

WASTE STREAM**5B20****Contaminated Solvent and Oils**

SITE Dounreay
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Dounreay Site Restoration Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	7.5 m ³
Future arisings -	1.4.2019 - 31.3.2029.....	86.0 m ³
Total future arisings:		86.0 m ³
Total waste volume:		93.5 m ³

Comment on volumes: Arisings from oils, solvents, and all other LLW liquids expected to be generated on site. This includes a small inventory of contaminated mercury. Arisings consist of a large volume of reprocessing solvents (to be washed) stored in tanks and miscellaneous oils/solvents used within facilities. Stocks are held within a dedicated oils and solvents facility.

Uncertainty factors on volumes:

Stock (upper):	x 1.05	Arisings (upper)	x 1.2
Stock (lower):	x 0.95	Arisings (lower)	x 0.8

WASTE SOURCE Fuel reprocessing and miscellaneous types of oils/solvents from machinery and experiments.

PHYSICAL CHARACTERISTICS

General description: The waste contains a variety of solvent and oils held in various locations. The waste is likely to contain small amounts of aqueous liquids. There are no large items in the waste.

Physical components (%wt): Washed solvent (60.2%), TBP/OK (others) (2.4%), lubricating oil (34%), other miscellaneous oils/solvents (3.4%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.97

Comment on density: Based on plant washing tank density. All solvents and oils assumed to have same density.

CHEMICAL COMPOSITION

General description and components (%wt): Washed solvent (60%), TBP/OK (others) (2%), lubricating oil (34%), others (4%).

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Likely to be present as water.
C-14: Likely to be present.
Cl-36: Not known to be present.
I-129: Likely to be present.
Ra: Not known to be present.
Th: Not known to be present.
U: Likely to be present
Np: Likely to be present
Pu: Likely to be present.

Metals and alloys (%wt): -

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	
Beryllium.....	0
Cobalt.....	0
Copper.....	
Lead.....	0
Magnox/Magnesium.....	0

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	Nickel.....	
	Titanium.....	
	Uranium.....	P
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	P
Organics (%wt):	The waste consists of lightly contaminated TBP/OK reprocessing solvent, and other lightly contaminated liquids including solvents and oils.	
	Total cellulosics.....	0
	Paper, cotton.....	0
	Wood.....	0
	Halogenated plastics	0
	Total non-halogenated plastics.....	0
	Condensation polymers.....	0
	Others.....	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.....	100.0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	P

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	Powder/Ash.....	0
Inorganic anions (%wt):	Trace quantities of inorganic anions are present.	
	Fluoride.....	TR
	Chloride.....	TR
	Iodide.....	TR
	Cyanide.....	0
	Carbonate.....	TR
	Nitrate.....	TR
	Nitrite.....	NE
	Phosphate.....	TR
	Sulphate.....	TR
	Sulphide.....	TR
Materials of interest for waste acceptance criteria:	Quantities of substances are not estimated.	
	Combustible metals.....	0
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	0
	Biodegradable materials.....	0
	Putrescible wastes.....	0
	Non-putrescible wastes.....	0
	Corrosive materials.....	0
	Pyrophoric materials.....	
	Generating toxic gases.....	
	Reacting with water.....	0
	Active particles.....	0
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Traces of toxic metals may be present. Solvents (60%).	
	Acrylamide.....	
	Benzene.....	NE
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	NE
	Styrene.....	
	Tri-butyl phosphate.....	TR
	Other organophosphates.....	TR
	Vinyl chloride.....	NE
	Arsenic.....	NE

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Barium.....
 Boron..... NE
 Cadmium..... NE
 Caesium.....
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium.....
 Tin..... NE
 Vanadium..... NE
 Mercury compounds..... TR
 Others..... NE
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

Yes
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... 5.0

The waste contains tributyl phosphate.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		40.0
Solidification		60.0
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Solvents which are to be washed will produce ILW Aqueous fraction (5B360) and a LLW Solvent fraction (5B20). The aqueous fraction containing the higher activity will be processed through DCP. The remaining "washed" solvent will be stabilised within Nochar, grouted in 200l drums, and disposed of to the LLW Disposal Facility. Reprocessing solvent will be washed and cemented prior to sentencing to LLW Disposal Facility. Other contaminated oils and solvents will be disposed using off-site routes, mainly incineration.

WASTE STREAM**5B20****Contaminated Solvent and Oils****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	60.0 40.0
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	

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 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	60.0	10	6

Other information:

Washed solvent currently assume to be solidified and sent to the LLW Disposal Facility. However, there is scope that this could be sent offsite for incineration now that this waste route is open.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

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: -

WASTE STREAM**5B20****Contaminated Solvent and Oils****RADIOACTIVITY**

Source:	The main source of activity is fission products and actinides associated with fuel reprocessing.
Uncertainty:	Specific Activity is based on the sample results from all IBCs contained within DN029 (averaged across the DN029 inventory). Oil and Solvent arisings is also based on these samples. The accuracy of arising activity estimates is to within a factor of 10.
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:	Stocks: by Sample analysis, Arisings: using the same sample analysis (best available data).
Other information:	No allowance has been made for decay of 'washed' solvent. Activity of oil and solvents in IBCs derived from sample analysis. Radionuclides have been reevaluated since 2016.

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Contaminated Solvent and Oils

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	3.44E-04	AA 1	3.44E-04	CC 2	Gd 153				
Be 10					Ho 163				
C 14	1.51E-06	AA 1	1.51E-06	CC 2	Ho 166m				
Na 22	2.95E-10	AA 1	2.95E-10	CC 2	Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60	3.41E-08	AA 1	3.41E-08	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	1.32E-09	AA 1	1.32E-09	CC 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	2.54E-07	AA 1	2.54E-07	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	2.39E-10	AA 1	2.39E-10	CC 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	7.21E-07	AA 1	7.21E-07	CC 2
Ag 108m					U 235	1.79E-08	AA 1	1.79E-08	CC 2
Ag 110m					U 236				
Cd 109					U 238	3.15E-07	AA 1	3.15E-07	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	4.47E-08	AA 1	4.47E-08	CC 2
Sn 123					Pu 239	9.30E-08	AA 1	9.30E-08	CC 2
Sn 126					Pu 240	9.30E-08	AA 1	9.30E-08	CC 2
Sb 125					Pu 241	1.06E-06	AA 1	1.06E-06	CC 2
Sb 126					Pu 242				
Te 125m					Am 241	3.55E-07	AA 1	3.55E-07	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242	9.26E-11	AA 1	9.26E-11	CC 2
Cs 135					Cm 243	4.17E-11	AA 1	4.17E-11	CC 2
Cs 137	1.05E-06	AA 1	1.05E-06	CC 2	Cm 244	4.17E-11	AA 1	4.17E-11	CC 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252	9.26E-11	AA 1	9.26E-11	CC 2
Sm 151					Other a	1.59E-08	AA 1	1.59E-08	CC 2
Eu 152					Other b/g	1.68E-08	AA 1	1.68E-08	CC 2
Eu 154	1.19E-08	AA 1	1.19E-08	CC 2	Total a	1.66E-06	AA 1	1.66E-06	CC 2
Eu 155	2.32E-07	AA 1	2.32E-07	CC 2	Total b/g	3.48E-04	AA 1	3.48E-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