



Excavated Material Quality and its potential for reuse in Relation to the TTF EIA

As per ERA requirements for PA/06096/23

Report



EXCAVATED MATERIAL QUALITY AND ITS POTENTIAL
FOR REUSE IN RELATION TO THE TTF EIA

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1 INTRODUCTION

This activity is being carried out to address ERA requirements (EA/00020/22) in relation to a development application submitted by Wasteserv Malta (WSM) to construct a new Thermal Treatment Facility (TTF). The proposed development will form part of the ECOHIVE Complex and will operate in conjunction with the other waste management facilities at Magħtab.

The Environment and Resources Authority (ERA) provides standard guidelines to carry out a land and groundwater contamination assessment. This report highlights the results obtained from the ERA approved methodology that was adopted.

1.1 PROJECT DESCRIPTION

The proposed facility incorporates the development of a new Thermal Treatment Facility (TTF) for the treatment of hazardous waste. The new hazardous waste incineration plant forms part of a strategy to centralise all the major waste operations carried out by Wasteserv Malta at one location. The project entails the construction of a new hazardous waste incineration plant comprising of two independent lines, and space for a potential third independent line in the future.



FIGURE 1: PROPOSED SITE FOR THE NEW THERMAL TREATMENT FACILITY

2 METHODOLOGY

2.1 SAMPLING STATIONS & METHODOLOGY

The preliminary investigation of land and groundwater contamination was guided by the sampling requirements stipulated in Table 1 of TORs for LGW Site Clearance issued by the ERA in 2021. The TORs state that sites between 10,000-50,000m² would require 5 to 15 points for land investigations, and 4 to 6 points for groundwater investigations, with one sample collected from each point.

During the construction phase, excavation and backfilling shall be limited to the built-up area of the proposed TTF. Geotechnical analysis was carried out to determine the final design of the foundations bearing the structural loads of the building. Oversite excavations vary from 0.25 to 9.5m below Ground Level (bGL), while backfilling depths range from 0.10 to 2.30m bGL. The maximum excavation depth of about 9.5m bGL will be reached in correspondence of excavations in pits such as cisterns and tanks. A 3m thick concrete slab foundation was preliminary designed as adequate to bear the loads of the structure.

Previous studies undertaken in adjacent sites to the TTF revealed no risk of materials contamination, hence, suggesting that the quality of the excavated material at the Scheme may be adequate to be reused. It is therefore likely that the total excavated volume standing at about 8,640m³ will be backfilled to reach the projected ground level.

The ground conditions within the TTF site are expected to be relatively homogenous in nature. Consequently, a reduced sampling effort was proposed based on the following justifications:

- The site for the TTF is in close proximity to the WtE and MRF;
- The maximum depth of the excavation for the TTF is of 9.5m while the depth of the boreholes drilled for the WtE and MRF were in between 10 and 30m deep from the surface. They were drilled by continuous rock core sampling;
- The geological properties for the Maltese limestones do not change substantially over such a short distance;
- The top soil type present is similar to that of the WtE and MRF, and the thickness of the overburden is therefore expected to be similar. This shall be verified during the field survey.

The reduced sampling effort at the TTF site entailed ground sampling from two separate locations which represent the site's spatial extent and the degree of excavation proposed within it. Kindly refer to Figure 2 and Table 1 for further information on the sampling locations. Continuous core recovery and drilling with auger were carried out for land contamination testing at the four sampling boreholes.

