/rubber (15%wt), wood (1%wt), other materials (1%wt), soil (11%), biodegradable materials (14%), Other material consists of glass (0.16%), small quantities of asbestos (0.01%wt), bitumen (0.17%) and polyurethane foam (0.09%). |
| Sealed sources: | The waste does not contain sealed sources. |
| Bulk density (t/$m^3$): | ~0.68 |
| Comment on density: | Density is based WCH mass divided by volume |

### CHEMICAL COMPOSITION

| | |
|---|---|
| General description and components (%wt): | Metal items and general wastes including laboratory trash. Metal (including drums) (47%wt), rubble (11%wt), plastics/rubber (15%wt), wood (1%wt), other materials (1%wt), soil (11%), biodegradable materials (14%), Other material consists of glass (0.16%), small quantities of asbestos (0.01%wt), bitumen (0.17%) and polyurethane foam (0.09%). |
| Chemical state: | Neutral |
| Chemical form of radionuclides: | H-3: Tritium present as surface contamination of waste by tritiated liquor.<br>C-14: Contamination in the form of graphite dust.<br>Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.<br>Se-79: The selenium content is insignificant.<br>Tc-99: The technetium content is insignificant.<br>Ra: The radium isotope content is insignificant.<br>Th: The thorium content is insignificant.<br>U: The uranium isotope content is insignificant.<br>Np: The neptunium content is insignificant.<br>Pu: The plutonium isotope content is probably in the form of plutonium oxides. |
| Metals and alloys (%wt): | There are no bulk items present. Typical thicknesses have not been estimated although the drums will have walls ~1mm thick. |

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| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|---|---|---|---|
| Stainless steel | 13.3 | including chromium (17%), iron (66%), moybdenum (2%) and nickel (12%) | |
| 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 | | | |
| 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 | 0 | | |
| Other metals | 0 | | |

Organics (%wt): There may be some paper mixed with the general laboratory trash. The waste possibly contains halogenated rubber as neoprene.

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| Total cellulosics | ~1.0 | | |
| Paper, cotton | ~0 | | |
| Wood | ~1.0 | | |
| Halogenated plastics | 0 | | |
| Total non-halogenated plastics | ~13.0 | Plastic components including sheeting dura pipe and tooling etc | |
| Condensation polymers | ~6.5 | | |
| Others | ~6.5 | | |
| Organic ion exchange materials | 0 | | |
| Total rubber | ~2.0 | | |
| Halogenated rubber | ~2.0 | possibly halogenated rubber as neoprene | |
| Non-halogenated rubber | ~0 | | |
| Hydrocarbons | 0.17 | | |
| Oil or grease | | | |
| Fuel | | | |
| Asphalt/Tarmac (cont.coal tar) | | | |
| Asphalt/Tarmac (no coal tar) | | | |

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| | | |
|---|---|---|
| Bitumen | 0.17 | Roofing felt or linings etc |
| Others | | |
| 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 | 0 | | |
| Sand | | | |
| Glass/Ceramics | 0.17 | including 0.01% fibre glass and rockwool | |
| Graphite | 0 | | |
| Desiccants/Catalysts | | | |
| Asbestos | TR | | |
| Non/low friable | TR | Typically, low porosity, monolithic asbestos cement blocks and mouldings and asbestos cement sheeting - Chrysotile, amosite and/or crocidolite | |
| Moderately friable | TR | Typically, ceiling tiles, insulating and asbestos cement sheeting - Chrysotile, amosite and/or crocidolite | |
| Highly friable | | | |
| Free aqueous liquids | 0 | | |
| Free non-aqueous liquids | 0 | | |
| Powder/Ash | TR | | |

Inorganic anions (%wt): Trace amounts as dried out salts on items.

| | (%wt) | Type(s) and comment |
|---|---|---|
| Fluoride | TR | |
| Chloride | TR | |
| Iodide | TR | |
| Cyanide | TR | |
| Carbonate | TR | |
| Nitrate | TR | |
| Nitrite | TR | |
| Phosphate | TR | |
| Sulphate | TR | |
| Sulphide | TR | |

Materials of interest for waste acceptance criteria: Asbestos may occasionally be present also possible trace powders from dried out salts on items.

