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Report

from Stany Pensaert
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EI Site Israel
Feasibility trials
Soil washing of mercury contaminated soils

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1. Introduction

DEME Environmental Contractors were contacted by LDD Tech in order to evaluate the treatability by soil washing of mercury contaminated soils which are encountered at the former chloralkali factory at Acre Israel.

LDD Tech asked DEC to focus at investigating the treatability of the mercury contaminated soil by means of complex soil washing. Preferably the soil washing should achieve the reuse targets for the site, which are now not fully established.

As a first step profound characterization of a variety of soil samples from the site covering the range of mercury concentrations and soil textures were carried out.

Then a stepwise research approach was followed:

- First the effectiveness of standard mobile soil washing was tested.
- Based on the results and in agreement with LDD a second mechanical step was added (attrition scrubbing) to see how this improves the efficiency.
- The third step involved chemical washing to see how this affects further mercury removal.

It will also provide a maximum mercury acceptance concentration level for washing, once the target level is set. This level can be used to estimate the amount of soil at the site that can be washed, and the amount of soil that should be disposed of off-site.

Secondly it was investigated if soils which cannot be treated by soil washing could be made compliant by chemical stabilization to the waste landfill acceptance criteria for mercury leaching preferably focusing on disposal at a non-hazardous landfill.

In addition the chemical stabilization treatment might also be applicable to the soil washing filter cake residue in order to dispose this at the lowest possible cost.

Finally we have quantified the emission of mercury vapour from the soil by means of an in house developed emission flux chamber. This allowed to assess the impact of mercury emissions and defines necessary mitigation measures.

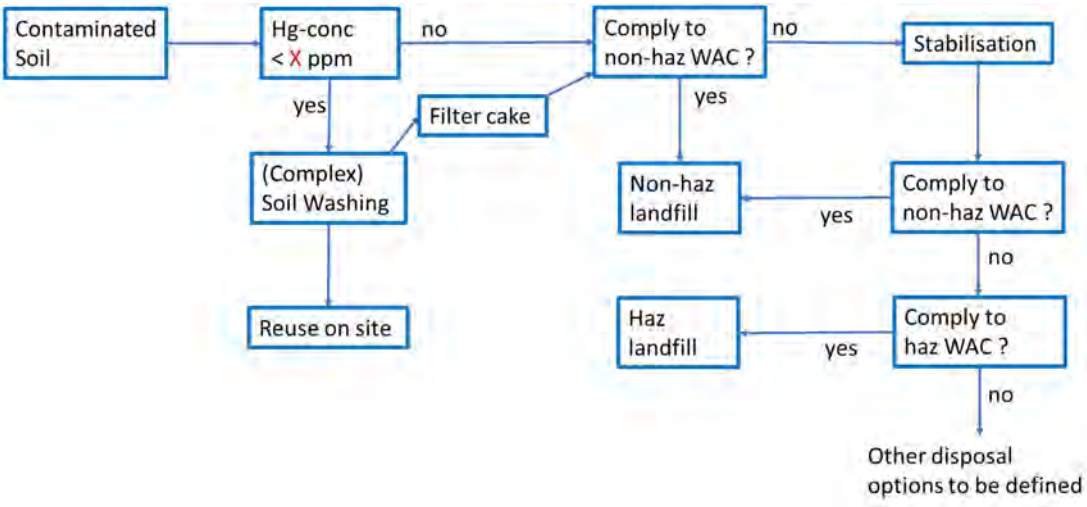
2. Treatment rationale and lab scale testing objectives.

2.1. Proposed treatment rationale.

As already mentioned in the introduction we see the mercury contaminated soil treatment as illustrated in the scheme below.

The **main objective** is to maximize the amount of soil that can be washed on-site however at an acceptable cost. Basically this means the soil washing acceptance concentration level (referred to X in the scheme) should be maximized. Therefore we will investigate which soil washing steps are required.

The **second objective** is, for the non-reusable soils, to maximize disposal at a non-hazardous waste landfill and hence minimize or even avoid disposal at more expensive disposal routes.



2.2. Test objectives.

From the above treatment rationale the objectives of the feasibility testing can be further defined:

- Characterize the soils and refer to preliminary reuse targets and disposal WAC (basically mercury concentrations and leachability).
- Quantify the potential emissions of mercury from the soils.
- Assess the feasibility of soil washing of the contaminated soils with the focus on reuse on site. We foresee a stepwise approach, in which the intensity and complexity of the soil washing process increases to ensure a maximum of treatment efficiency for a maximum volume to be treated:
    - Standard soil washing steps (particle size and density separation) as the basis.
    - Attrition scrubbing as extra physical mercury liberation step.
    - Chemical leaching as additional treatment step.

- The efficiencies of the various washing steps in this process will be evaluated. The necessary process steps required to achieve the reuse standards can be defined, and the acceptance level (X in the scheme) can be increased as high as possible. In case the reuse standards (as far as they are defined yet) are not met the residual concentration levels that can be achieved can be considered as BATNEEC treatment approach, being a basis for discussion on the final overall treatment schedule for this site.
- Evaluate the disposal possibilities of the filter cake residue, and chemical stabilization if required.
- Soils that are not feasible for washing (mercury concentration > X mg/kg DM) and which do not comply to the non-haz WAC will be tested by chemical stabilization.
- Estimate a budget cost of the various treatment options derived. Related to landfilling, the mechanism of accounting the environmental tax will need to be discussed (reduction or exemption of landfill cost after “treatment”) in order to compile the budget cost.

3. Sample collection and characterisation.

3.1. Sampling of the soil.

LDD Tech took 20 soil samples of each about 15 kg at the EI site. The samples were sent to DECs research centre in Belgium by LDD Tech. The 20 samples were received November 22nd 2021 in the DEME research lab. The samples were named alphabetically A to T.

3.2. Characterization of the soil samples.

After homogenization the 20 samples were characterized as follows:

- Visual and microscopic assessment
- Moisture content and organic matter content by means of LOI (loss on ignition).
- Particle size distribution (PSD) on the minus 2 mm fraction by means of laser diffraction.
- Total mercury by means of portable XRF.
- Mercury speciation: Hg total, Hg elemental, Hg inorganic, organic Hg.
- Leaching of mercury.
- Conductivity (salt content indication).

3.2.1. Internal characterisation at DEME lab.

3.2.1.1. Visual and microscopic assessment of the soil samples.

After homogenization and subsampling for external analyses the samples were stored back in their original buckets. Pictures of the surface of the samples can be seen in Figure 1.

It can be seen that most samples consist of fairly dry pale brown sand with variable amounts of gravels and only limited amount of organic matter. Only sample Q is different and seems to contain clayey material.

Under the microscope most samples do not show the presence of metallic mercury. Only for a few samples mercury droplets were observed as shown in Figure 2. Later it became clear that these were the most contaminated samples (mercury concentrations > 5000 mg/kg DM).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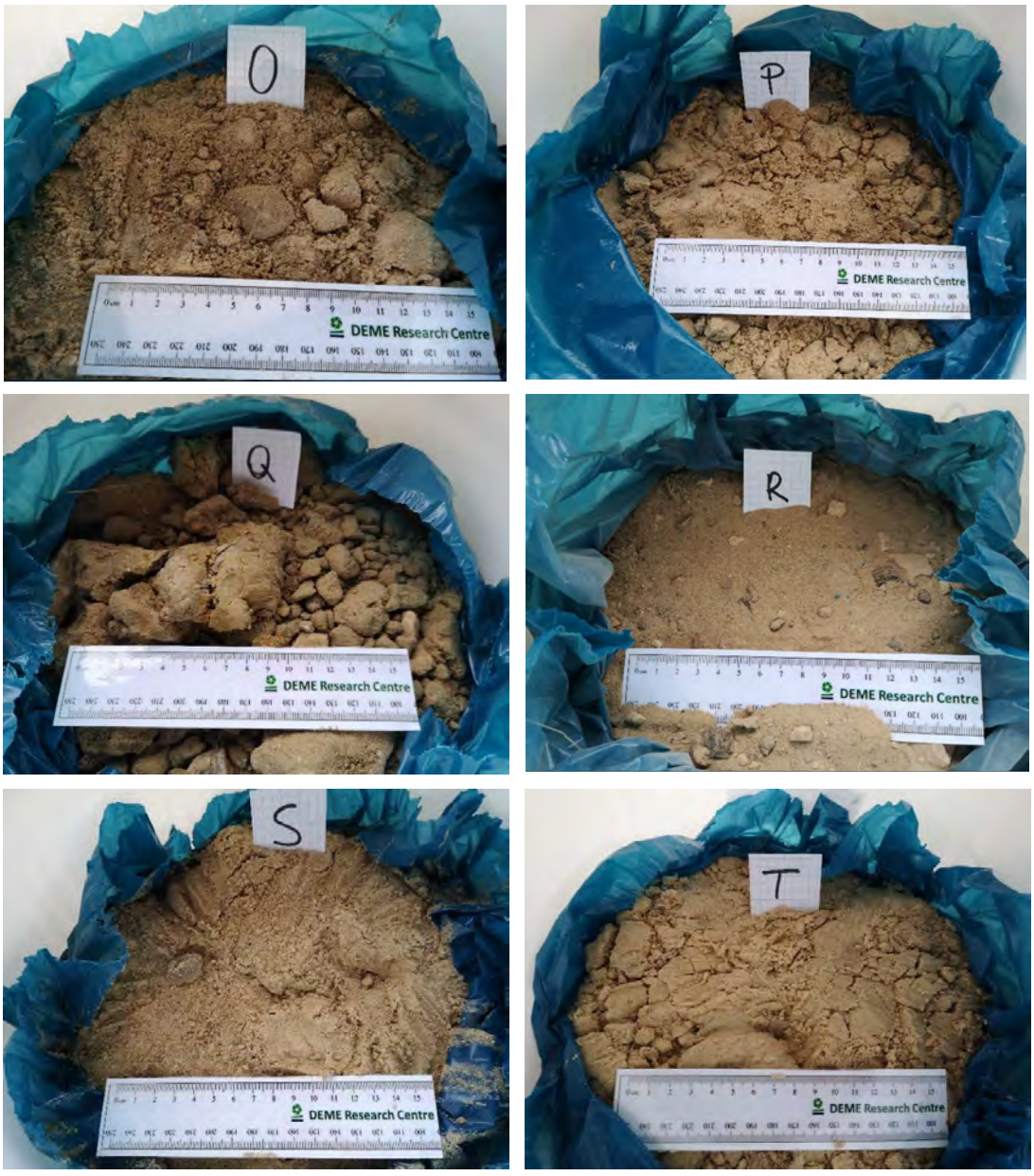

Figure 1. Visual assessment of the soil samples.

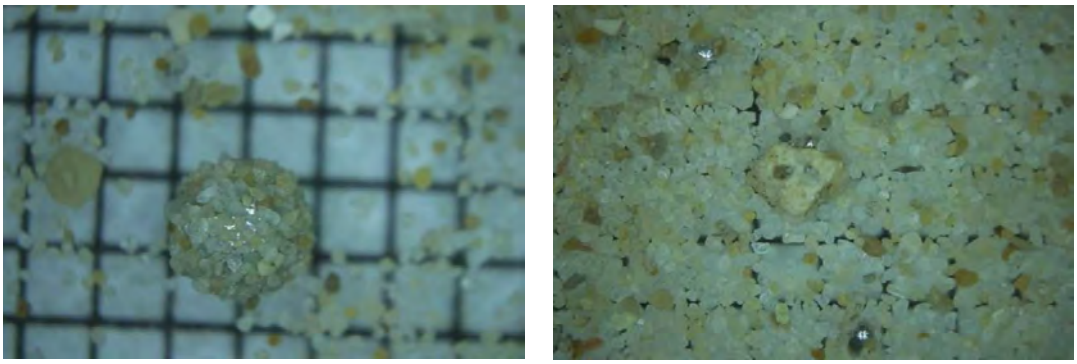

Figure 2. Microscopic view of some of the sand samples (grids background are 1 by 1 mm). Left: mercury droplet covered with sand grains. Right: mercury droplets attached to sand particles.

3.2.1.2. Moisture and organic matter content.

Subsamples from the buckets were taken and dried at 105 °C to determine the dry matter content (DMC) or moisture content. Results see Table 1. It can be observed that most soils are fairly dry. The high moisture content of sample Q is in line with its clayey nature.

The organic matter contents are fairly low and confirm the visual observations.

Table 1. Dry matter content and organic matter content of all samples. Organic matter is expressed as Loss on Ignition (LOI).

Sample	DM (%)	Moisture (%)	LOI%
A	94,49%	5,51%	0,5%
B	89,77%	10,23%	0,4%
C	89,04%	10,96%	0,4%
D	98,43%	1,57%	3,4%
E	98,28%	1,72%	0,4%
F	98,67%	1,33%	3,4%
G	97,08%	2,92%	1,0%
H	95,77%	4,23%	0,2%
I	98,47%	1,53%	7,3%
J	95,13%	4,87%	1,2%
K	96,37%	3,63%	1,4%
L	87,69%	12,31%	0,6%
M	98,83%	1,17%	1,8%
N	97,24%	2,76%	1,0%
O	96,37%	3,63%	1,7%
P	87,74%	12,26%	0,6%
Q	68,03%	31,97%	6,7%
R	99,16%	0,84%	6,5%
S	97,14%	2,86%	1,3%
T	89,38%	10,62%	0,4%

3.2.1.3. Particle size distribution of the sand fraction.

A full particle size distribution on all 20 samples was not performed as the observed amounts of gravel are fairly limited and will have no impact on full scale soil wash productions. The gravel fractions were determined on the four samples that were selected for the soil washing trials as will be further reported.

More important are the amount of fines as they will be considered as washing residue and will have an impact on throughput rates of a washing plant. One hundred grammes subsample of each of the 20 samples were dry sieved at 2 mm. The minus 2 mm fraction was subjected to organic matter destruction by means of peroxide, then treated with a dispersant, and finally analysed by means of a Malvern Mastersizer 3000. Each sample was measured in triplicate.

The full results are collected in annex 1. Table 2 summarizes the average fines fraction in the 0 – 2 mm part of the soils. Apart from sample D most samples show a very low fines content of only a few percent. As expected the clayey sample Q showed a very high fines content (more than 50 %) and is considered not suitable for soil washing.

Figure 3. Laser diffraction apparatus Malvern Mastersizer 3000.

Table 2. Fines content (fraction < 63 µm) of the 0 – 2 mm fraction of the soils determined by laser diffraction.

Sample	Fraction <63 µm (%)
A	1,59
B	0,58
C	0,00
D	13,84
E	0,00
F	5,76
G	3,55
H	2,10
I	7,60

J	1,56
K	1,62
L	0,00
M	3,61
N	0,00
O	1,29
P	0,00
Q	53,35
R	5,65
S	2,69
T	0,00

3.2.1.4. Metal concentrations by XRF

After homogenization the 20 sample buckets were analysed by means of a portable XRF (Olympus Delta). At least ten spot analyses per sample were carried out and measuring on coarse stones was avoided.

The full analysis can be found in annex 2. Only mercury is found to be the contaminant of concern and will be further analyzed during the scope of this research.

Table 3 summarizes the average concentrations of mercury measured by XRF both from the DEC and the LDD measurements. Large differences can be observed between the two data sets probably due to the inhomogeneous distribution of mercury droplets in the soil (nugget effect). This emphasizes that the XRF analyses for mercury (but also external lab analyses) must be interpreted with caution.

Table 3. Mercury concentrations measured by XRF in ppm. Comparison DEC and LDD analyses.

Sample	XRF DEC	XRF LDD
A	402	58
B	149	88
C	110	33
D	423	193
E	35	27
F	552	157
G	190	33
H	135	50
I	2.209	2.012
J	1.252	88
K	1.329	274
L	428	94
M	967	219
N	506	88
O	1.451	545
P	180	103

Q	319	93
R	3.540	637
S	674	149
T	118	110

3.2.2. External analyses.

3.2.2.1. Mercury analyses and mercury speciation.

Subsamples of the 20 samples were sent to i2 Analytical Ltd for total mercury content and mercury speciation. The methodology is based on EPA 3200 Mercury Speciation. A description can be found in annex 3. The mercury speciation splits the mercury compounds into elemental mercury, inorganic mercury, and organic mercury.

The results can be found in Table 4.

Table 4. Overview mercury analyses for the initial soil samples: XRF results, total mercury, and mercury speciations.