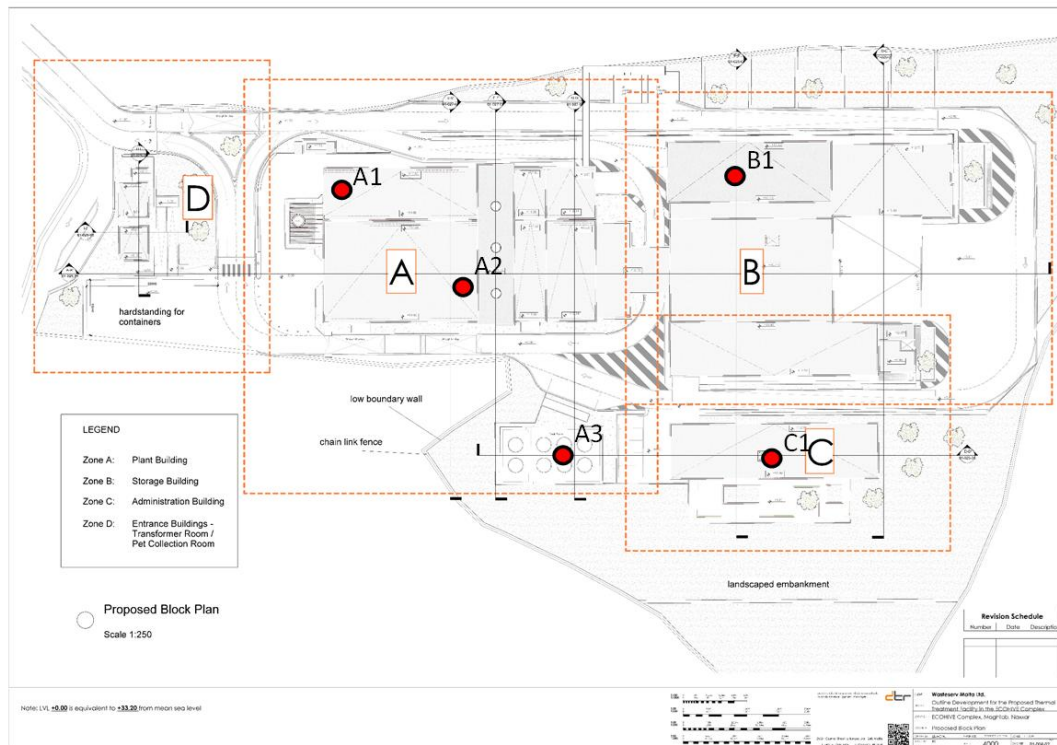


FIGURE 2: SAMPLING STATIONS (MARKED IN RED)

TABLE 1: PROPOSED SAMPLING STATIONS AND DEPTHS

AREA	GPS COORDINATES (INDICATIVE)	PLANNED AVERAGE EXCAVATION DEPTH	PROPOSED SAMPLING DEPTH (BOREHOLES)	SAMPLING DEPTH(S)
A (A1)	449832.73276, 3977790.97690	3.25	0	-
A (A2)	449866.46880, 3977782.09899	3.25	0	-
A (A3)	449902.74139, 3977767.13338	9.50	3	1.0, 3.0 and 5.5
B (B1)	449907.30716, 3977852.86858	3.85 to 4.35	1	1.0
C (C1)	449944.59437, 3977793.00613	-1.90 (fill)	0	-

The samples were stored and sealed in clean environments to ensure no cross-contamination occurred. Manual handling of samples was avoided. The samples were stored in glass containers and vials as appropriate. All samples were photographed and kept in a cool environment at a temperature < 8°C. Samples were then shipped to an ISO 17025 accredited laboratory for analysis within 24 hours.

2.2 CHEMICAL ANALYSIS

Chemical analysis was carried out on the fine fraction sample (<2mm) since this is the fraction in which contaminants tend to accumulate. The chemical analyses were carried out at a laboratory accredited to EN ISO/IEC 17025. The chosen parameters are based on the Environmental Monitoring Plan for monitoring leachate contamination at Ghallis Landfill, as well as the parameters listed in the Italian Decreto 152 of 2006.

TABLE 2: CHEMICAL PARAMETERS FOR LAND CONTAMINATION TESTING WITH PROPOSED LODs AND METHODOLOGIES

PARAMETER	INDUSTRIAL LIMIT ACCORDING TO ITALIAN DECRETO 152 OF 2006 (MG/KG DW)	LOD	U.O.M	METHOD
Mercury	5	0.1	Mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016
Cadmium	15	0.2		
Lead	1000	1		
Nickel	500	1		
Arsenic	50	1		
Chromium	800	1		
Copper	600	5		
Zinc	1500	5		
Cyanides	100	0.1	Mg/kg	MU 2251:08 App C
PCBs (SUM of 7 PCB congeners: 28, 52, 101, 118, 138, 153 and 180)	5	0.001	Mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018
PAHs (Sum)	100	0.01	Mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018
Benzo(a)anthracene	10			
Benzo(a)pyrene	10			
Benzo(b)fluoranthene	10			
Benzo(k)fluoranthene	10			
Benzo(g,h,i)perylene	10			
Chrysene	10			
Dibenzo(a,e)pyrene	10			
Dibenzo(a,l)pyrene	10			
Dibenzo(a,i)pyrene	10			
Dibenzo(a,h)pyrene	10			
Dibenzo(a,h)anthracene	10			
Indenopyrene	5			

Pyrene	50			
Napthalene	50			
Fluoranthene	N/A			
Dioxins and furans (PCDD, PCDF, WHO TEQ)	100ng/kg	0.00001	Mg/kg	EPA 8280 B 2007 + UNEP/POPS/COP.3/ INF/27 11/04/2007 WHO 2005 TEF
Mineral oil	N/A	1.0	Mg/kg	UNI EN 14039:2005
Benzene	2	0.01	Mg/kg	EPA 5035A 2002 + EPA 8260D 2018
Toluene	50			
Ethylbenzene	50			
Xylene	50			
Total Organic Carbon (TOC)	N/A	0.01	%	UNI EN 13137:2002

2.3 HP CRITERIA ASSESSMENT

To determine whether the material to be excavated is hazardous (EWC code 17 05 03*) or non-hazardous (EWC code 17 05 04) waste, the results were evaluated against the HP criteria listed in Schedule 3 of S.L.549.63. If the limit values established by the HP criteria are exceeded, the waste is classified as being hazardous for that specific HP criterion.

When dealing with metals, the level of contamination for each parameter reflects the total mixtures and compounds present in all of their chemical forms, not just in their pure elemental form. Therefore, the suspected chemical compound was identified based on the contamination pressures within the area of study.

The process was carried out by identifying the potential hazardous material in the material, determining its molar mass and converting the % concentration of the metal form into the % concentration of the suspected hazardous metal compound. The respective hazard class and hazard statement of the contaminant was determined from the 1272/2008 Regulations and compared to Schedule 3 of SL 549.63 (WASTE REGULATIONS) to identify the properties of waste which render it hazardous.