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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..... | 0 | |
| Non-putrescible wastes..... | 14.0 | |
| Corrosive materials..... | 0 | |
| Pyrophoric materials..... | 0 | |
| Generating toxic gases..... | 0 | |
| Reacting with water..... | P | Galvanised metal may be present in the waste (estimated surface area <1000 m2). If this metal is greater than 10 m2 in a consignment, this will be treated by painting or wrapping to prevent hydrogen production following interactions with the grout. |
| Higher activity particles..... | | |
| Soluble solids as bulk chemical compounds..... | | |

Hazardous substances / non hazardous pollutants: Asbestos is present.

| | (%wt) | Type(s) and comment |
|---|---|---|
| Acrylamide..... | | |
| Benzene..... | | |
| Chlorinated solvents..... | | |
| Formaldehyde..... | | |
| Organometallics..... | | |
| Phenol..... | | |
| Styrene..... | | |
| Tri-butyl phosphate..... | | |
| Other organophosphates..... | | |
| Vinyl chloride..... | | |
| Arsenic..... | | |
| Barium..... | | |
| Boron..... | 0 | |
| Boron (in Boral)..... | | |
| Boron (non-Boral)..... | | |
| Cadmium..... | | |
| Caesium..... | | |
| Selenium..... | | |
| Chromium..... | | |
| Molybdenum..... | | |

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| | | |
|---|---|---|
| Thallium..... | | |
| Tin..... | | |
| Vanadium..... | | |
| Mercury compounds..... | | |
| Others..... | 0 | Steve Vick International Foam pack polyurethane resin MP-41 will be used in conjunction with the MX-1 hardener. |
| Electronic Electrical Equipment (EEE) | | |
| EEE Type 1..... | P | 50 off stripped down circuit boards |
| EEE Type 2..... | P | 20 off mixed plant items |
| EEE Type 3..... | P | 200 off mixed electrical power tools |
| EEE Type 4..... | | |
| EEE Type 5..... | P | 50 off rechargeable batteries |

Complexing agents (%wt): Yes

| | (%wt) | Type(s) and comment |
|---|---|---|
| EDTA..... | | |
| DPTA..... | | |
| NTA..... | | |
| Polycarboxylic acids……. | | |
| Other organic complexants..... | | |
| Total complexing agents..... | TR | |

Potential for the waste to contain discrete items: Yes. 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 | 11.8 |
| Supercompaction (HFC) | Off-site | 11.8 |
| Incineration | Off-site | 54.4 |
| Solidification | | |
| Decontamination | | |
| Metal treatment | Off-site | 2.2 |
| Size reduction | | |
| Decay storage | | |
| Recyling / reuse | | |
| Other / various | | |
| None | | 31.6 |

Comment on planned treatments: The proposed waste routing for the waste stream is: 11.8 vol% Supercompaction, 54.4 vol% incineration, 17.1 vol% LLW disposal, 2.2 vol% metal recycling, 14.5 vol% VLLW disposal,

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**Disposal Routes:**

| Disposal Route | Stream volume % | Disposal density t/m3 |
|---|---|---|
| Expected to be consigned to the LLW Repository | 28.9 | 0.68 |
| Expected to be consigned to a Landfill Facility | 14.5 | 0.68 |
| Expected to be consigned to an On-Site Disposal Facility | | |
| Expected to be consigned to an Incineration Facility | 54.4 | 0.40 |
| Expected to be consigned to a Metal Treatment Facility | 2.2 | 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 02 03

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

| 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 m³ | Number of packages |
|---|---|---|---|
| 1/3 Height IP-1 ISO | | | |
| 2/3 Height IP-2 ISO | | | |
| 1/2 Height WAMAC IP-2 ISO | 11.8 | 43.2 | 3 |
| 1/2 Height IP-2 Disposal/Re-usable ISO | 17.1 | 10 | 14 |
| 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. 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.