Sample	XRF DEC	XRF LDD	Total Mercury	Inorganic Mercury	Organo-Mercury Species	Elemental Mercury
A	402	58	290	152	24	69
B	149	88	190	65	13	94
C	110	33	120	61	9	15
D	423	193	370	244	13	43
E	35	27	43	27	2	7
F	552	157	290	150	25	67
G	190	33	300	176	19	58
H	135	50	190	68	9	104
I	2.209	2.012	3.300	409	52	2.825
J	1.252	88	2.800	583	80	1.537
K	1.329	274	5.400	547	55	4.595
L	428	94	1.400	134	50	984
M	967	219	890	286	63	383
N	506	88	2.600	281	48	1.978

O	1.451	545	6.200	676	75	5.060
P	180	103	460	126	38	271
Q	319	93	570	463	4	50
R	3.540	637	15.000	2.450	267	11.860
S	674	149	2.900	547	96	1.843
T	118	110	190	32	11	130

First of all it can be observed that the total mercury values analysed by the external lab are much higher than the XRF results. The correlation between XRF measured by DEC and the lab is shown in Figure 4. Averaged on all results the lab values are about 3.35 times higher than the XRF values. Apart from that the correlation shows quite some scatter resulting in a fairly low R^2 value.

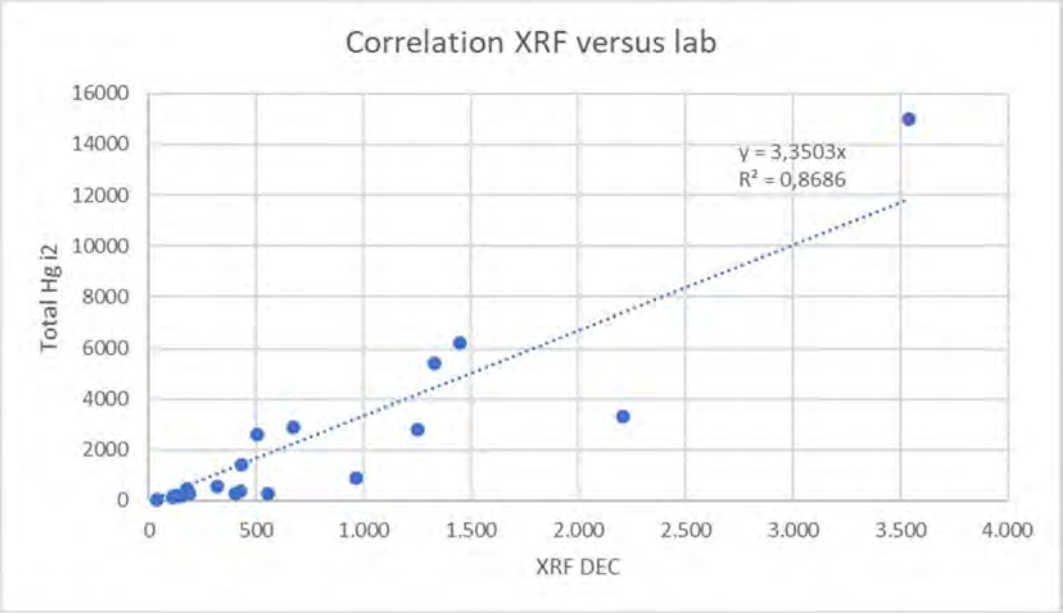

Figure 4. Correlation XRF and lab results.

The lab results of Table 4 are summarized in Figure 5 and Figure 6. From Figure 5 it can be observed that for the higher concentrations the mercury mainly consists of elemental mercury while for the lower concentrations (see Figure 6) the inorganic fraction of mercury is prevailing. This can be explained by the fact that the smaller droplets present at lower concentrations have undergone more weathering than larger droplets present at higher concentrations.

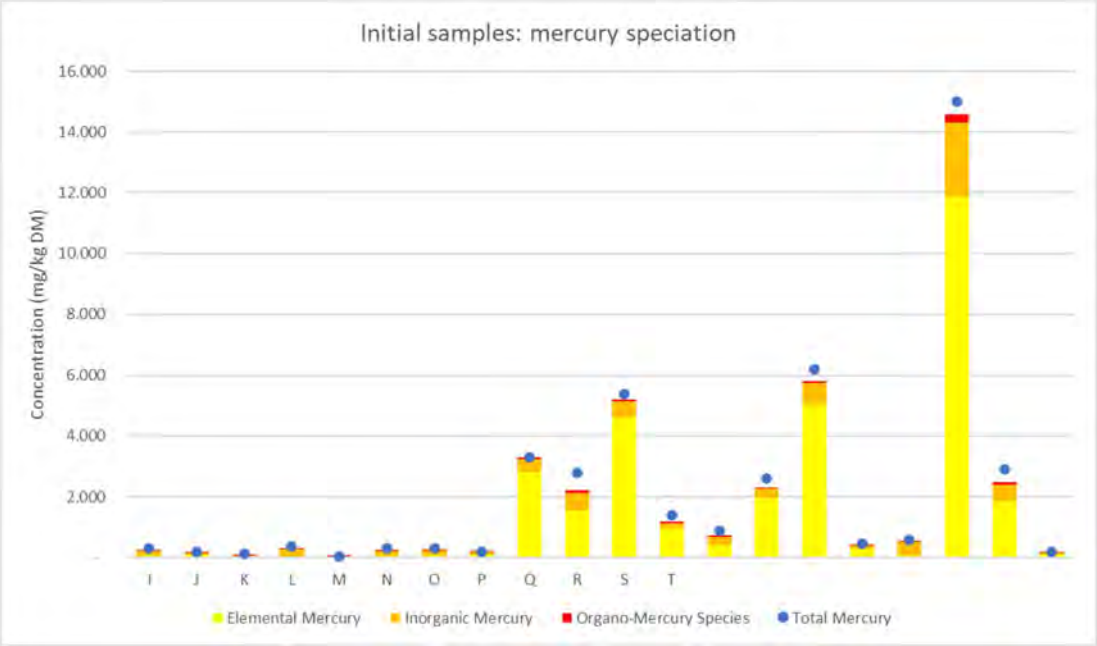

Figure 5. Overview of the mercury analyses and speciations by i2 Analytical Ltd.

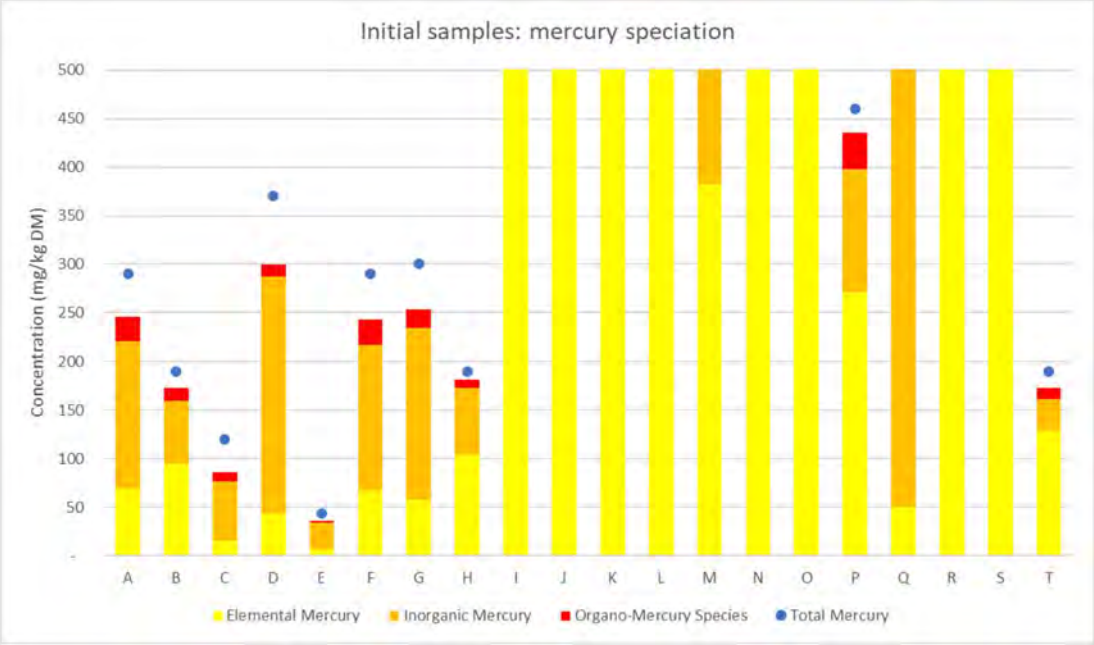

Figure 6. Overview of the mercury analyses and speciations by i2 Analytical Ltd (detail).

3.2.2.2. Leaching of mercury.

The leaching behaviour of the initial samples was also tested in order to evaluate the compliance with landfill waste acceptance. Leaching was carried out by i2 Analytical Ltd according to a batch leaching test EN-12457-2. The full reports can be found in annex 4. Table 5 summarizes the results.

When comparing to the European WAC for landfills (0.2 mg/kg DM for non-hazardous and 2 mg/kg DM for hazardous landfills) the leachability of most samples is quite high. None of the samples comply to the non-hazardous WAC and 14 of the 20 samples exceed the hazardous waste WAC of 2 mg/kg DM. If soils need to be disposed off site a pretreatment (immobilization) is necessary.

The pH of the leachates is quite high but this is expected based on the industrial activities (chloralkali plant). The electrical conductivity is for most samples very low (except one).

Table 5. Overview of the leaching results including pH and conductivity. As reference the total mercury content of the sample is listed.

Sample	pH	E.C. (µS/cm)	Leachable Hg (mg/kg DM)	Total Hg i2 (mg/kg DM)
A	9,5	130	2,1	290
B	9,3	87	0,94	190
C	8,7	63	0,52	120
D	8,5	91	0,4	370
E	9,3	57	0,65	43
F	8,7	53	1,1	290
G	8,9	67	5,9	300
H	9	61	2,1	190
I	8,5	60	6,7	3300
J	8,9	78	67	2800
K	9	65	35	5400
L	8,8	56	4	1400
M	8,7	63	3,5	890
N	8,7	46	17	2600
O	8,6	50	8,1	6200
P	8,8	51	6,3	460
Q	8,8	2800	0,36	570
R	8,3	82	66	15000
S	8,7	58	16	2900
T	8,6	50	2,1	190

3.3. Selection of the soil samples for treatment trials.

Based on the characterization in agreement with LDD four samples were selected for further trials. The basis for the selection is summarized in Table 6. The selection criteria were mercury concentration, leaching, and fraction of inorganic mercury.

Samples C, G, K and L were selected.

The initial plan was to select the samples according to their relevance at the site. Based on the site investigation about 80 % of the volumes showed mercury levels below 3-100 mg/kg DM and soil samples within this concentration range would be selected. However only one sample (sample E) was within this range. Finally it was decided to select four samples over the complete range of concentrations found in the characterization phase.

Table 6. Motivation for selection of the samples for soil treatment trials.

Sample	Total Hg i2 (mg/kg DM)	Leachable Hg (mg/kg DM)	Motivation selection		
			concentration	leaching	% inorganic Hg
E	43	0,65			
C	120	0,52	low	low	high
B	190	0,94			
H	190	2,1			
T	190	2,1			
A	290	2,1			
F	290	1,1			
G	300	5,9	low	high	high
D	370	0,4			
P	460	6,3			
Q	570	0,36			
M	890	3,5			
L	1400	4	medium	high	low
N	2600	17			
J	2800	67			
S	2900	16			
I	3300	6,7			
K	5400	35	high	high	low
O	6200	8,1			
R	15000	66			

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4. Soil washing trials.

4.1. Stepwise procedure.

A step wise procedure was followed:

Step 1: standard soil washing.

- Separation of gravel, sand and fines by means of wet sieving with clean water at a maximum of water to solid ratio of 10. The wash water will be collected and analyzed for dissolved mercury.
- The sand and gravel are drained, dried at 40 °C and then analysed by means of XRF. A visual assessment by means of a magnifying glass (for the gravel) and stereo microscope (for the sand) will be done.
- The generated fines are separated from the wash water by decantation, dried at 40 °C to prevent mercury evaporation, and analysed by XRF.
- The gravel will be further washed, drained, and analyzed for mercury by means of XRF. These analyses will be only indicative as they will be rather superficial analyses. The physical nature of the gravels will be assessed and reported.
- Sands are further washed in an upstream classifying column by means of clean water (water to solid < 10). After draining the washed sand for a sufficient time it is analysed for mercury by XRF. Also the upstream residue (mostly organic matter) will be analysed with XRF. The sand will be visually assessed by means of a stereo microscope in order to see presence of remaining droplets or stains of metallic mercury. Microscopic research will also reveal the mineralogical nature of the sands and might explain the level of residual concentrations of mercury.
  These sand fractions will also be sent for mercury analysis and speciation (Hg total, Hg elemental, inorganic Hg, organic Hg) to an external lab.

Based on all tested samples a mass balance will be presented which shows the various mineral outputs (gravel, sand, fines residue) and the partitioning of mercury in the process.

Step 2. Extra mechanical washing: attrition scrubbing.

- The 4 sand fractions obtained from step 1 will be further tested by means of attrition scrubbing. The attrition scrubbing might further liberate mercury from the surface of the sand grains.
- The efficiency of this extra treatment step will be followed by analysing mercury by XRF.
- The amount of extra fines residue caused by the attrition scrubbing will be evaluated.
- The scrubbed sand from each test which showed the best effect (lowest XRF result for mercury) will be sent for mercury analysis and speciation (Hg total, Hg elemental, inorganic Hg, organic Hg) to an external lab.

Step 3. Extra chemical washing: chemical leaching.

- As a third step chemical leaching will be applied on the sand fraction derived after attrition scrubbing.
- The leaching conditions (pH, leaching chemicals, durations) will be based our experience and the results of the previous steps and the analytical speciation of the present mercury.
- The efficiency of this extra treatment step will be followed by analysing mercury by XRF.
- The leached sand from each test which showed the best effect (lowest XRF result for mercury) will be sent for mercury analysis and speciation (Hg total, Hg elemental, inorganic Hg, organic Hg) to an external lab.

4.2. Step 1 Soil washing.

4.2.1. Wet sieving

About 5 kg was subsampled from the four selected soil samples and were wet sieved at a 2 mm and a 63 µm sieve. The obtained fractions were dried at 40 °C and weighed to calculate a particle size distribution. The result can be seen in Table 7.

The sand and gravel fractions can be seen in

Figure 7.

The gravel fraction mainly consists of limestone which was confirmed by a HCl test. Although the sand fraction mainly consists of quartz sand (as shown in Figure 2) a HCl test proved it contains around 17 % $CaCO_3$.

The obtained gravel and sand were also analysed for mercury by means of XRF. The results will be discussed further in the report.

The fines were analysed by means of XRF and externally by i2 Analytical. The results can be found in Table 8. It is obvious that the fines are a sink for mercury and therefore removing them will contribute to the washing efficiency. XRF and lab results correspond very well. A composite sample of the fines was made and sent to i2 Analytical for WAC analysis. Due to the limited amount of sample only the leaching behaviour was analysed. The results can be found in Table 9. The only non compliant parameter is the leachable mercury as expected. The leachability is about tenfold the hazardous waste landfill WAC. So as such the filter cakes from the soil washing are not suitable for landfill disposal.

The wash water was also analysed. The results can be found in Table 11. The values comply well with the leaching values of the initial soils (taking into account the factor L/S = 10).

Table 7. Particle size distribution.

Sample	gravel	sand	fines
C	0,35%	95,00%	4,64%
K	14,49%	83,39%	2,12%
L	1,44%	97,61%	0,94%
G	15,63%	81,97%	2,40%

Table 8. Mercury concentrations in the fines (XRF and lab)

Sample	Mercury (XRF ppm)	Mercury (lab mg/kg DM)
Fines C	2411	2200
Fines G	2716	2500
Fines K	20117	19000
Fines L	3241	2400

Table 9. Compliance of the fines (composite sample) to the landfill WAC.

	Fines C+G+K+L	inert	non haz	haz
As	0.101	0,5	2	25
Ba	0.465	20	100	300
Cd	0.0028	0,04	1	5
Cr	0.0087	0,5	10	70
Cu	0.045	2	50	100
Hg	24.2	0,01	0,2	2
Mo	0.0202	0,5	10	30
Ni	0.026	0,4	10	40
Pb	0.043	0,5	10	50
Sb	< 0.017	0,06	0,7	5
Se	< 0.040	0,1	0,5	7
Zn	0.059	4	50	200
Chloride	58	800	15000	25000
Fluoride	0.52	10	150	500
Sulphate	34	1000	20000	50000
TDS	700	4000	60000	100000
Phenol Index	< 0.10	1	-	-
DOC	70.7	500	800	1000

Table 10. Mercury concentrations in the wash water.