The worst-case compound of the element/parameter was compared to the thresholds stipulated in Schedule 3 of SL 549.63 and classified as hazardous according to the following thresholds:

- i. Exceeds the concentration limits for all the identified hazard statements, the material is classified as hazardous;
- ii. Does not exceed any concentration limits of the identified hazard statements, the material is classified as non-hazardous;
- iii. Exceeds the concentration limits for at least one of the identified hazard statements, the material is classified as hazardous for its related hazardous property.

2.4 IDENTIFYING THE DISPOSAL ROUTE

Since the applicant may consider disposing the excavated material on land, additional chemical testing and leachate testing were carried out. Tests on the granular fraction of the material were conducted in accordance with Council Decision 2003/33/EC. The leachate testing was carried out in line with the analytical standards listed in Table 3. The findings are presented in a report remarking on the level of contamination to guide the ERA's decision.

TABLE 3: LEACHATE TEST PARAMETERS AND METHODOLOGIES

PARAMETER	LOD	U.O.M	METHOD
Arsenic (As)	0.0005	mg/kg	UNI EN 12457-2:2004 + UNI EN ISO 17294-02:2016
Antimony (Sb)			
Barium (Ba)	0.01		
Cadmium (Cd)	0.0005		
Chromium total (Cr)			
Copper (Cu)	0.005		
Mercury (Hg)	0.0001		
Molybdenum (Mo)	0.001		
Nickel (Ni)			
Selenium (Se)			
Tin (Sn)			
Zinc (Zn)	0.01		
Lead (Pb)	0.001		
Chloride (Cl ⁻)	0.1	mg/kg	UNI EN 12457-2:2004 + UNI EN ISO 10304-1:2009
Fluoride (F ⁻)	0.05		
Sulphate (SO ₄ ²⁻)	0.1		
Dissolved organic Carbon (DOC)	0.1	Mg/kg	UNI EN 12457-2:2004 + UNI EN 1484:1999
Total Dissolved Solids (TDS)	20	Mg/kg	UNI EN 12457-2:2004 + APAT CNR IRSA 2090 A, Man 29 2003
Phenol Index	0.01	Mg/kg	UNI EN 12457-2:2004 + UNI EN 16192:2012 + ISO6439:1990
pH	-	Unit	UNI EN 12457-2:2004 + UNI EN ISO 10523:2012
ANC (Acid Neutralisation Capacity)	0.01	mol/kg	UNI EN 12457-2:2004 + UNI CEN/TS 15364:2006

ELUATE PREPARATION DATA

Mass parameters	Kg	UNI EN 12457-2:2004
Size reduction method	-	Pestel and mortar
Moisture content ratio	%	UNI EN 12457-2:2004
Leaching agent volume	L	

ELUATE PREPARATION DATA

pH	Unit	
Conductivity	$\mu\text{S}/\text{cm}$	
Temperature	$^{\circ}\text{C}$	

3 RESULTS

3.1 GROUND CONTAMINATION ANALYSIS

The test accreditation certificates of the results from the laboratory analysis of the samples are enclosed as Appendix 1. The results indicated in the tables below indicate that none of the samples exceed the limit stipulated in the Decreto 152 of 2006. Consequently, the material excavated from the TTF site is not comminated and is suitable for backfilling.

TABLE 4: RESULTS FROM GROUND CONTAMINATION ANALYSIS

ANALYTE	U.O.M	LIMIT (DECRETO 152 OF 2006)	BH3S	BH3M	BH3D	BH1S
Arsenic	Mg/kg	50	2.9	6.9	6.5	3.5
Cadmium	Mg/kg	15	0.28	< 0.2	0.34	0.35
Chromium	Mg/kg	800	13	19	23	16
Mercury	Mg/kg	5	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	Mg/kg	500	8.6	11	11	14
Lead	Mg/kg	1000	< 1	< 1	< 1	< 1
Copper	Mg/kg	600	< 5	6.9	5.4	< 5
Zinc	Mg/kg	1500	20	28	28	19

ANALYTE	U.O.M	LIMIT (DECRETO 152 OF 2006)	BH3S	BH3M	BH3D	BH1S
Cyanides	Mg/kg	100	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,e)pyrene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,l)pyrene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,i)pyrene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)pyrene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	Mg/kg	10	< 0.1	< 0.1	< 0.1	< 0.1
Indenopyrene	Mg/kg	5	< 0.1	< 0.1	< 0.1	< 0.1

ANALYTE	U.O.M	LIMIT (DECRETO 152 OF 2006)	BH3S	BH3M	BH3D	BH1S
Pyrene	Mg/kg	50	< 0.1	< 0.1	< 0.1	< 0.1
Naphtalene	Mg/kg	50	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	Mg/kg	N/A	< 0.1	< 0.1	< 0.1	< 0.1
Summation of PAHs	Mg/kg	100	< 0.1	< 0.1	< 0.1	< 0.1
Benzene	Mg/kg	2	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	Mg/kg	50	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	Mg/kg	50	< 0.1	< 0.1	< 0.1	< 0.1
Xylene	Mg/kg	50	< 0.1	< 0.1	< 0.1	< 0.1
Summation (PCDD)/(PCDF) WHO-TEQ	Mg/kg	0.0001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
PCB28	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
PCB52	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
PCB101	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
PCB118	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001