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|---|---|
| Waste Characterisation Form (WCH): | The waste meets the LLWR's Waste Acceptance Criteria (WAC).<br>The waste has a current WCH.<br>Inventory information is consistent with the current WCH. |
| Waste consigned for disposal to LLWR in year of generation: | - |

**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: | - |

### RADIOACTIVITY

| | |
|---|---|
| Source: | Activation and contamination of materials. |
| Uncertainty: | Activity values are current best estimates. The values quoted are indicative of the activities that are expected. They are estimates based upon operating experience. |
| 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: | Specific activities have been estimated from a radionuclide fingerprint derived from measurements. Data has been taken from WCH 1MXN-3HIA-0-WCH-4591 V9 decayed three years from 2019 ref date to 2022. |
| Other information: | Activity estimates are shown in the table. |

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| Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code | Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code |
|---|---|---|---|---|---|---|---|---|---|
| H 3 | | | 2.92E-07 | C C 1 | Gd 153 | | | | 8 |
| Be 10 | | | | 8 | Ho 163 | | | | 8 |
| C 14 | | | 1.24E-07 | C C 1 | Ho 166m | | | | 8 |
| Na 22 | | | | 8 | Tm 170 | | | | 8 |
| Al 26 | | | | 8 | Tm 171 | | | | 8 |
| Cl 36 | | | 1.02E-07 | C C 1 | 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 | | | 1.42E-07 | C C 1 | Pb 210 | | | | 8 |
| Co 60 | | | 1.19E-07 | C C 2 | Bi 208 | | | | 8 |
| Ni 59 | | | | 8 | Bi 210m | | | | 8 |
| Ni 63 | | | 9.04E-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 | | | 9.17E-05 | 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 | | | 3.73E-08 | C C 2 | Th 234 | | | 1.65E-08 | 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 | | | 1.74E-08 | C C 1 |
| Ag 108m | | | 5.66E-08 | C C 2 | U 235 | | | 3.89E-09 | C C 1 |
| Ag 110m | | | | 8 | U 236 | | | | 8 |
| Cd 109 | | | | 8 | U 238 | | | 1.65E-08 | C C 1 |
| Cd 113m | | | | 8 | Np 237 | | | | 8 |
| Sn 119m | | | | 8 | Pu 236 | | | | 8 |
| Sn 121m | | | | 8 | Pu 238 | | | 3.02E-06 | C C 1 |
| Sn 123 | | | | 8 | Pu 239 | | | 8.34E-06 | C C 1 |
| Sn 126 | | | | 8 | Pu 240 | | | 2.98E-06 | C C 1 |
| Sb 125 | | | 9.62E-09 | C C 2 | Pu 241 | | | 6E-05 | C C 1 |
| Sb 126 | | | | 8 | Pu 242 | | | | 8 |
| Te 125m | | | 2.41E-09 | 8 | Am 241 | | | 2.33E-05 | C C 1 |
| Te 127m | | | | 8 | Am 242m | | | | 8 |
| I 129 | | | | 8 | Am 243 | | | | 8 |
| Cs 134 | | | 1.34E-08 | C C 2 | Cm 242 | | | | 8 |
| Cs 135 | | | | 8 | Cm 243 | | | 4.68E-09 | C C 1 |
| Cs 137 | | | 7.95E-05 | C C 2 | Cm 244 | | | 1.61E-07 | C C 1 |
| Ba 133 | | | 3.7E-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 | | | 6.31E-08 | C C 1 | Cf 251 | | | | 8 |
| Sm 147 | | | | 8 | Cf 252 | | | | 8 |
| Sm 151 | | | | 8 | Other a | | | | |
| Eu 152 | | | 7.38E-08 | C C 2 | Other b/g | | | | |
| Eu 154 | | | 3.48E-07 | C C 2 | **Total a** | **0** | | **3.78E-05** | **C C 2** |
| Eu 155 | | | 3.6E-08 | C C 2 | **Total b/g** | **0** | | **2.34E-04** | **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