Sample	Mercury (µg/l)
Process water C	< 0.5
Process water G	430
Process water K	2100
Process water L	130

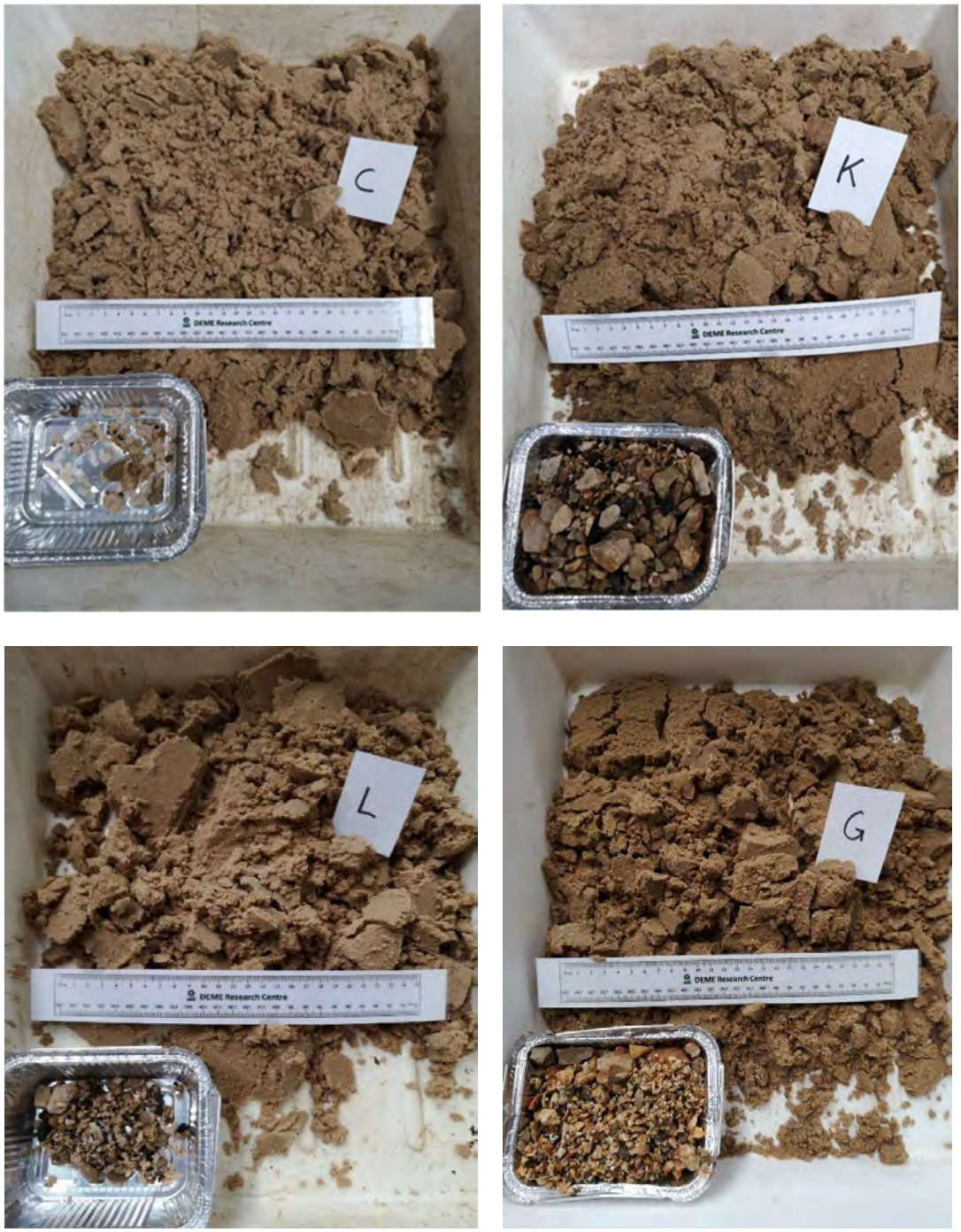

Figure 7.View on the gravel and sand fractions after wet sieving.

4.2.2. Organic matter removal by upstreaming.

The sand samples were further treated with upstreaming. In a soil washing process the organic matter is removed from the sand fraction by means of upstream classifying. Upstream classifying is a process step in which the sand is fluidized by an upgoing vertical flow of water. The sand slurry acts as a dense medium and as a result the less dense organic fibres and particles are segregated to the top and removed. In full scale this is a semi-continuous process, which is simulated in the lab by a small batch upstream classifying column as shown in Figure 8.

Figure 8. Upstream classifier in the lab.

The amount of organic matter separated from the sand by upstreaming was very limited and could hardly be quantified. From all four sand samples less than 0.5 % organic matter was removed. This of course could be expected based on the low organic matter content observed in the characterization phase.

The upstreamed sand was dried and analysed for mercury by XRF and by an external analysis for mercury and its speciation. The results are discussed further in the report.

4.2.3. Organic matter removal from gravel.

The gravel fractions from samples K and G were further washed by means of a small gravel washer which removes any surface contaminants and separates the organic matter particles.

It was observed that black organic particles were present in the gravel fractions, see

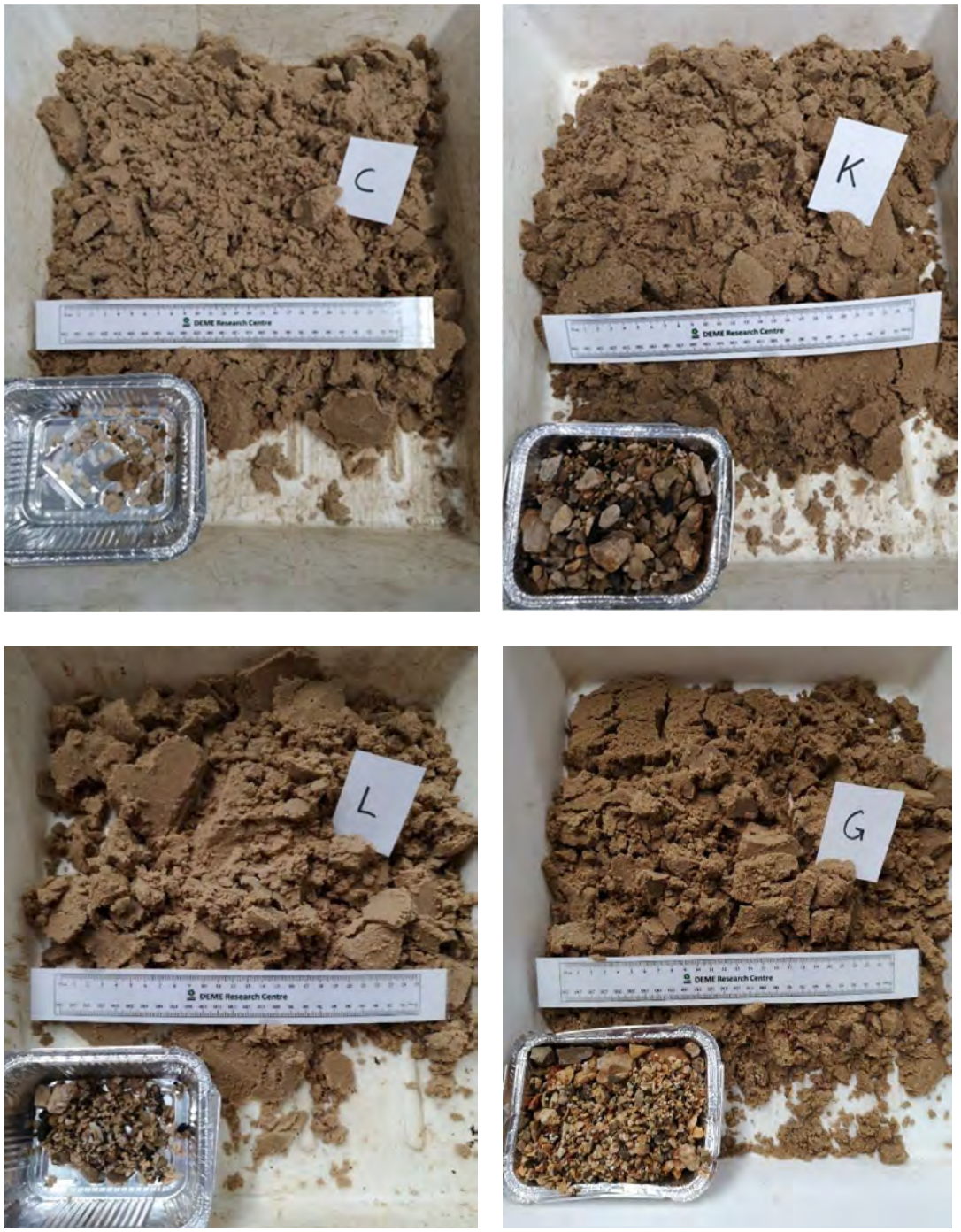

Figure 7. These black particles are suspected to be asphalt.

The washed gravel was dried and analysed by i2 Analytical Ltd. The results can be found in Table 11.

Although the gravels look visually perfectly clean still considerable amounts of mercury can be found. We have the suspicion that the mercury (soluble inorganic mercury ?) is absorbed in the porous limestone matrix.

Table 11. Mercury concentration of the washed gravels.

Sample	Mercury (mg/kg DM)
C	N/A
G	14
K	71
L	N/A

4.3. Step 2. Attrition scrubbing of the sands.

The sands were further treated by attrition scrubbing. Attrition scrubbing is the process in which the sand slurry is intensively agitated and the surface of the grains are scrubbed by their interaction. In this way precipitations are removed. The sands were treated in the lab attrition scrubber (see Figure 9) for 15 minutes at 300 RPM. The moisture content was set at 25% to create a thick slurry.

After scrubbing the sand slurry was wet sieved again at 63 µm to remove the scrubbing residue.

The amount of dried scrubbing residue was weighed to assess the residue production generated by the scrubbing and then analysed by XRF. The scrubbed sands were also dried and analysed by XRF and externally by the lab. Results will be discussed further.

Figure 9. Lab attrition scrubber

4.4. Step 3 - Chemical washing.

As third washing step chemical washing was carried out on the scrubbed sand samples from step 2.

Based on the observations (presence of limestone absorbing mercury) and literature two washing conditions were used:

- Hydrochloric acid (32%), 10 ml per 100 g sand (= 144 kg HCl(32%) per dry ton sand), 2 hours shaking.
- Caustic Soda (40%), 2 ml per 100 g sand (35 kg NaOH(40%) per dry ton sand), 2 hours.

It was observed that HCl caused a serious effervescent reaction clearly due to the presence of limestone in the sand. Therefore the carbonate content of the sand was determined (gravimetric by an excess HCl) and was found to be 17 %.

After two hours washing the sand samples were rinsed with tap water on a 63 µm sieve to remove all washing liquid and dissolved compounds. The rinsed sand was then dried at 40 °C and analysed for mercury by XRF and by i2 Analytical.

The results can be found in Table 12 and Table 13. It can be seen that the NaOH had almost no effect. The HCl washing on the other hand is promising although not on all samples, but as mentioned above the HCl consumption is very high.

The fairly good efficiency of the HCl washing confirms that a significant part of the mercury is absorbed in the limestone particles. Dissolving the limestone also removes the mercury. This was confirmed by analysing the sand samples on which the carbonate content was determined. These samples had been treated with an excess of HCl in order to remove all limestone. When analysing these samples with XRF all mercury concentrations were below 15 ppm, which confirms that the limestone act as a sink for mercury.

Figure 10. Sand samples during chemical washing

Table 12. Efficiency of the HCl washing on the various speciations.

	scrubbed sand					HCl washing				
	XRF	Lab				XRF	Lab			
	Mercury total	Mercury total	Inorganic Mercury	Organo-Mercury	Hg°	Mercury total	Mercury total	Inorganic Mercury	Organo-Mercury	Hg°
C	77,0	52	33,0	10,6	6,6	33,3	31,0	18,7	6,8	3,8
G	64,0	52	32,1	9,8	8,2	11,0	27,0	11,1	8,2	6,2
K	175,3	200	92,6	36,4	55,1	57,0	99,0	47,8	23,4	20,5
L	62,0	62	30,2	15,9	12,8	32,8	62,0	17,9	23,8	13,9

Table 13. Efficiency of the NaOH washing on the various speciations.

	scrubbed sand					NaOH washing				
	XRF	Lab				XRF	Lab			
	Mercury total	Mercury total	Inorganic Mercury	Organo-Mercury	Hg°	Mercury total	Mercury total	Inorganic Mercury	Organo-Mercury	Hg°
C	77,0	52	33,0	10,6	6,6	56,3	55,0	24,0	13,7	12,6
G	64,0	52	32,1	9,8	8,2	44,0	46,0	13,1	17,1	11,8
K	175,3	200	92,6	36,4	55,1	182,5	190,0	68,2	69,2	46,4
L	62,0	62	30,2	15,9	12,8	40,3	54,0	15,2	24,0	11,0

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5. Chemical stabilisation testing.

5.1. Selection of the samples for chemical stabilization.

For the chemical stabilization tests other samples have been selected than for the washing trials. We selected a range of samples from low to high concentrations and increasing leachabilities, see Table 14.

Table 14. Selection of samples for chemical stabilization.

Sample	Total Hg i2 (mg/kg DM)	Leachable Hg (mg/kg
C	120	0,52
A	290	2,1
N	2600	17
R	15000	66

5.2. Additives and mix formulations.

Three additives have been selected based on experience:

- Additive 1: Ferric Chloride: 5 m% dosing.
- Additive 2: Zerovalent iron: 5 m% dosing
- Additive 3: TMT-15: 0.5 m% dosing

The additives were mixed with the soils and the mixes were analysed for leaching after one week of resting.

5.3. Results of the chemical stabilization

The mixed samples were subjected to a shake leaching test (EN 12457-2) by i2 Analytical. All EU leaching waste acceptance criteria were analysed in the leachates. Table 15 shows the results and compares the results to the EU landfill WAC.

The initial samples A, N, R exceed the hazardous waste leaching criteria, while sample C exceeds non-hazardous waste but complies to hazardous waste.

The results of the chemical stabilization are very variable. For the samples C and A the leaching was increased by treatment (except A2), while for the samples N and R leaching was (significantly) reduced. It was unfortunately not possible to reduce the leachability and make the mixes compliant with the WAC. Only mix A2 was reduced to comply with hazardous waste but the initial sample A was only just above the hazardous waste WAC.

Table 15. Results of the chemical stabilization tests.

	C initial	C1	C2	C3	A initial	A1	A2	A3	N initial	N1	N2	N3	R initial	R1	R2	R3	inert	non-haz	haz
As		0.0124	< 0.0100	< 0.0100		< 0.0100	0.0152	0.0168		< 0.0100	0.0278	< 0.0100		< 0.0100	< 0.0100	< 0.0100	0,5	2	25
Ba		0.532	0.151	0.112		7.77	0.799	0.595		0.769	0.105	0.162		32.2	1.26	0.419	20	100	300
Cd		0.0014	0.0021	0.0017		0.0018	0.0040	0.0042		0.0067	0.0021	0.0069		0.256	0.0068	0.0128	0,04	1	5
Cr		0.0048	0.018	0.011		0.0057	0.036	0.044		0.0048	0.013	0.091		0.011	< 0.0040	0.050	0,5	10	70
Cu		0.0076	0.20	0.038		0.045	0.51	0.32		0.082	0.076	0.15		0.094	0.10	0.32	2	50	100
Hg	0,52	0.646	0.709	0.926	2,1	6.17	1.44	3.09	17	3.10	3.17	13.2	66	6.90	4.71	11.1	0,01	0,2	2
Mo		0.0043	0.0296	0.0088		0.0058	0.0258	0.0167		0.0048	0.0296	0.0125		0.0090	0.0459	0.0101	0,5	10	30
Ni		0.038	0.050	0.032		0.033	0.059	0.056		0.053	0.034	0.10		0.075	0.027	0.082	0,4	10	40
Pb		0.019	0.074	0.051		0.017	0.11	0.27		0.036	0.050	0.31		0.027	0.041	0.27	0,5	10	50
Sb		< 0.017	< 0.017	< 0.017		< 0.017	< 0.017	< 0.017		< 0.017	< 0.017	< 0.017		< 0.017	< 0.017	< 0.017	0,06	0,7	5
Se		< 0.040	< 0.040	0.041		0.061	< 0.040	0.049		0.078	< 0.040	< 0.040		< 0.040	0.067	< 0.040	0,1	0,5	7
Zn		0.072	1.3	0.18		0.12	1.9	0.65		0.19	0.51	0.37		0.16	0.52	0.90	4	50	200
Chloride		4700	8.0	1000		11000	15	800		12000	11	650		11000	66	490	800	15000	25000
Fluoride		< 0.50	0.98	< 0.50		< 0.50	1.6	0.57		< 0.50	1.1	< 0.50		< 0.50	1.4	< 0.50	10	150	500
Sulphate		23	12	2300		41	30	1800		21	19	1600		35	25	930	1000	20000	50000
TDS		4800	320	1400		10000	690	1600		9000	380	1300		8600	480	1200	4000	60000	100000
Phenol Index		< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	1	-	-
DOC		37.2	63.4	115		27.1	92.0	146		73.6	85.3	148		37.1	59.2	130	500	800	1000

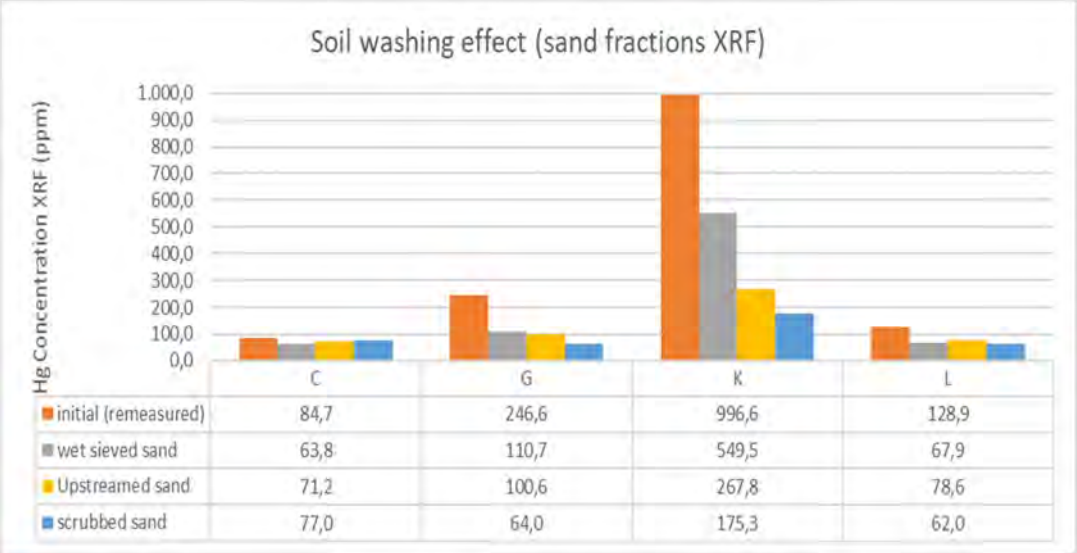
6. Discussion of the results.