ANALYTE	U.O.M	LIMIT (DECRETO 152 OF 2006)	BH3S	BH3M	BH3D	BH1S
PCB138	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
PCB153	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
PCB180	Mg/kg	5	< 0.001	< 0.001	< 0.001	< 0.001
Total Organic Carbon	%	N/A	< 0.01	< 0.01	< 0.01	< 0.01
Mineral oils	Mg/kg	N/A	< 1	< 1	< 1	< 1

3.2 HP CRITERIA ASSESSMENT

Based on the lab analysis of the samples and the characterisation of waste according to Schedule 3 of SL 549.63 (WASTE REGULATIONS), the samples have been categorised as shown in Table 5. The results obtained indicate that the material is considered Non-Hazardous and therefore can be classified as EWC 17 05 04.

TABLE 5: WASTE CHARACTERIZATION PROCESS FOR GROUND SAMPLES

CODE	DESCRIPTION	CLASSIFICATION				JUSTIFICATION
		BH3S	BH3M	BH3D	BH1S	
HP1	Explosive	N/A	N/A	N/A	N/A	Not applicable, since no compounds with H200, H201, H202, H203, H204, H240 and H241 are present.
HP2	Oxidising	N	N	N	N	Despite the presence of H271 in chromium (III) chromate which would render all samples hazardous for HP2, this was considered unrealistic since: 1. Assuming that all metallic chromium is present as chromium (III) chromate, the concentration does not exceed 0.042% (w/w), which is extremely low; Other chromium compounds are likely to be present, meaning the chromium (III) chromate concentration would be even lower

CODE	DESCRIPTION	CLASSIFICATION				JUSTIFICATION
		BH3S	BH3M	BH3D	BH1S	
HP3	Flammable	N/A	N/A	N/A	N/A	Not applicable, since no compounds with H220, H221, H222, H223, H224, H225, H226, H228, H242, H250, H251, H250, H260 and H261 properties are present.
HP4	Irritant	N	N	N	N	Non-hazardous. Even though H314 properties are demonstrated in chromium compounds, H318 is present in copper (I) oxide, and H315 & H319 were present in tributyltin oxide, their % concentrations did not exceed the cut-off values for HP4 (1-5%, 1% and 10%, respectively).
HP5	Specific target organ toxicity	N	N	N	N	Non-hazardous. Although H372 was present in cadmium oxide, nickel monoxide and tributyltin oxide, and H373 was present in dimethyl mercury and lead alkyls, the % concentrations did not exceed the threshold limits (1% and 10%, respectively).
HP6	Acute toxicity	N	N	N	N	Non-hazardous since the samples do not contain substances classified as H300, H301, H310, H311, H330, H331 above 0.1% or H302, H312 and H332 above 1% threshold limits.

CODE	DESCRIPTION	CLASSIFICATION				JUSTIFICATION
		BH3S	BH3M	BH3D	BH1S	
HP7	Carcinogenic	N	N	N	N	Non-hazardous, since: 1. The total concentration of compounds with H350 does not exceed the threshold of 0.1%; and 2. The total concentration of compounds with H351 does not exceed the threshold of 1%. Despite the fact that various compounds entail H350 and H351 properties.
HP8	Corrosive	N	N	N	N	Non-hazardous, since the concentration of compounds with H314 (chromium (III) chromate) does not exceed the threshold limit (5%).
HP9	Infectious	N/A	N/A	N/A	N/A	Not applicable, since none of the analysed compounds can be considered 'infectious'.
HP10	Toxic for reproduction	N	N	N	N	Non-hazardous as H360, H361 concentrations do not exceed the 0.3% and 3% w/w threshold values, respectively.
HP11	Mutagenic	N	N	N	N	Non-hazardous, even though H340 properties are present in benzo(a)pyrene and H341 is present through cadmium oxide, the concentrations do not

CODE	DESCRIPTION	CLASSIFICATION				JUSTIFICATION
		BH3S	BH3M	BH3D	BH1S	
						exceed the threshold limits (0.1% and 1%, respectively).
HP12	Acute toxic gas	N/A	N/A	N/A	N/A	Not applicable, since no compounds with EUH029, EUH031 and EUH032 are present.
HP13	Sensitising	N	N	N	N	Non-hazardous, even though H317 is present through chromium (III) chromate, nickel monoxide and benzo(a)pyrene, the total concentration does not exceed the threshold limit (10%).
HP14	Ecotoxic	N	N	N	N	Non-hazardous, since the total concentration of compounds with H400 and H410 do not exceed the threshold of 25%.
HP15	Hazardous property not displayed in original waste	N/A	N/A	N/A	N/A	Not applicable, since no compounds with H205, EUH001, EUH019 and EUH044 are present.

3.3 LEACHATE RESULTS

The results obtained from the leachability tests described in Section 2.4 are summarised hereunder. The analytical results presented in mg/kg allows comparison to the EU Limits stipulated in 2003/33/EC. The certified reports of the two results obtained are included in Appendix I.

TABLE 6: LEACHABILITY RESULTS COMPARED TO EU LIMITS IN 2003/33/EC (GREY SHADING = NOT DETECTED, GREEN = BELOW EU LIMIT)

PARAMETER	UNIT	BH3S	BH3M	BH3D	BH1S	EU LIMITS IN 2003/33/EC L/S = 10 L/KG (MG/KG DRY)
Arsenic LT	Mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	2
Antimony LT	Mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.7
Barium LT	Mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	100
Cadmium LT	Mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	1
Chromium LT	Mg/kg	< 0.005	< 0.005	< 0.005	< 0.005	10
Mercury LT	Mg/kg	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.2
Molybdenum LT	Mg/kg	0.031	< 0.0001	0.034	0.021	10
Nickel LT	Mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	10
Lead LT	Mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	10
Copper LT	Mg/kg	< 0.005	< 0.005	< 0.005	< 0.005	50
Selenium LT	Mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.5

PARAMETER	UNIT	BH3S	BH3M	BH3D	BH1S	EU LIMITS IN 2003/33/EC L/S = 10 L/KG (MG/KG DRY)
Tin LT	Mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.7
Zinc LT	Mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	50
Chloride LT	Mg/kg	3.33	4.30	4.20	3.29	15,000
Fluoride LT	Mg/kg	0.51	0.55	0.65	0.56	150
Sulphate LT	Mg/kg	2.66	8.00	5.40	3.22	20,000
DOC LT	Mg/kg	12.1	25.8	43.2	26.3	800
TDS LT	Mg/kg	38	34	22	26	60,000
Mass of lab sample	Kg	0.94	0.95	1.86	1.86	-
Size reduction method	-	Mortal & pestle				-
Moisture content ratio	%	0.32	0.47	0.48	0.48	-
Leaching agent volume	L	0.9	0.9	0.9	0.9	-
pH	Unit	9.2	9.2	9.1	9.1	-
Conductivity	µS/cm	66	83	81	81	-
Temperature	°C	24.4	24.4	24.4	24.4	-

The concentration of parameters across all samples is similar, indicating little discrepancy between the leachability characteristics of sediment within the stations sampled.

When comparing the results obtained to the EU Council Directive 2003/33/EC Annex, Section 2.2.2 – Limit Values for non-Hazardous Wastes, it is evident that none of the samples exceed the threshold limit values. As previously stated, the material excavated from the site can be backfilled or disposed at a local landfill. The Contractor shall inform the ERA about the preferred disposal option.