6.1. Overall efficiency of the various soil washing steps.

The efficiency of the various mechanical soil washing steps (step 1 and 2) was evaluated during the tests by means of XRF. The results can be found in Figure 11. It can be seen that the highest mercury removal is achieved during wet sieving, which is basically removing the fines from the sand. For the higher contaminated sample K upstreaming has also a significant effect as it removes organic matter charged with mercury.

Attrition scrubbing seems to have some added value, in particular on the higher contaminated samples.

The residual concentrations however are still quite high compared to the envisaged target levels.



	C	G	K	L
initial (remeasured)	84,7	246,6	996,6	128,9
wet sieved sand	63,8	110,7	549,5	67,9
Upstreamed sand	71,2	100,6	267,8	78,6
scrubbed sand	77,0	64,0	175,3	62,0

Figure 11. Mercury concentrations in the various treatment steps (XRF analyses).

The step 1 (= wet sieving + upstreaming) and step 2 (= attrition scrubbing) samples were sent to i2 Analytical for analysis of total mercury and mercury speciation. When looking at total mercury, summarized in Figure 12, the effect of the washing steps seems to be much more spectacular. This is however mainly due to the much higher concentrations measured by the lab of the initial and step 1 samples compared to the XRF results. Looking at the step 2 samples (after scrubbing) the lab results comply well to the XRF results. The conclusion remains that the final concentrations are still quite high compared to the envisaged targets.

The sand after step 1 was also tested for leaching of mercury. The results can be found in Table 16. It can be seen that washing reduces the leachability but not to the same extent. The reason is not clear. Except for sample G the leachabilities of the other samples has been reduced to below the hazardous WAC of 2 mg/kg DM. Possibly an extra chemical stabilization could reduce the leachabilities further to below the non-hazardous WAC of 0.2 mg/kg DM although this should be confirmed.

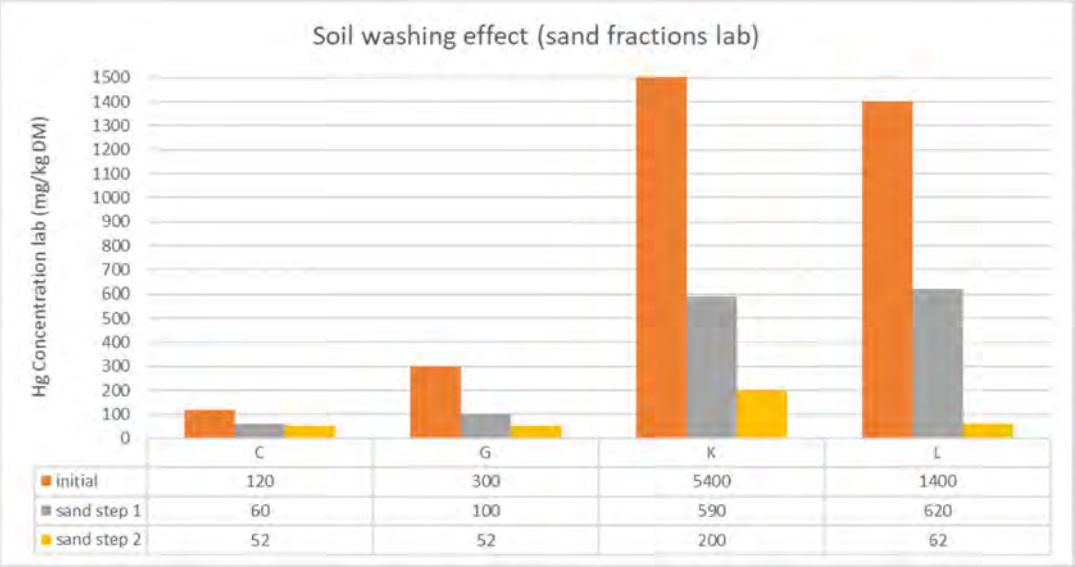


Figure 12. Total mercury concentrations in function of the washing steps.

Table 16. Leachability of the sand after step 1 washing.

mg/kg DM	Leaching	
Sample name	Initial	Sand after step 1
C	0,52	0,243
G	5,9	4,94
K	35	0,876
L	4	0,794

6.2. Speciation of the mercury compounds and efficiency per compound.

The samples sent to i2 Analytical were also analysed for mercury speciations. Table 17 shows the mercury total and its speciations for the initial soil and the sand after step 1.

The reduction in mercury content due to step 1 washing is mainly attributed to the removal of elemental mercury, even for the lower concentrations.

It can be seen from Table 18 that attrition scrubbing has added value to all mercury speciations in particular the elemental mercury at the higher concentrations.

As expected, efficiencies of washing decrease with lower (initial) mercury concentrations. For sample C a reduction of about 57 % of the mercury concentration is still achieved. The highest efficiency achieved was even 96 % for the high concentrations, although it requires scrubbing to get that high efficiency.

Table 17. Mercury speciations of initial soil and sand after step 1, and reductions in %. All based on the lab results.

mg/kg DM	initial soil				sand after step 1 (wet screening + upstreaming)				reductions			
Sample	Hg total	Inorgan. Mercury	Organo-Mercury	Hg°	Hg total	Inorgan Mercury	Organo Mercury	Hg°	Hg total	Inorgan Mercury	Organo Mercury	Hg°
C	120	61,06	9,294	15,27	60	38,88	8,316	6,417	50%	36%	11%	58%
G	300	176,3	18,79	57,83	100	45,02	13,23	31,17	67%	74%	30%	46%
K	5400	547,3	54,95	4595	590	225,9	122,9	210,9	89%	59%	-124%	95%
L	1400	133,7	50,4	984,4	620	210	134,2	259,7	56%	-57%	-166%	74%

Table 18. Mercury speciations of sand after step 2 , and reductions compared to the initial soil. All based on the lab results.

mg/kg DM	sand after step 2 (scrubbing)				reductions after step 2			
Sample name	Hg total	Inorganic Mercury	Organo-Mercury Species	Elemental Mercury	Hg total	Inorganic Mercury	Organo-Mercury Species	Elemental Mercury
C	52	32,96	10,56	6,584	57%	46%	-14%	57%
G	52	32,12	9,823	8,16	83%	82%	48%	86%
K	200	92,64	36,37	55,12	96%	83%	34%	99%
L	62	30,2	15,94	12,77	96%	77%	68%	99%

6.3. Efficiency for low contaminated soils.

Only one of the 20 initial soil samples contained less than 100 mg/kg DM of mercury: sample E contains 43 mg/kg DM of mercury, mainly consisting of inorganic mercury. It was decided also to wash this sample and to evaluate the efficiency. The results can be found in Figure 13.

Surprisingly the results are better than expected from the previous trials. The reduction by step 1 (wet sieving + upstreaming) is more than 75 %. Scrubbing adds little but the mercury concentrations are already very low.

The samples from the E washing trial were also sent to i2 Analytical. See results in Figure 14. Here the sand after step 1 shows a higher mercury content than the initial sample. The scrubbed sand on the other hand is only 7.9 mg/kg DM. The efficiencies for the various speciations can be found in Table 19 and Table 20.

Table 19. Mercury speciations of initial soil E and sand after step 1, and reductions in %. All based on the lab results.

mg/kg DM	initial soil				sand after step 1 (wet screening + upstreaming)				reductions			
Sample	Hg total	Inorgan. Mercury	Organo-Mercury	Hg°	Hg total	Inorgan Mercury	Organo Mercury	Hg°	Hg total	Inorgan Mercury	Organo Mercury	Hg°
E	43	27	2	7	48	21,2	7,2	13,3	-12%	23%	-339%	-99%

Table 20. Mercury speciations of sand of soil E after step 2 , and reductions compared to the initial soil. All based on the lab results.

mg/kg DM	sand after step 2 (scrubbing)				reductions after step 2			
Sample name	Hg total	Inorganic Mercury	Organo-Mercury Species	Elemental Mercury	Hg total	Inorganic Mercury	Organo-Mercury Species	Elemental Mercury
E	7,9	4	1,2	1,8	82%	85%	25%	72%

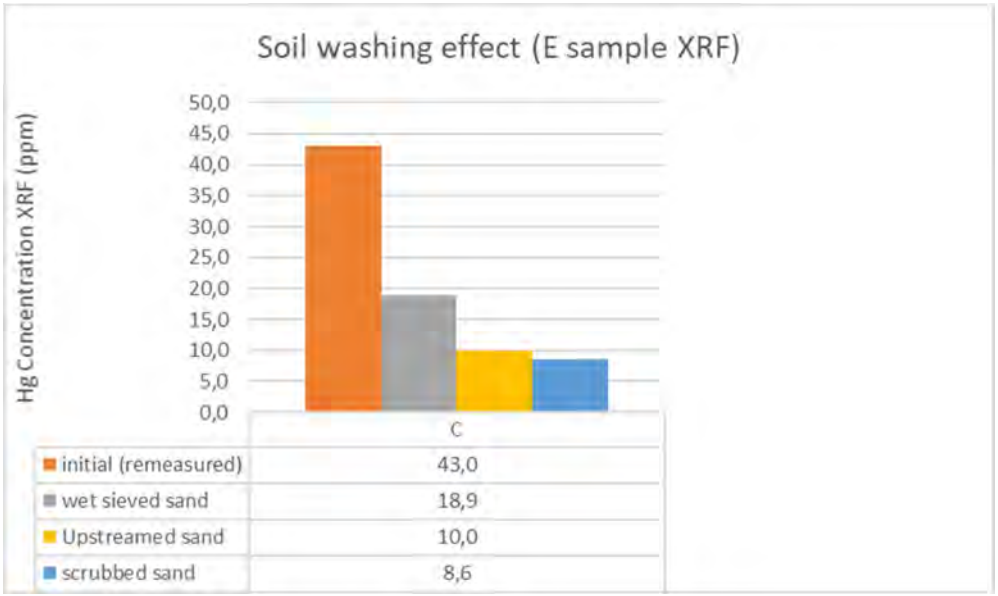


Figure 13. Washing effects on sample E (XRF)

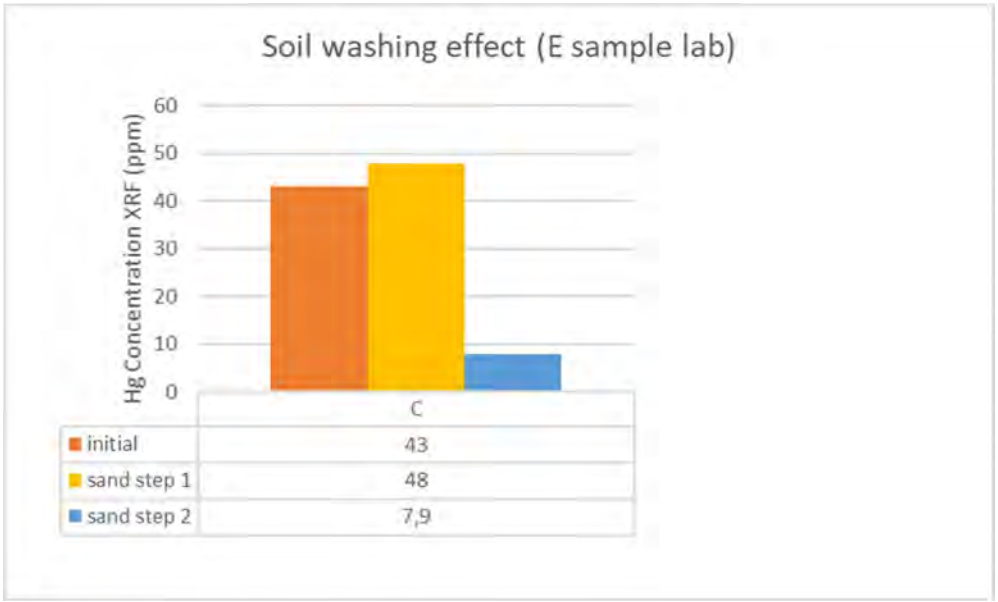


Figure 14. Washing effects on sample E (lab results)

7. Emission testing.

7.1. General approach

DEC has developed an emission management design approach for contaminated sites. This approach allows to qualify and quantify emissions of (semi)volatile contaminants enabling estimating the impact and defining mitigation measures, such as the use of tents for excavation.

The approach is summarized below. Basically emissions can be quantified via 3 ways (1A, 1B and 2). As soil samples will be made available the pathway 1B can be followed. The desk based approach (pathway 2) based on a kinetic model will be followed but only elemental mercury is included in the model (elemental mercury is probably the driving force for mercury emission).

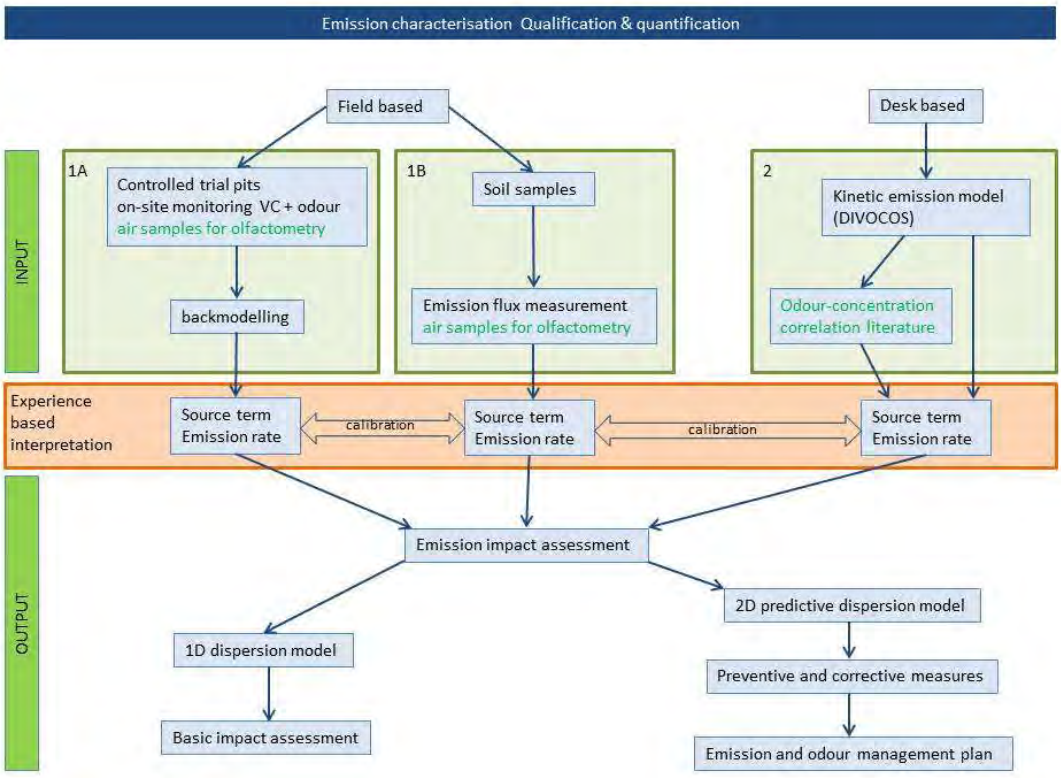


Figure 15. Emission assessment approach.