APPENDIX I: CERTIFIED LABORATORY REPORTS

Client: AIS Environment Ltd						
Sampling mode: By the customer						
Report issue date: 02/10/2024						
Analyte	U.o.m.	Sampling Date	02/08/2024	02/08/2024	02/08/2024	02/08/2024
		Sample number	2162039-001	2162039-002	2162039-003	2162039-004
		Method	Soil from sampling point identified as "BH3S Limestone outcrops". Sampled at 11:00 by the customer and delivered to Sunlab Group Ltd. - ID SUNLAB 20240802A-001 Activity required by SUNLAB GROUP Ltd	Soil from sampling point identified as "BH3M Limestone outcrops". Sampled at 11:00 by the customer and delivered to Sunlab Group Ltd. - ID SUBLAB 20240802A-002 Activity required by Sunlab Group LTD	Soil from sampling point identified as "BH3D Limestone outcrops". Sampled at 11:00 by the customer and delivered to Sunlab Group Ltd. - ID SUBLAB 20240802A-003 Activity required by Sunlab Group LTD	Soil from sampling point identified as "BH1S Limestone outcrops". Sampled at 11:00 by the customer and delivered to Sunlab Group Ltd. - ID SUBLAB 20240802A-004 Activity required by Sunlab Group LTD
CHEMICAL PARAMETERS						
METALS						
Arsenic	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	2,9	6,9	6,5	3,5
Cadmium	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	0,28	< 0,2	0,34	0,35
Chromium	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	13	19	23	16
Mercury	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	< 0,1	< 0,1	< 0,1	< 0,1
Nickel	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	8,6	11	11	14
Lead	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	< 1	< 1	< 1	< 1
Copper	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	< 5	6,9	5,4	< 5
Zinc	mg/kg	UNI EN 13657:2004 + UNI EN 16170:2016	20	28	28	19
ANIONS						
Cyanides	mg/kg	MU 2251:08 App C	< 0,1	< 0,1	< 0,1	< 0,1
POLYCYCLIC AROMATIC HYDROCARBONS						
Benzo (a) anthracene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Benzo (a) pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Benzo (b) fluoranthene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Benzo (k) fluoranthene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Benzo(g,h,i)perylene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Chrysene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Dibenzo (a,e) pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Dibenzo (a,l) pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Dibenzo (a,i) pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Dibenzo(a,h)pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Dibenzo(a,h)anthracene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Indeno (1,2,3-c,d) pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Pyrene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Naphthalene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Fluoranthene	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
Summation of polycyclic aromatic hydrocarbons	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,01	< 0,01	< 0,01	< 0,01
AROMATIC ORGANIC COMPOUNDS						
Benzene	mg/kg	EPA 5035A 2002 + EPA 8260D 2018	< 0,01	< 0,01	< 0,01	< 0,01
Toluene	mg/kg	EPA 5035A 2002 + EPA 8260D 2018	< 0,01	< 0,01	< 0,01	< 0,01
Ethylbenzene	mg/kg	EPA 5035A 2002 + EPA 8260D 2018	< 0,01	< 0,01	< 0,01	< 0,01
Xylenes	mg/kg	EPA 5035A 2002 + EPA 8260D 2018	< 0,01	< 0,01	< 0,01	< 0,01
DIOXINS AND FURANS						
Summation (PCDD)/ (PCDF) WHO-TEQ	mg/kg	EPA 8280 B 2007 + UNEP/POPS/COP.3/INF/27 11/04/2007 WHO 2005 TEF	< 0,00001	< 0,00001	< 0,00001	< 0,00001
PCB con GC-QQQ						
PCB28	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB52	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB101	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB118	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB138	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB153	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
PCB180	mg/kg	EPA 3541 1994 + EPA 3630C 1996 + EPA 8270E 2018	< 0,001	< 0,001	< 0,001	< 0,001
OTHER SUBSTANCES						
TOC	%	UNI EN 13137:2002	< 0,01	< 0,01	< 0,01	< 0,01
Mineral Oils (C10÷40)	mg/kg	UNI EN 14039:2005	< 1	< 1	< 1	< 1
Acid Neutralization Capacity	mol/kg	UNI CEN/TS 15364:2006	See Attached	See Attached	See Attached	See Attached
Acceptance parameters on the eluate from leaching tests UNI EN 12457-2:2004						
Arsenic LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,5	< 0,5	< 0,5	< 0,5
Antimony LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,1	< 0,1	< 0,1	< 0,1
Barium LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,01	< 0,01	< 0,01	< 0,01
Cadmium LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,5	< 0,5	< 0,5	< 0,5
Chromium LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,005	< 0,005	< 0,005	< 0,005
Copper LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,005	< 0,005	< 0,005	< 0,005
Mercury LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,0001	< 0,0001	< 0,0001	< 0,0001
Molybdenum LT	mg/kg	UNI EN ISO 17294-2:2023	0,031	< 0,0001	0,034	0,021
Nickel LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,001	< 0,001	< 0,001	< 0,001
Lead LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,001	< 0,001	< 0,001	< 0,001
Tin LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,001	< 0,001	< 0,001	< 0,001
Selenium LT	mg/kg	UNI EN ISO 17294-2:2023	< 0,001	< 0,001	< 0,001	< 0,001
Zinc TC	mg/kg	UNI EN ISO 17294-2:2023	< 0,01	< 0,01	< 0,01	< 0,01
Chloride LT	mg/kg	UNI EN ISO 10304-1:2009	3,33	4,3	4,2	3,29
Fluoride LT	mg/kg	UNI EN ISO 10304-1:2009	0,51	0,55	0,65	0,56
Sulphates LT	mg/kg	UNI EN ISO 10304-1:2009	2,66	8	5,4	3,22
DOC LT	mg/kg	UNI EN 1484:1999	12,1	25,8	43,2	26,3
TDS LT	mg/kg	APAT CNR IRSA 2090 A Man 29 2003	38	34	22	26
Phenol index LT	mg/kg	UNI EN 16192:2012 + ISO 6439:1990	< 0,01	< 0,01	< 0,01	< 0,01
pH LT	unità	APAT CNR IRSA 2060 Man 29 2003	9,2	9,2	9,1	9,1
Eluate preparation data according to UNI EN 12457-2:2004						
Mass of the laboratory sample (Kg)			0,94	0,95	1,86	1,86
Size reduction method			Shredder	Shredder	Shredder	Shredder
Moisture content ratio MC (%)			0,32	0,47	0,48	0,48
Date of the test that produced the eluate			04/09/2024	04/09/2024	04/09/2024	04/09/2024
Volume of leaching agent (l)			0,9	0,9	0,9	0,9
pH (unit)			9,2	9,2	9,1	9,1
Conductivity (µS/cm)			66	83	81	81
Temperature (°C)			24,4	24,4	24,4	24,4

< Not evaluable for Value below the Detection Limit of the Test Method

This document does not constitute a Test Report, the results are to be considered only as an anticipation of the data of the tests carried out.

These must be validated according to the provisions of the company management system in the operating instruction IO.21.01. Therefore they may be subject to change.

APPENDIX II: WORKINGS

Replicate BH3S					
Metal			Compound		
Chemical	RAM	Conc (mg/kg)	Compound chemical	RMM	% Conc
Arsenic	75	2.9	Arsenic acid and its salts	142	0.000549067
Cadmium	112	0.28	Cadmium oxide	128	0.000032
Chromium	52	13	Chromium III chromate	452	0.0113
Mercury	201	0.1	Dimethyl mercury	231	1.14925E-05
Nickel	59	8.6	Nickel Monoxide	75	0.00109322
Lead	207	1	Tetraethyl lead (Lead alkyls)	323	0.000156039
Copper	65	5	Copper (I) oxide	143	0.0011
Zinc	64	20	Zinc oxide	81	0.00253125
Benzo(a)pyrene	252	0.01	Benzo(a)pyrene	252	0.000001
Benzo(k)fluoranthene	252	0.01	Benzo(k)fluoranthene	252	0.000001
Benzo (g,h,i) perylene	276	0.01	Benzo (g,h,i) perylene	276	0.000001
Indeno (1,2,3-cd) pyrene	290	0.01	Indeno (1,2,3-cd) pyrene	290	0.000001
Fluoranthene	202	0.01	Fluoranthene	202	0.000001
Total PCB content	1	0.001	Total PCB content	1	0.0000001
Total organic carbon	1	0.01	Total organic carbon	1	0.000001