7.2. Emission flux measurement on soil samples (pathway 1B)

Clean air is sent over the surface of a soil sample by which the volatile compounds are transferred to the air. The concentrations of the mercury in the air is analysed by means of a mercury vapour sensor (Jerome 431). Air speed and temperature can be adjusted, and soil samples can be exposed at various conditions (at rest, stirred) which allows the assessment of various activity conditions (soil at rest e.g. in stockpile, soil during excavation). The result from the test is a so-called emission flux, i.e. the mass of volatile compounds emitted per unit of time and surface area.

The set up can be seen in Figure 16.

The emission flux values derived from the various samples will again be used to calculate a source term which in turn can be used as input value for dispersion modeling. In addition these flux values can be site specific correlated to the concentrations in the soil which allows to estimate flux values from soil concentrations determined during previously site investigation.

The following samples were selected, based on their mercury concentrations:

- Sample R: 15000 mg/kg DM
- Sample I: 3300 mg/kg DM
- Sample D: 370 mg/kg DM
- Sample E: 43 mg/kg DM

Figure 16. Emission flux chamber with mercury analyser.

Initially the emission fluxes on the selected samples were measured at the ambient temperature of the research lab (10.8 °C). Samples R and I have also been measured at a temperature of 18 °C to check the influence of temperature on the emission. In addition the emission of a large drop of mercury (about 2 cm²) has been measured as well as reference.

The concentrations measured in the air leaving the flux setup are shown in Figure 17. The average fluxes are calculated based on these readings by multiplying the average air concentrations with the air flow rate, then dividing by the exposed sample surface. These derived fluxes are summarized in Table 21.

It is obvious that the emission fluxes increase with increasing (elemental) mercury concentration, although the flux is not really proportional to the concentration. It can be seen that temperature has a substantial influence on the emission flux.

The evaporation rate of the pure mercury was found to be 2190 mg/m²/h which is higher than the literature value of 500 mg/m²/h.

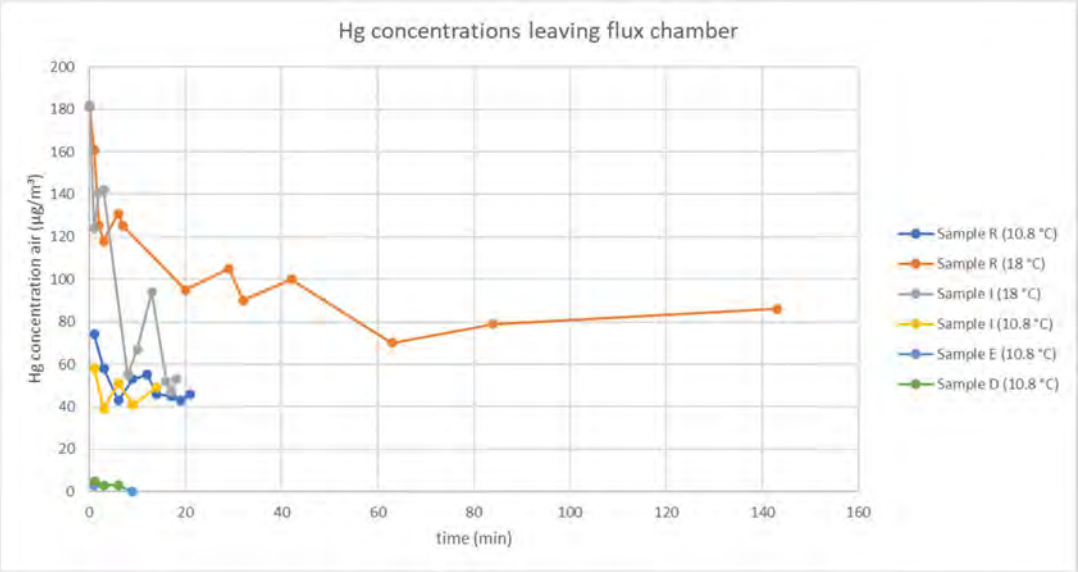


Figure 17. Emission flux measurements over time.

Table 21. Emission fluxes calculated from the flux setup readings.

Emission flux (mg/m²/h)						
T (°C)	Sample R	Sample I	Sample D	Sample E	Pure Hg	Pure Hg (literature)
10,8	59,7	55,3	4,3	2,3	2190	500
18	149,3	126,7				

7.3. Emission flux calculation based on modeling (pathway 2)

The kinetic emission flux modeling Divocos was applied to estimate the emission fluxes. Divocos was developed by the Dutch Institute RIVM specifically for contaminated site management.

For any of the concentrations in the range of the selected samples the saturation level concentration of mercury vapour in the air voids was reached.

Divocos allows to calculate mercury emissions caused by excavation, which can be calculated back to emission fluxes.

The obtained values for three different temperatures were:

Table 22. Results of the Divocos model.

Temperature	Mercury vapour equilibrium concentration (mg/m³)	Mercury emission flux (mg/m²/h)
11 °C	12.47	2.37
19 °C	16.84	3.37
30 °C	25.48	5.45

The emission fluxes from the soil during excavation clearly increase with soil temperature, almost proportional to the increase of the mercury vapour pressure with temperature. The temperature dependence however is less than what measured in the flux experiments.

The estimated fluxes are comparable to the experimentally determined fluxes of the less contaminated samples (D and E) but are about one order of magnitude smaller than the experimental fluxes of the highly contaminated samples.

7.4. Impact of the emissions to air quality.

The emission fluxes can be used as a source term for dispersion modeling. This enables to assess the impact of the emissions to the air quality downwind of the remediation works. In the example in Figure 18 we have assumed a 100 m² excavation area, a flux of 150 mg/m²/h (highest measured) and a typical wind speed of 5 m/s for that area. The figure shows the mercury concentrations downwind of the excavation area for different atmospheric conditions (Pasquill classes). As a reference the 8 hours exposure limit of 100 µg/m³ and the site specific safety level of 10 µg/m³ are shown. It can be seen that within less than 100 m the mercury levels drop to below 10 µg/m³. Near the excavation (within 20 m) necessary measures should be taken for working people.

It can be concluded that the expected impact is limited, but we recommend to confirm this with regular monitoring.

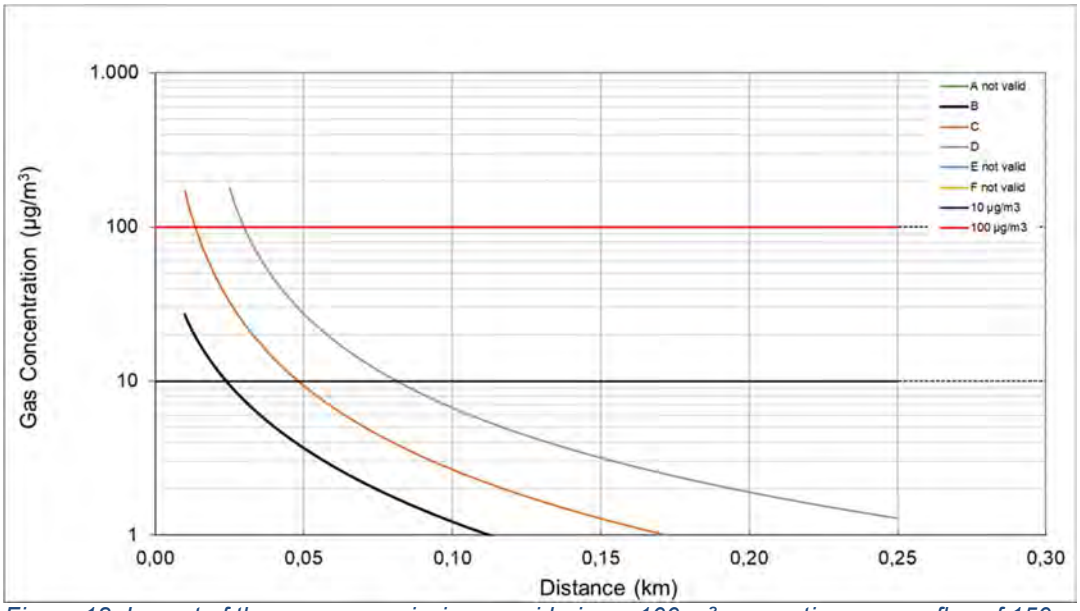


Figure 18. Impact of the mercury emission considering a 100 m² excavation area, a flux of 150 mg/m²/h and a wind speed of 5 m/s.

8. Final Conclusions

8.1. Representativity of the soil samples.

The soil samples provided in our research centre cover a wide span of mercury concentrations which allowed to select a number of samples with concentrations representative for what was found on the site during the previous site investigation work.

In joint agreement with LDD it was decided to select four samples from the range between 120 mg/kg DM and 5400 mg/kg DM for the washing trials. In addition also lowest contaminated sample with 43 mg/kg DM mercury was tested for soil washing efficiency.

With respect to particle size distribution all samples were quite similar (fine sand mainly) and according to LDD representative for the site.

8.2. Compliance of soil samples with EU WAC for landfilling.

Two third of the provided samples cannot be landfilled even at a hazardous waste landfill due to exceedance in mercury leaching. The other third complies to hazardous waste but not to non-hazardous waste. Again it must be emphasized that most samples were quite high in concentration compared to the mass balance of the site. It is expected based on the analyses that soils below 200 mg/kg DM of mercury comply to the haz waste WAC, which covers most of the soils at site.

The more contaminated soils cannot be landfilled without (pre)treatment.

8.3. Soil washing feasibility.

For low contaminated soil samples (< 200 mg/kg DM) the mercury removal efficiency that can be achieved is at least 50 %. Higher efficiencies have been obtained by adding scrubbing on top of the basic washing but the added value is limited.

Depending on the final remediation target the acceptance criterium of the soil washing process can be determined. At the moment discussions are ongoing on this subject and it is expected that the remediation target will be based only on elemental mercury and will lie in the range of 24 to 46 mg/kg DM. Since the mercury content in the lower contaminated samples consists of less than 50 % elemental mercury this would result in the fact that potentially soils up to about 100 mg/kg DM total mercury already comply with the reuse target, which is the majority of the soil volume. Soils above 100 mg/kg DM possibly up to about 300 ppm will be treatable.

The on-site target limit for inorganic mercury however is much higher (350 mg/kg DM) combined with the fairly good washing efficiency on this compound might allow to treat quite a lot of soils exceeding this level.

Chemical washing showed some interesting results but will be too complex in terms of process and expensive in terms of choice with equipment material choice.

8.4. Disposal of residue.

The fines cake was found to have a high leachability of mercury. Based on the chemical stabilization trials of the soils it could be possible to reduce the leaching to below the hazardous waste WAC, but further testing should be required.

Alternatively the filter cake, which is fairly limited, can be treated by thermal desorption and made compliant to disposal at landfill or even reuse on site.

8.5. Chemical stabilisation of soils.

Chemical stabilisation results of the highly contaminated soils show a good reduction in mercury leaching, but it might be hard to comply with landfill WAC. The chemical stabilization of washed sands was not tested, but most washed sand already complies to hazardous waste landfill WAC. To reduce further to below non-haz waste WAC further testing should be carried out.

8.6. Emission of mercury from the contaminated soils.

Even for the higher contaminated soils the emission of mercury has only limited impact to the surroundings. Obviously it is recommended to foresee the necessary respiratory protection equipment near the sources and carry out continuous monitoring during the works.

The fairly limited emission will also allow to perform full scale treatment such as washing in open air. Obviously the highest potential sources of emissions (treatment, stockpiling, mixing,…) should be located far enough from unprotected receptors (site boundary) upwind the prevailing wind directions. Again continuous monitoring should confirm dispersion of any emissions is sufficient.

8.7. General conclusion

Washing the sandy soil has certainly potential because the fact the different mercury speciations have all their own target levels and in function of the speciation the washing can be evaluated. It is expected soils up to (at least) 100 mg/kg DM of elemental mercury can be washed to below the future level (to be defined but probably between 24 to 46 mg/kg DM) and soils up to 800 mg/kg DM of inorganic mercury can be treated to below the 350 mg/kg DM target for inorganic mercury.

In order to evaluate the washability of soil during full scale works an assessment should be made based on mercury speciation analyses, e.g. by analysing excavated stockpiling prior to sentencing them to the relevant treatment pathway.

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Annex 1. Full PSD reports

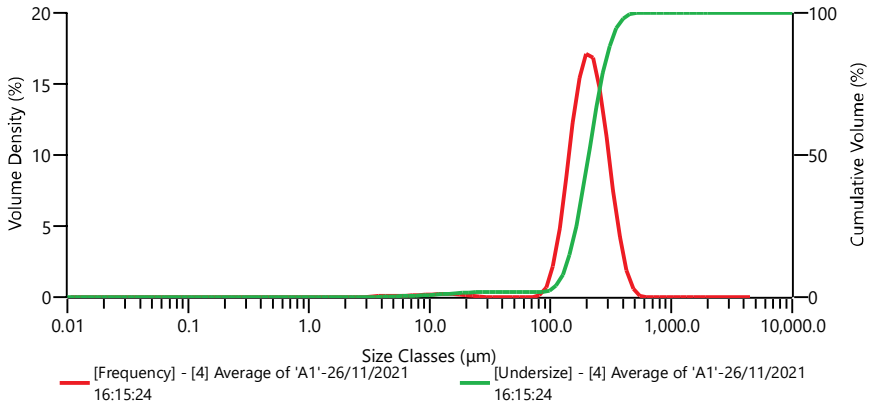
Results

Sample Name	Average of 'A1'
Dv (10)	132 µm
Dv (50)	207 µm
Dv (90)	320 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .98 Mesokurtic
Inclusive Skewness: .02 Near Symmetrical
Inclusive SD: .5 Moderately Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	1,51	250	70,59
1,00	0,00	30,0	1,62	300	86,04
2,00	0,00	32,0	1,62	400	98,05
3,00	0,00	40,0	1,62	425	98,75
4,00	0,06	50,0	1,62	500	99,84
5,00	0,17	60,0	1,62	600	100,00
6,00	0,27	63,0	1,62	630	100,00
6,20	0,29	75,0	1,62	700	100,00
7,00	0,37	80,0	1,65	800	100,00
8,00	0,47	100	2,42	900	100,00
9,00	0,57	125	7,39	1000	100,00
10,0	0,68	150	18,08	1500	100,00
16,0	1,27	200	46,31	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	1.62
Fine sand (63-200um)	44.69
Medium sand (200-630um)	53.69
Coarse sand (630-2000um)	0
Total sand (63-2000um)	98.38

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

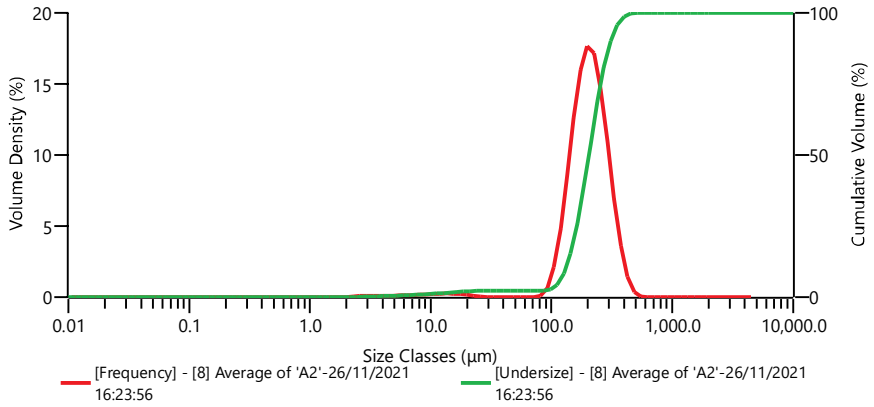
Results

Sample Name	Average of 'A2'
Dv (10)	131 µm
Dv (50)	204 µm
Dv (90)	309 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .99 Mesokurtic
Inclusive Skewness: .03 Near Symmetrical
Inclusive SD: .48 Well Sorted
Inclsuive Mean: 2.3 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	1,98	250	72,59
1,00	0,00	30,0	2,11	300	87,78
2,00	0,00	32,0	2,11	400	98,66
3,00	0,11	40,0	2,11	425	99,18
4,00	0,28	50,0	2,11	500	99,93
5,00	0,41	60,0	2,11	600	100,00
6,00	0,53	63,0	2,11	630	100,00
6,20	0,56	75,0	2,11	700	100,00
7,00	0,65	80,0	2,12	800	100,00
8,00	0,77	100	2,85	900	100,00
9,00	0,89	125	7,76	1000	100,00
10,0	1,02	150	18,69	1500	100,00
16,0	1,71	200	47,84	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	2.11
Fine sand (63-200um)	45.74
Medium sand (200-630um)	52.16
Coarse sand (630-2000um)	0
Total sand (63-2000um)	97.89