Replicate BH1S					
Metal			Compound		
Chemical	RAM	Conc (mg/kg)	Compound chemical	RMM	% Conc
Arsenic	75	3.5	Arsenic acid and its salts	142	0.000662667
Cadmium	112	0.35	Cadmium oxide	128	0.00004
Chromium	52	16	Chromium III chromate	452	0.013907692
Mercury	201	0.1	Dimethyl mercury	231	1.14925E-05
Nickel	59	14	Nickel Monoxide	75	0.001779661
Lead	207	1	Tetraethyl lead (Lead alkyls)	323	0.000156039
Copper	65	5	Copper (I) oxide	143	0.0011
Zinc	64	19	Zinc oxide	81	0.002404688
Benzo(a)pyrene	252	0.01	Benzo(a)pyrene	252	0.000001
Benzo(k)fluoranthene	252	0.01	Benzo(k)fluoranthene	252	0.000001
Benzo (g,h,i) perylene	276	0.01	Benzo (g,h,i) perylene	276	0.000001
Indeno (1,2,3-cd) pyrene	290	0.01	Indeno (1,2,3-cd) pyrene	290	0.000001
Fluoranthene	202	0.01	Fluoranthene	202	0.000001
Total PCB content	1	0.001	Total PCB content	1	0.0000001
Total organic carbon	1	0.01	Total organic carbon	1	0.000001

Replicate BH3M					
Metal			Compound		
Chemical	RAM	Conc (mg/kg)	Compound chemical	RMM	% Conc
Arsenic	75	6.9	Arsenic acid and its salts	142	0.0013064
Cadmium	112	0.2	Cadmium oxide	128	2.28571E-05
Chromium	52	19	Chromium III chromate	452	0.016515385
Mercury	201	0.1	Dimethyl mercury	231	1.14925E-05
Nickel	59	11	Nickel Monoxide	75	0.001398305
Lead	207	1	Tetraethyl lead (Lead alkyls)	323	0.000156039
Copper	65	6.9	Copper (I) oxide	143	0.001518
Zinc	64	28	Zinc oxide	81	0.00354375
Benzo(a)pyrene	252	0.01	Benzo(a)pyrene	252	0.000001
Benzo(k)fluoranthene	252	0.01	Benzo(k)fluoranthene	252	0.000001
Benzo (g,h,i) perylene	276	0.01	Benzo (g,h,i) perylene	276	0.000001
Indeno (1,2,3-cd) pyrene	290	0.01	Indeno (1,2,3-cd) pyrene	290	0.000001
Fluoranthene	202	0.01	Fluoranthene	202	0.000001
Total PCB content	1	0.001	Total PCB content	1	0.0000001
Total organic carbon	1	0.01	Total organic carbon	1	0.000001

Replicate BH3D					
Metal			Compound		
Chemical	RAM	onc (mg/k	Compound chemical	RMM	% Conc
Arsenic	75	6.5	Arsenic acid and its salts	142	0.001230667
Cadmium	112	0.34	Cadmium oxide	128	3.88571E-05
Chromium	52	23	Chromium III chromate	452	0.019992308
Mercury	201	0.1	Dimethyl mercury	231	1.14925E-05
Nickel	59	11	Nickel Monoxide	75	0.001398305
Lead	207	1	Tetraethyl lead (Lead alkyls)	323	0.000156039
Copper	65	5.4	Copper (I) oxide	143	0.001188
Zinc	64	28	Zinc oxide	81	0.00354375
Benzo(a)py	252	0.01	Benzo(a)pyrene	252	0.000001
Benzo(k)fl	252	0.01	Benzo(k)fluoranthene	252	0.000001
Benzo (g,h	276	0.01	Benzo (g,h,i) perylene	276	0.000001
Indeno (1,	290	0.01	Indeno (1,2,3-cd) pyrene	290	0.000001
Fluoranth	202	0.01	Fluoranthene	202	0.000001
Total PCB	1	0.001	Total PCB content	1	0.0000001
Total orga	1	0.01	Total organic carbon	1	0.000001