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

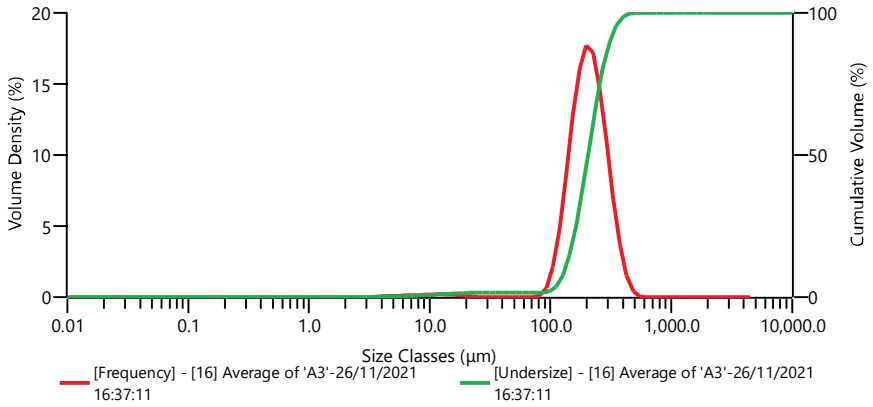
Results

Sample Name	Average of 'A3'
Dv (10)	132 µm
Dv (50)	204 µm
Dv (90)	311 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .98 Mesokurtic
Inclusive Skewness: .01 Near Symmetrical
Inclusive SD: .48 Well Sorted
Inclsuive Mean: 2.29 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	1,41	250	72,24
1,00	0,00	30,0	1,45	300	87,47
2,00	0,00	32,0	1,45	400	98,53
3,00	0,00	40,0	1,45	425	99,09
4,00	0,04	50,0	1,45	500	99,91
5,00	0,13	60,0	1,45	600	100,00
6,00	0,24	63,0	1,45	630	100,00
6,20	0,26	75,0	1,45	700	100,00
7,00	0,35	80,0	1,47	800	100,00
8,00	0,45	100	2,20	900	100,00
9,00	0,56	125	7,19	1000	100,00
10,0	0,67	150	18,20	1500	100,00
16,0	1,23	200	47,46	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	1.45
Fine sand (63-200um)	46.01
Medium sand (200-630um)	52.54
Coarse sand (630-2000um)	0
Total sand (63-2000um)	98.55

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

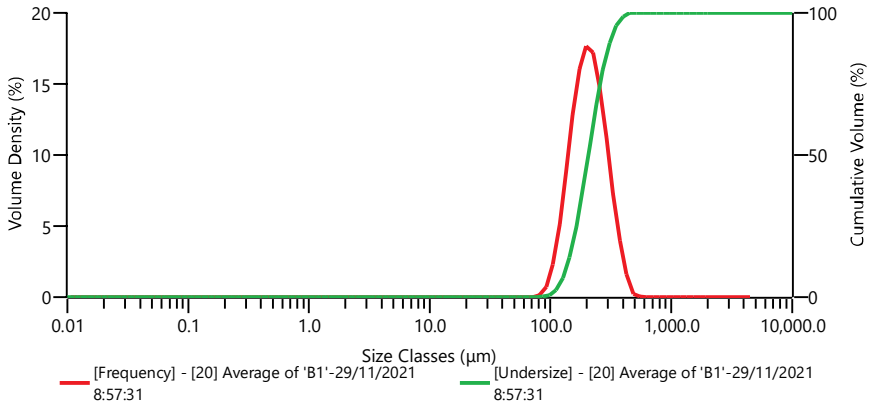
Results

Sample Name	Average of 'B1'
Dv (10)	134 µm
Dv (50)	206 µm
Dv (90)	314 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: 0 Near Symmetrical
Inclusive SD: .47 Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	71,60
1,00	0,00	30,0	0,00	300	87,06
2,00	0,00	32,0	0,00	400	98,63
3,00	0,00	40,0	0,00	425	99,23
4,00	0,00	50,0	0,00	500	99,97
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,02	800	100,00
8,00	0,00	100	0,84	900	100,00
9,00	0,00	125	6,15	1000	100,00
10,0	0,00	150	17,45	1500	100,00
16,0	0,00	200	46,81	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	46.81
Medium sand (200-630um)	53.19
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

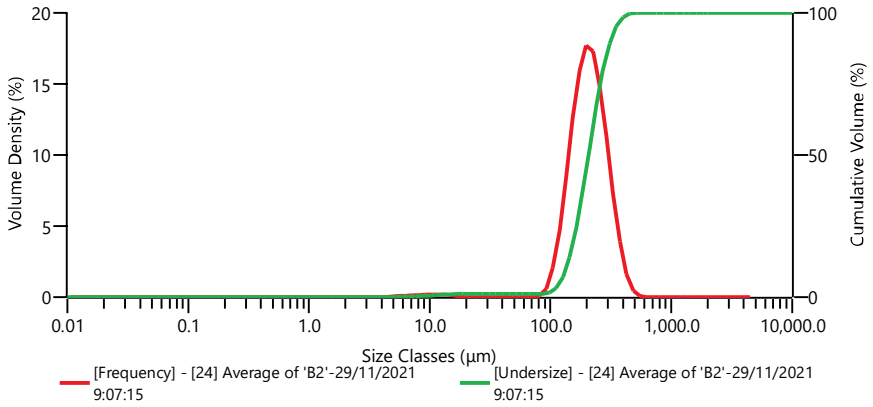
Results

Sample Name	Average of 'B2'
Dv (10)	134 µm
Dv (50)	206 µm
Dv (90)	315 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .97 Mesokurtic
Inclusive Skewness: .01 Near Symmetrical
Inclusive SD: .48 Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



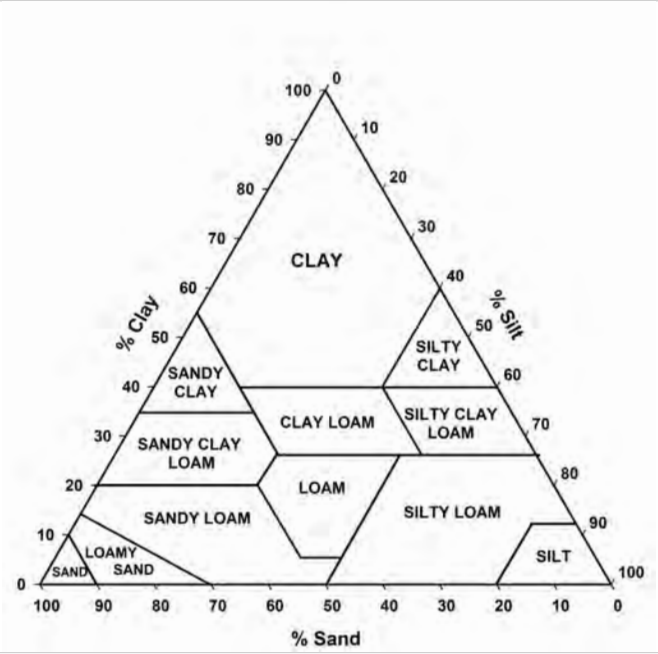
Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,96	250	71,37
1,00	0,00	30,0	0,96	300	86,89
2,00	0,00	32,0	0,96	400	98,39
3,00	0,00	40,0	0,96	425	99,00
4,00	0,00	50,0	0,96	500	99,89
5,00	0,00	60,0	0,96	600	100,00
6,00	0,07	63,0	0,96	630	100,00
6,20	0,09	75,0	0,96	700	100,00
7,00	0,17	80,0	0,97	800	100,00
8,00	0,27	100	1,66	900	100,00
9,00	0,38	125	6,50	1000	100,00
10,0	0,48	150	17,36	1500	100,00
16,0	0,93	200	46,46	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0.96
Fine sand (63-200um)	45.51
Medium sand (200-630um)	53.54
Coarse sand (630-2000um)	0
Total sand (63-2000um)	99.04

Soil texture triangle (USDA)



Soil Texture

Soil Texture: sand

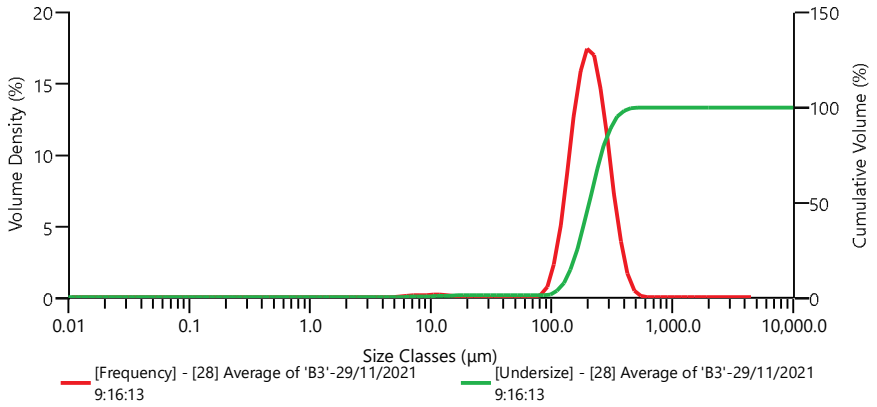
Results

Sample Name	Average of 'B3'
Dv (10)	133 µm
Dv (50)	205 µm
Dv (90)	315 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .97 Mesokurtic
Inclusive Skewness: .01 Near Symmetrical
Inclusive SD: .48 Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



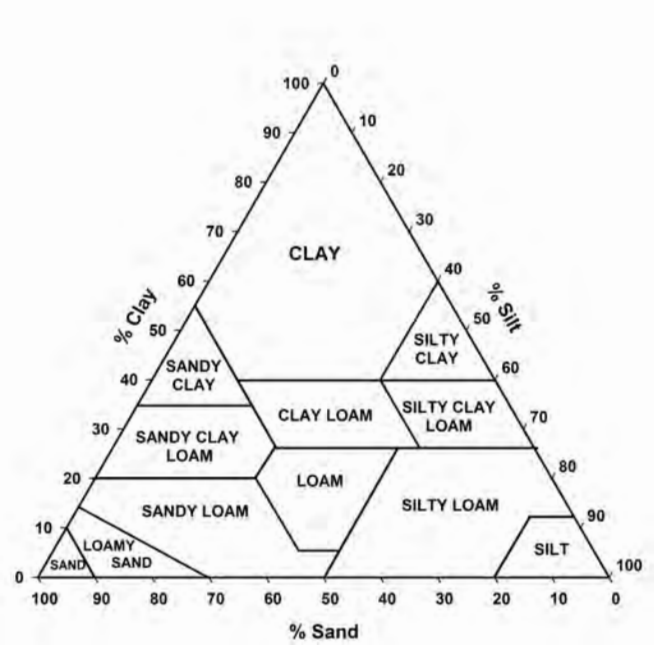
Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,79	250	71,63
1,00	0,00	30,0	0,79	300	86,93
2,00	0,00	32,0	0,79	400	98,38
3,00	0,00	40,0	0,79	425	98,99
4,00	0,00	50,0	0,79	500	99,90
5,00	0,00	60,0	0,79	600	100,00
6,00	0,01	63,0	0,79	630	100,00
6,20	0,03	75,0	0,79	700	100,00
7,00	0,09	80,0	0,81	800	100,00
8,00	0,18	100	1,64	900	100,00
9,00	0,28	125	6,88	1000	100,00
10,0	0,37	150	18,04	1500	100,00
16,0	0,77	200	47,08	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0.79
Fine sand (63-200um)	46.29
Medium sand (200-630um)	52.92
Coarse sand (630-2000um)	0
Total sand (63-2000um)	99.21

Soil texture triangle (USDA)



Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

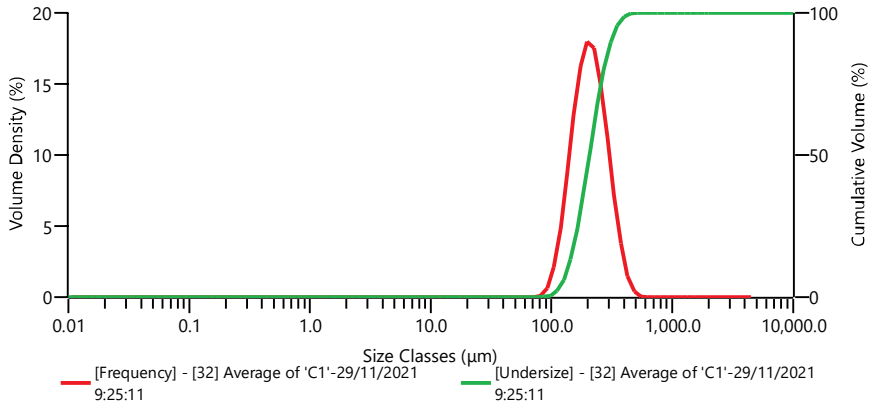
Results

Sample Name	Average of 'C1'
Dv (10)	136 µm
Dv (50)	206 µm
Dv (90)	312 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: 0 Near Symmetrical
Inclusive SD: .47 Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	71,76
1,00	0,00	30,0	0,00	300	87,30
2,00	0,00	32,0	0,00	400	98,57
3,00	0,00	40,0	0,00	425	99,12
4,00	0,00	50,0	0,00	500	99,92
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,02	800	100,00
8,00	0,00	100	0,71	900	100,00
9,00	0,00	125	5,67	1000	100,00
10,0	0,00	150	16,81	1500	100,00
16,0	0,00	200	46,53	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	46.53
Medium sand (200-630um)	53.47
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

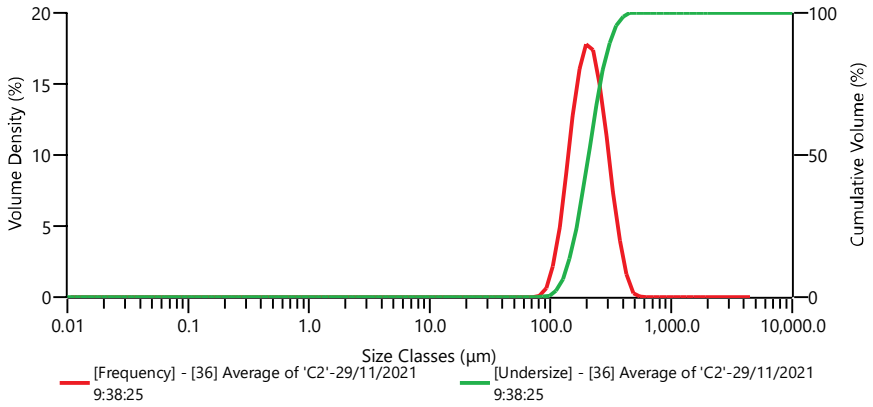
Results

Sample Name	Average of 'C2'
Dv (10)	136 µm
Dv (50)	206 µm
Dv (90)	314 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: 0 Near Symmetrical
Inclusive SD: .47 Well Sorted
Inclsuive Mean: 2.27 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	71,37
1,00	0,00	30,0	0,00	300	87,01
2,00	0,00	32,0	0,00	400	98,63
3,00	0,00	40,0	0,00	425	99,23
4,00	0,00	50,0	0,00	500	99,96
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,02	800	100,00
8,00	0,00	100	0,73	900	100,00
9,00	0,00	125	5,77	1000	100,00
10,0	0,00	150	16,88	1500	100,00
16,0	0,00	200	46,30	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	46.3
Medium sand (200-630um)	53.7
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

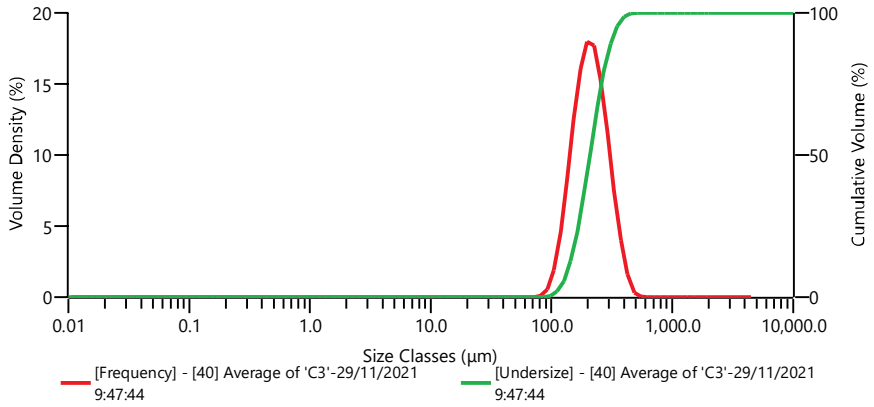
Results

Sample Name	Average of 'C3'
Dv (10)	137 µm
Dv (50)	208 µm
Dv (90)	315 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: 0 Near Symmetrical
Inclusive SD: .46 Well Sorted
Inclsuive Mean: 2.26 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	70,78
1,00	0,00	30,0	0,00	300	86,75
2,00	0,00	32,0	0,00	400	98,56
3,00	0,00	40,0	0,00	425	99,16
4,00	0,00	50,0	0,00	500	99,94
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,01	800	100,00
8,00	0,00	100	0,60	900	100,00
9,00	0,00	125	5,21	1000	100,00
10,0	0,00	150	15,93	1500	100,00
16,0	0,00	200	45,30	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	45.3
Medium sand (200-630um)	54.7
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

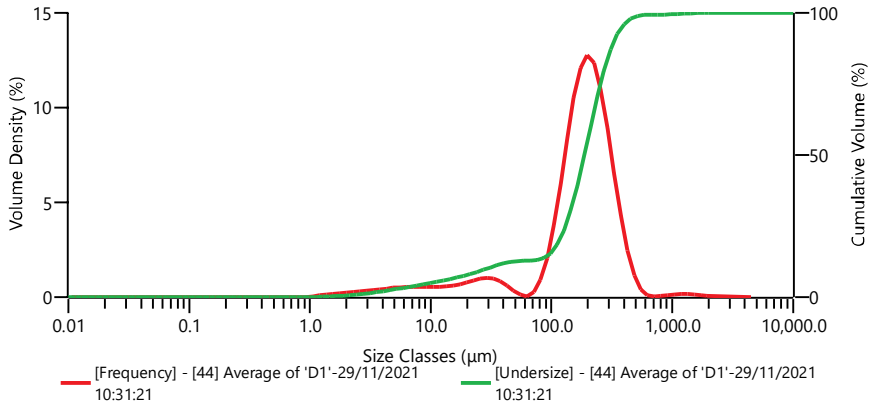
Results

Sample Name	Average of 'D1'
Dv (10)	29,5 µm
Dv (50)	187 µm
Dv (90)	332 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 2.23 Very Leptokurtic
Inclusive Skewness: .38 Strongly Fine Skewed
Inclusive SD: 1.18 Poorly Sorted
Inclsuive Mean: 2.5 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	7,70	250	73,39
1,00	0,00	30,0	10,11	300	85,20
2,00	0,51	32,0	10,52	400	96,04
3,00	1,25	40,0	11,82	425	96,99
4,00	1,96	50,0	12,54	500	98,72
5,00	2,63	60,0	12,71	600	99,26
6,00	3,22	63,0	12,71	630	99,28
6,20	3,34	75,0	12,89	700	99,30
7,00	3,76	80,0	13,19	800	99,32
8,00	4,23	100	15,75	900	99,38
9,00	4,65	125	22,86	1000	99,46
10,0	5,02	150	33,21	1500	99,83
16,0	6,70	200	55,51	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.51
Silt (2 - 63um)	12.2
Fine sand (63-200um)	42.8
Medium sand (200-630um)	43.77
Coarse sand (630-2000um)	0.72
Total sand (63-2000um)	87.29

Soil texture triangle (USDA)

Soil Texture

Soil Texture: loamy sand

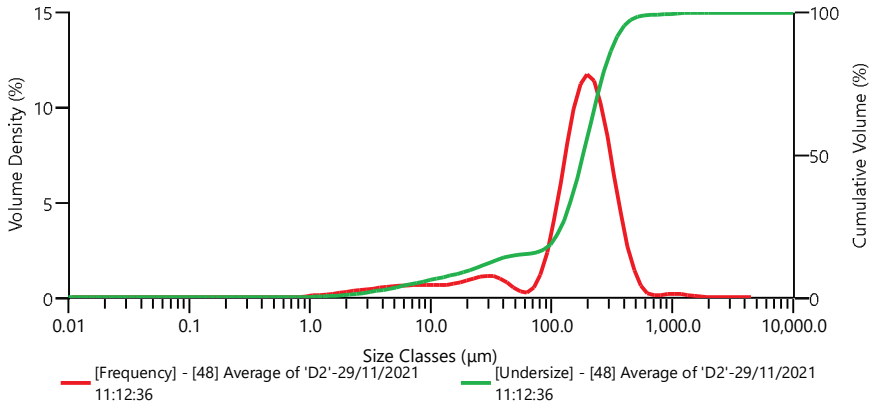
Results

Sample Name	Average of 'D2'
Dv (10)	23,2 µm
Dv (50)	182 µm
Dv (90)	337 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 2.15 Very Leptokurtic
Inclusive Skewness: .43 Strongly Fine Skewed
Inclusive SD: 1.33 Poorly Sorted
Inclsuive Mean: 2.62 Fine Grained

Frequency (compatible) and Undersize



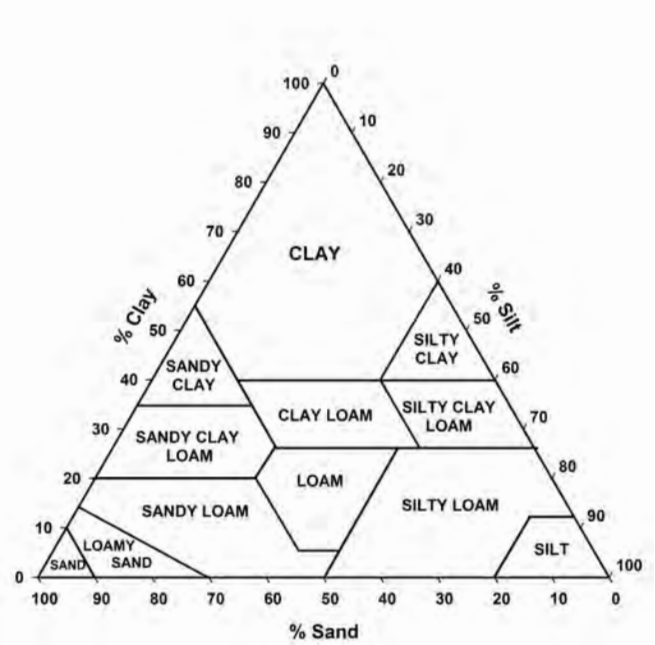
Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	9,10	250	73,57
1,00	0,01	30,0	11,81	300	84,68
2,00	0,70	32,0	12,28	400	95,40
3,00	1,60	40,0	13,77	425	96,44
4,00	2,46	50,0	14,72	500	98,43
5,00	3,24	60,0	15,08	600	99,20
6,00	3,93	63,0	15,15	630	99,26
6,20	4,06	75,0	15,57	700	99,35
7,00	4,55	80,0	15,99	800	99,42
8,00	5,09	100	18,99	900	99,52
9,00	5,57	125	26,31	1000	99,62
10,0	5,99	150	36,28	1500	99,97
16,0	7,95	200	57,04	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.7
Silt (2 - 63um)	14.44
Fine sand (63-200um)	41.9
Medium sand (200-630um)	42.21
Coarse sand (630-2000um)	0.74
Total sand (63-2000um)	84.85

Soil texture triangle (USDA)



Soil Texture

Soil Texture: loamy sand

PSD

DEME Research Centre

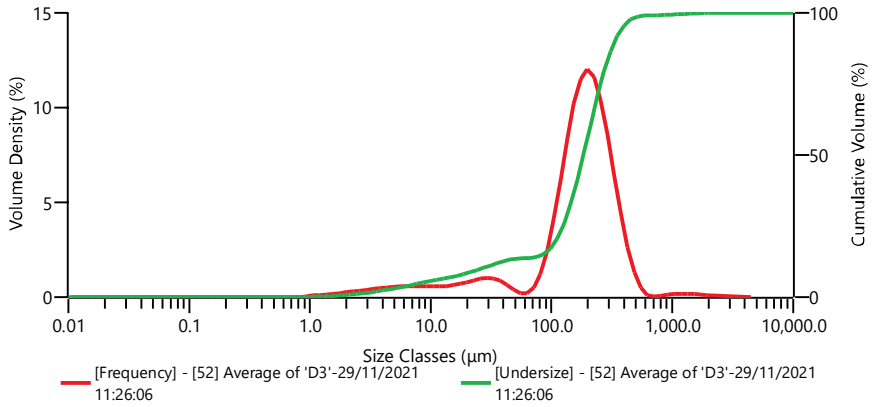
Results

Sample Name	Average of 'D3'
Dv (10)	26,6 µm
Dv (50)	184 µm
Dv (90)	336 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 2.18 Very Leptokurtic
Inclusive Skewness: .4 Strongly Fine Skewed
Inclusive SD: 1.26 Poorly Sorted
Inclsuive Mean: 2.55 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	8,35	250	73,46
1,00	0,01	30,0	10,80	300	84,73
2,00	0,66	32,0	11,23	400	95,53
3,00	1,50	40,0	12,56	425	96,55
4,00	2,29	50,0	13,35	500	98,47
5,00	3,01	60,0	13,62	600	99,13
6,00	3,66	63,0	13,67	630	99,16
6,20	3,78	75,0	14,06	700	99,19
7,00	4,23	80,0	14,49	800	99,21
8,00	4,73	100	17,60	900	99,27
9,00	5,17	125	25,15	1000	99,35
10,0	5,56	150	35,40	1500	99,78
16,0	7,32	200	56,63	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.66
Silt (2 - 63um)	13.01
Fine sand (63-200um)	42.96
Medium sand (200-630um)	42.53
Coarse sand (630-2000um)	0.84
Total sand (63-2000um)	86.33

Soil texture triangle (USDA)

Soil Texture

Soil Texture: loamy sand

PSD

DEME Research Centre

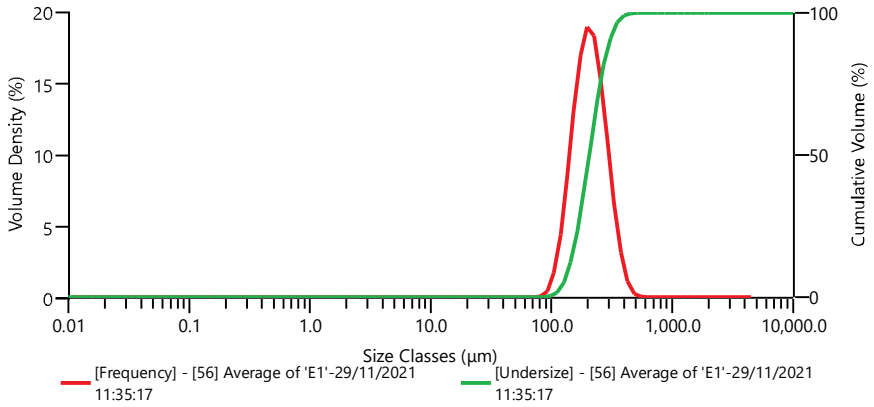
Results

Sample Name	Average of 'E1'
Dv (10)	138 µm
Dv (50)	205 µm
Dv (90)	305 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: -0.01 Near Symmetrical
Inclusive SD: .44 Well Sorted
Inclsuive Mean: 2.28 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	73,23
1,00	0,00	30,0	0,00	300	88,84
2,00	0,00	32,0	0,00	400	99,04
3,00	0,00	40,0	0,00	425	99,43
4,00	0,00	50,0	0,00	500	99,96
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,01	800	100,00
8,00	0,00	100	0,49	900	100,00
9,00	0,00	125	4,81	1000	100,00
10,0	0,00	150	15,76	1500	100,00
16,0	0,00	200	46,78	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	46.78
Medium sand (200-630um)	53.22
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

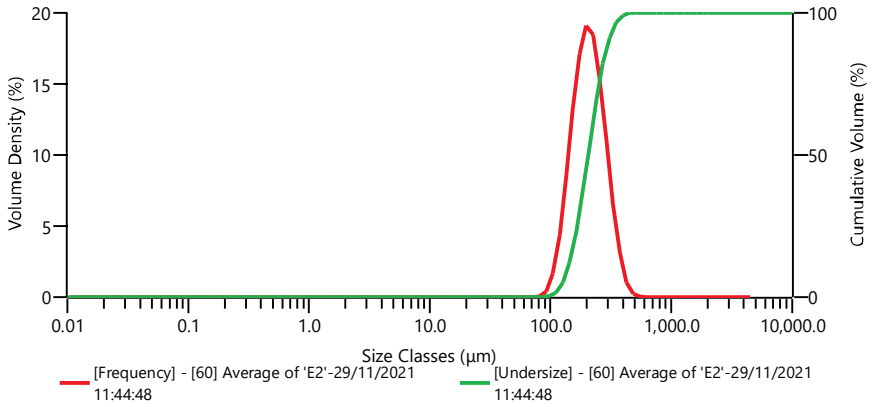
Results

Sample Name	Average of 'E2'
Dv (10)	139 µm
Dv (50)	205 µm
Dv (90)	304 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .95 Mesokurtic
Inclusive Skewness: -0.01 Near Symmetrical
Inclusive SD: .44 Well Sorted
Inclsuive Mean: 2.29 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	73,40
1,00	0,00	30,0	0,00	300	89,02
2,00	0,00	32,0	0,00	400	99,10
3,00	0,00	40,0	0,00	425	99,47
4,00	0,00	50,0	0,00	500	99,97
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,00	800	100,00
8,00	0,00	100	0,46	900	100,00
9,00	0,00	125	4,71	1000	100,00
10,0	0,00	150	15,66	1500	100,00
16,0	0,00	200	46,84	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	46.84
Medium sand (200-630um)	53.16
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

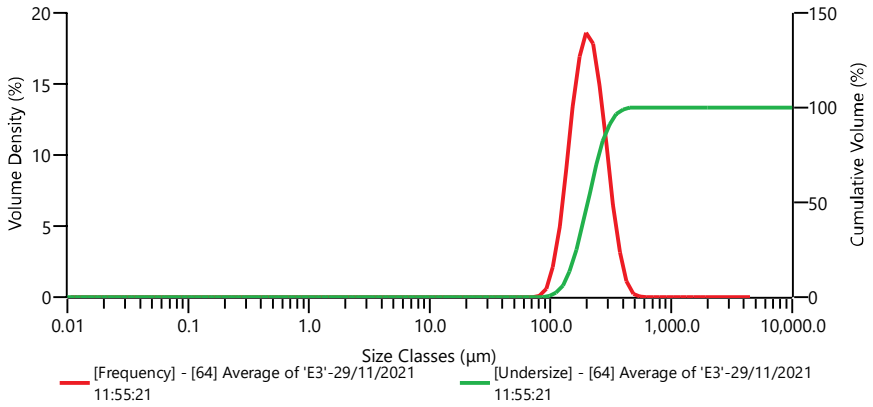
Results

Sample Name	Average of 'E3'
Dv (10)	135 µm
Dv (50)	203 µm
Dv (90)	304 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .96 Mesokurtic
Inclusive Skewness: 0 Near Symmetrical
Inclusive SD: .45 Well Sorted
Inclsuive Mean: 2.3 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	0,00	250	73,84
1,00	0,00	30,0	0,00	300	89,01
2,00	0,00	32,0	0,00	400	99,05
3,00	0,00	40,0	0,00	425	99,44
4,00	0,00	50,0	0,00	500	99,97
5,00	0,00	60,0	0,00	600	100,00
6,00	0,00	63,0	0,00	630	100,00
6,20	0,00	75,0	0,00	700	100,00
7,00	0,00	80,0	0,02	800	100,00
8,00	0,00	100	0,70	900	100,00
9,00	0,00	125	5,71	1000	100,00
10,0	0,00	150	17,21	1500	100,00
16,0	0,00	200	48,11	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	0
Fine sand (63-200um)	48.11
Medium sand (200-630um)	51.89
Coarse sand (630-2000um)	0
Total sand (63-2000um)	100

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

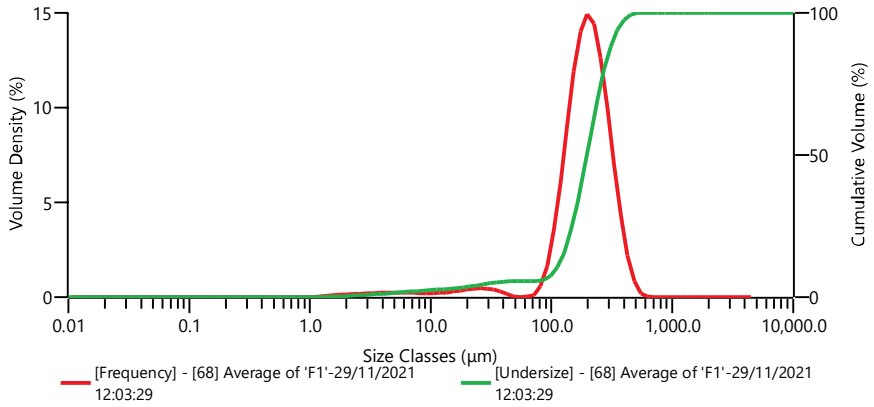
Results

Sample Name	Average of 'F1'
Dv (10)	111 µm
Dv (50)	196 µm
Dv (90)	323 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.78 Very Leptokurtic
Inclusive Skewness: .26 Fine Skewed
Inclusive SD: .82 Moderately Sorted
Inclsuive Mean: 2.36 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	3,57	250	72,65
1,00	0,00	30,0	4,72	300	86,07
2,00	0,30	32,0	4,90	400	97,47
3,00	0,74	40,0	5,38	425	98,31
4,00	1,12	50,0	5,52	500	99,71
5,00	1,43	60,0	5,52	600	100,00
6,00	1,70	63,0	5,52	630	100,00
6,20	1,74	75,0	5,58	700	100,00
7,00	1,91	80,0	5,75	800	100,00
8,00	2,09	100	7,74	900	100,00
9,00	2,24	125	14,72	1000	100,00
10,0	2,38	150	26,05	1500	100,00
16,0	3,07	200	51,79	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.3
Silt (2 - 63um)	5.23
Fine sand (63-200um)	46.27
Medium sand (200-630um)	48.21
Coarse sand (630-2000um)	0
Total sand (63-2000um)	94.48