Metal compound	H-statement																									
	H271	H300	H301	H302	H310	H312	H314	H315	H317	H318	H319	H330	H331	H332	H340	H341	H350	H351	H360	H361f-d	H372	H373	H400	H401	H410	H413
Arsenic acid and its salts			Y										Y				Y						Y		Y	
Cadmium oxide												Y				Y	Y			Y	Y		Y		Y	
Chromium III chromate	Y						Y		Y								Y						Y		Y	
Dimethyl mercury		Y			Y							Y										Y	Y		Y	
Nickel Monoxide									Y								Y				Y					Y
Tetraethyl lead (Lead alkyls)		Y			Y							Y							Y			Y	Y		Y	
Copper (I) oxide				Y						Y				Y									Y		Y	
Zinc oxide																							Y		Y	
Benzo(a)pyrene									Y						Y		Y		Y				Y		Y	
Benzo(k)fluoranthene																	Y						Y		Y	
Benzo (g,h,i) perylene																							Y		Y	
Indeno (1,2,3-cd) pyrene																		Y								
Fluoranthene				Y																			Y		Y	
Total PCB content																						Y	Y		Y	
Total organic carbon																										
Tributyltin oxide			Y			Y		Y			Y								Y		Y		Y		Y	
TOTAL BH3S (% conc)	0.011	0.000	0.001	0.001	0.000	0.000	0.011	0.000	0.012	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.013	0.000	0.000	0.000	0.001	0.000	0.016	0.000	0.016	0.001
TOTAL BH3M (% conc)	0.017	0.000	0.001	0.002	0.000	0.000	0.017	0.000	0.018	0.002	0.000	0.000	0.001	0.002	0.000	0.000	0.019	0.000	0.000	0.000	0.001	0.000	0.023	0.000	0.023	0.001
TOTAL BH3D (% conc)	0.020	0.000	0.001	0.001	0.000	0.000	0.020	0.000	0.021	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.023	0.000	0.000	0.000	0.001	0.000	0.026	0.000	0.026	0.001
TOTAL BH1S (% conc)	0.014	0.000	0.001	0.001	0.000	0.000	0.014	0.000	0.016	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.016	0.000	0.000	0.000	0.002	0.000	0.018	0.000	0.018	0.002

Code	Description	Classification SL 549.63	Notes	Classification			
				BH3S	BH3M	BH3D	BH1S
HP1	Explosive	Presence or absence of H200, H201, H202, H203, H204, H240, H241		N/A	N/A	N/A	N/A
HP2	Oxidising	Presence or absence of H270, H271, H272 and the source is not marine	Not marine	NH	NH	NH	NH
HP3	Flammable	Presence or absence of H220, H221, H222, H223, H224, H225, H226, H228, H242, H250, H251, H250, H260, H261		N/A	N/A	N/A	N/A
HP4	Irritant	Sum of H314 between 1% and 5% Sum of H318 > 1% Sum of H315, H319 > 10%	If sum of H314 > 5%, then HP8 will apply so HP4 would not apply	NH	NH	NH	NH
HP5	Specific target organ toxicity	STOT SE 1: Sum of H370 > 1% STOT SE 2: Sum of H371 > 10% STOT SE 3: Sum of H335 > 20% STOT SE 1: Sum of H372 > 1% STOT SE 2: Sum of H373 > 10% Asp tox 1: Sum of H304 > 10%		NH	NH	NH	NH
HP6	Acute toxicity	Contains individual substances classified as H300, H301, H310, H311, H330, H331 above 0.1% or H302, H312 and H332 above 1% cut-off values?	If False, it is not included in the sum of the concentrations for that hazard category code.	FALSE	FALSE	FALSE	FALSE
		If the above is true, the waste is hazardous if: sum of H300 ≥ 0.1% (Acute Tox. 1 oral)		NH	NH	NH	NH
		or sum of H300 ≥ 0.25% (Acute Tox. 2 oral)		NH	NH	NH	NH
		or sum of H301 ≥ 5%		NH	NH	NH	NH
		or sum of H302 ≥ 25%		NH	NH	NH	NH
		or sum of H310 ≥ 0.25 (Acute Tox. 1 Derm)		NH	NH	NH	NH
		or sum of H310 ≥ 2.5% (Acute Tox. 2 Derm)		NH	NH	NH	NH
		or sum of H311 ≥ 15%		N/A	N/A	N/A	N/A
		or sum of H312 ≥ 55%		NH	NH	NH	NH
		or sum of H330 ≥ 0.1% (Acute Tox 1. Inhal)		NH	NH	NH	NH
		or sum of H330 ≥ 0.5% (Acute Tox 2. Inhal)		NH	NH	NH	NH
		or sum of H331 ≥ 3.5%		NH	NH	NH	NH
		or sum of H332 ≥ 22.5%		NH	NH	NH	NH
HP7	Carcinogenic	Carc. 1: Sum of H350 > 0.1% Carc. 2: Sum of H351 > 1%		NH	NH	NH	NH
HP8	Corrosive	Sum of H314 > 5%	Concentrations between 1 and 5% would be considered as HP4	NH	NH	NH	NH
HP9	Infectious	Containing microorganisms or toxins		N/A	N/A	N/A	N/A
HP10	Toxic for reproduction	Repr. 1: Sum of H360 > 0.3% Repr. 2: Sum of H361 > 3%		NH	NH	NH	NH
HP11	Mutagenic	Muta 1: Sum of H340 > 0.1% Muta 2: Sum of H341 > 1%		NH	NH	NH	NH
HP12	Acute toxic gas	Presence or absence of EUH029, EUH031, EUH032		N/A	N/A	N/A	N/A
HP13	Sensitising	Sum of H317, H334 > 10%		NH	NH	NH	NH
HP14	Ecotoxic	Sum of H400 and H410 > 25%	Immediate or delayed risks for the environment	NH	NH	NH	NH
HP15	Hazardous property not displayed in original waste	Presence or absence of H205, EUH001, EUH019, EUH044		N/A	N/A	N/A	N/A