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

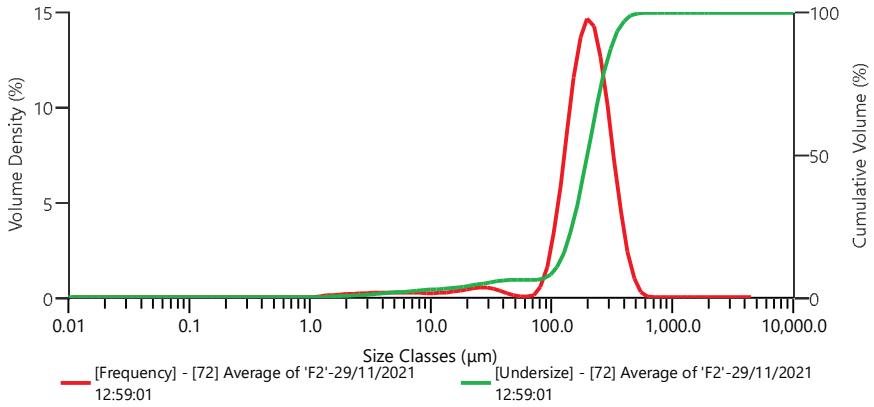
Results

Sample Name	Average of 'F2'
Dv (10)	109 µm
Dv (50)	198 µm
Dv (90)	327 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.84 Very Leptokurtic
Inclusive Skewness: .27 Fine Skewed
Inclusive SD: .85 Moderately Sorted
Inclsuive Mean: 2.36 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	3,79	250	71,75
1,00	0,00	30,0	5,02	300	85,30
2,00	0,32	32,0	5,21	400	97,15
3,00	0,79	40,0	5,76	425	98,07
4,00	1,21	50,0	5,98	500	99,64
5,00	1,55	60,0	6,00	600	100,00
6,00	1,84	63,0	6,00	630	100,00
6,20	1,89	75,0	6,05	700	100,00
7,00	2,07	80,0	6,21	800	100,00
8,00	2,26	100	8,12	900	100,00
9,00	2,43	125	14,88	1000	100,00
10,0	2,57	150	25,88	1500	100,00
16,0	3,28	200	51,08	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.32
Silt (2 - 63um)	5.68
Fine sand (63-200um)	45.08
Medium sand (200-630um)	48.92
Coarse sand (630-2000um)	0
Total sand (63-2000um)	94

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

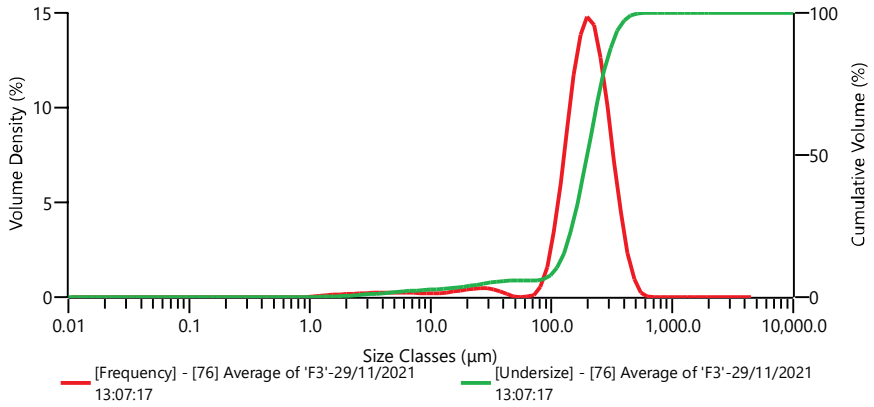
Results

Sample Name	Average of 'F3'
Dv (10)	110 µm
Dv (50)	197 µm
Dv (90)	326 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.83 Very Leptokurtic
Inclusive Skewness: .27 Fine Skewed
Inclusive SD: .84 Moderately Sorted
Inclsuive Mean: 2.36 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	3,77	250	72,09
1,00	0,00	30,0	4,94	300	85,58
2,00	0,41	32,0	5,12	400	97,26
3,00	0,88	40,0	5,60	425	98,15
4,00	1,29	50,0	5,75	500	99,66
5,00	1,63	60,0	5,75	600	100,00
6,00	1,90	63,0	5,75	630	100,00
6,20	1,95	75,0	5,80	700	100,00
7,00	2,12	80,0	5,96	800	100,00
8,00	2,30	100	7,89	900	100,00
9,00	2,45	125	14,75	1000	100,00
10,0	2,58	150	25,91	1500	100,00
16,0	3,27	200	51,35	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.41
Silt (2 - 63um)	5.34
Fine sand (63-200um)	45.6
Medium sand (200-630um)	48.65
Coarse sand (630-2000um)	0
Total sand (63-2000um)	94.25

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

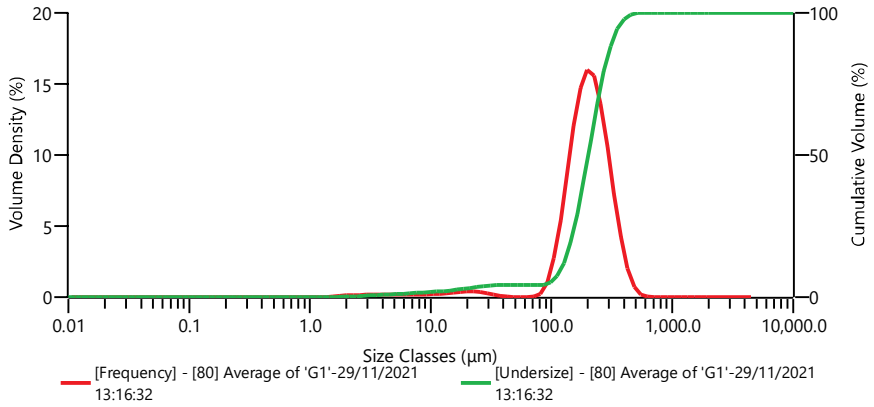
Results

Sample Name	Average of 'G1'
Dv (10)	120 µm
Dv (50)	201 µm
Dv (90)	321 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.05 Mesokurtic
Inclusive Skewness: .07 Near Symmetrical
Inclusive SD: .56 Moderately Well Sorted
Inclsuive Mean: 2.32 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	3,00	250	71,76
1,00	0,00	30,0	3,89	300	86,11
2,00	0,11	32,0	3,98	400	97,76
3,00	0,45	40,0	4,16	425	98,53
4,00	0,74	50,0	4,16	500	99,78
5,00	0,98	60,0	4,16	600	100,00
6,00	1,17	63,0	4,16	630	100,00
6,20	1,20	75,0	4,16	700	100,00
7,00	1,33	80,0	4,22	800	100,00
8,00	1,47	100	5,43	900	100,00
9,00	1,59	125	11,31	1000	100,00
10,0	1,71	150	22,32	1500	100,00
16,0	2,48	200	49,28	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.11
Silt (2 - 63um)	4.05
Fine sand (63-200um)	45.12
Medium sand (200-630um)	50.72
Coarse sand (630-2000um)	0
Total sand (63-2000um)	95.84

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

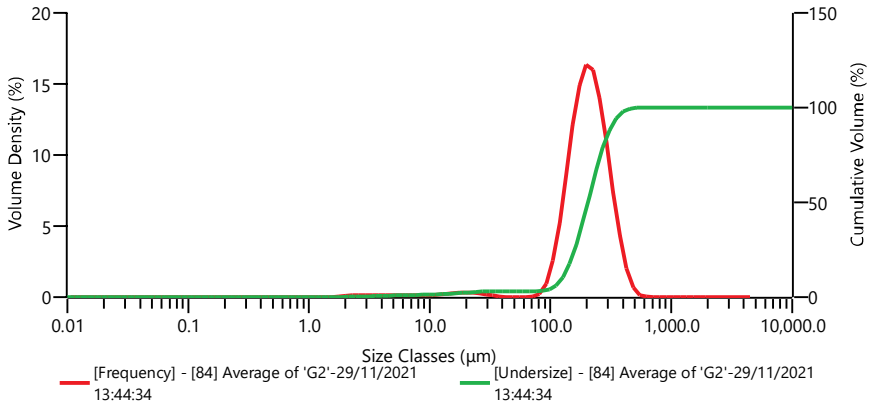
Results

Sample Name	Average of 'G2'
Dv (10)	126 µm
Dv (50)	204 µm
Dv (90)	322 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.01 Mesokurtic
Inclusive Skewness: .04 Near Symmetrical
Inclusive SD: .53 Moderately Well Sorted
Inclsuive Mean: 2.3 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	2,24	250	71,08
1,00	0,00	30,0	2,93	300	85,88
2,00	0,03	32,0	2,99	400	97,81
3,00	0,31	40,0	3,06	425	98,58
4,00	0,54	50,0	3,06	500	99,80
5,00	0,73	60,0	3,06	600	100,00
6,00	0,87	63,0	3,06	630	100,00
6,20	0,89	75,0	3,06	700	100,00
7,00	0,97	80,0	3,11	800	100,00
8,00	1,07	100	4,20	900	100,00
9,00	1,15	125	9,81	1000	100,00
10,0	1,24	150	20,70	1500	100,00
16,0	1,82	200	48,00	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.03
Silt (2 - 63um)	3.03
Fine sand (63-200um)	44.94
Medium sand (200-630um)	52
Coarse sand (630-2000um)	0
Total sand (63-2000um)	96.94

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

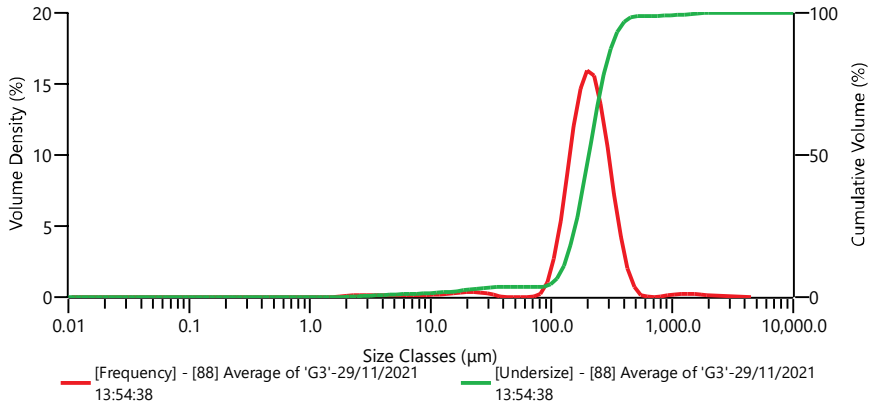
Results

Sample Name	Average of 'G3'
Dv (10)	123 µm
Dv (50)	203 µm
Dv (90)	328 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.04 Mesokurtic
Inclusive Skewness: .04 Near Symmetrical
Inclusive SD: .56 Moderately Well Sorted
Inclsuive Mean: 2.3 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	2,46	250	70,73
1,00	0,00	30,0	3,26	300	85,10
2,00	0,06	32,0	3,34	400	96,74
3,00	0,35	40,0	3,44	425	97,49
4,00	0,61	50,0	3,44	500	98,71
5,00	0,81	60,0	3,44	600	98,92
6,00	0,96	63,0	3,44	630	98,92
6,20	0,99	75,0	3,44	700	98,92
7,00	1,09	80,0	3,50	800	98,94
8,00	1,19	100	4,67	900	99,00
9,00	1,28	125	10,46	1000	99,09
10,0	1,37	150	21,37	1500	99,66
16,0	2,00	200	48,25	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.06
Silt (2 - 63um)	3.38
Fine sand (63-200um)	44.81
Medium sand (200-630um)	50.68
Coarse sand (630-2000um)	1.08
Total sand (63-2000um)	96.56

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

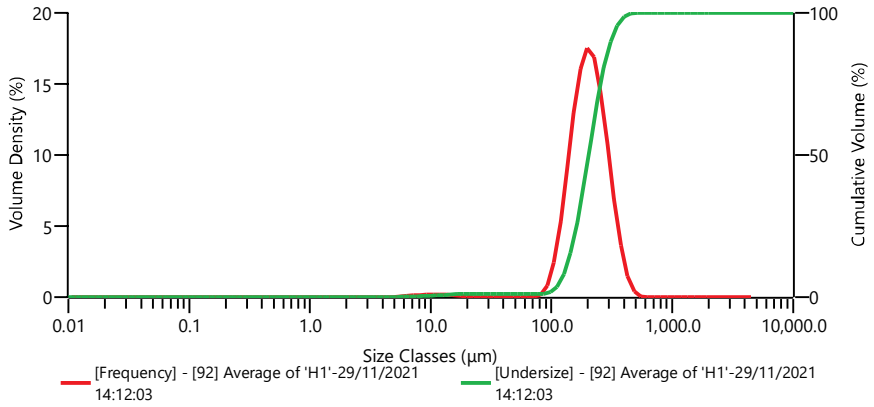
Results

Sample Name	Average of 'H1'
Dv (10)	131 µm
Dv (50)	203 µm
Dv (90)	310 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .97 Mesokurtic
Inclusive Skewness: .01 Near Symmetrical
Inclusive SD: .48 Well Sorted
Inclsuive Mean: 2.3 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	1,01	250	72,77
1,00	0,00	30,0	1,01	300	87,68
2,00	0,00	32,0	1,01	400	98,56
3,00	0,00	40,0	1,01	425	99,11
4,00	0,00	50,0	1,01	500	99,92
5,00	0,00	60,0	1,01	600	100,00
6,00	0,05	63,0	1,01	630	100,00
6,20	0,07	75,0	1,01	700	100,00
7,00	0,14	80,0	1,04	800	100,00
8,00	0,24	100	1,96	900	100,00
9,00	0,34	125	7,51	1000	100,00
10,0	0,44	150	19,02	1500	100,00
16,0	0,91	200	48,41	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	1.01
Fine sand (63-200um)	47.39
Medium sand (200-630um)	51.59
Coarse sand (630-2000um)	0
Total sand (63-2000um)	98.99

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

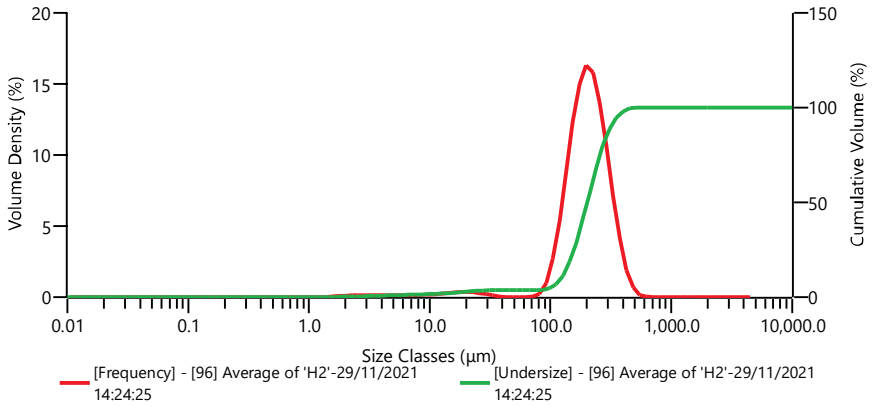
Results

Sample Name	Average of 'H2'
Dv (10)	123 µm
Dv (50)	201 µm
Dv (90)	319 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 1.03 Mesokurtic
Inclusive Skewness: .06 Near Symmetrical
Inclusive SD: .54 Moderately Well Sorted
Inclsuive Mean: 2.32 Fine Grained

Frequency (compatible) and Undersize



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	2,73	250	72,07
1,00	0,00	30,0	3,48	300	86,50
2,00	0,10	32,0	3,54	400	97,94
3,00	0,41	40,0	3,61	425	98,66
4,00	0,66	50,0	3,61	500	99,81
5,00	0,86	60,0	3,61	600	100,00
6,00	1,02	63,0	3,61	630	100,00
6,20	1,05	75,0	3,61	700	100,00
7,00	1,15	80,0	3,66	800	100,00
8,00	1,26	100	4,81	900	100,00
9,00	1,37	125	10,63	1000	100,00
10,0	1,48	150	21,77	1500	100,00
16,0	2,24	200	49,25	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.1
Silt (2 - 63um)	3.51
Fine sand (63-200um)	45.64
Medium sand (200-630um)	50.75
Coarse sand (630-2000um)	0
Total sand (63-2000um)	96.39

Soil texture triangle (USDA)

Soil Texture

Soil Texture: sand

PSD

DEME Research Centre

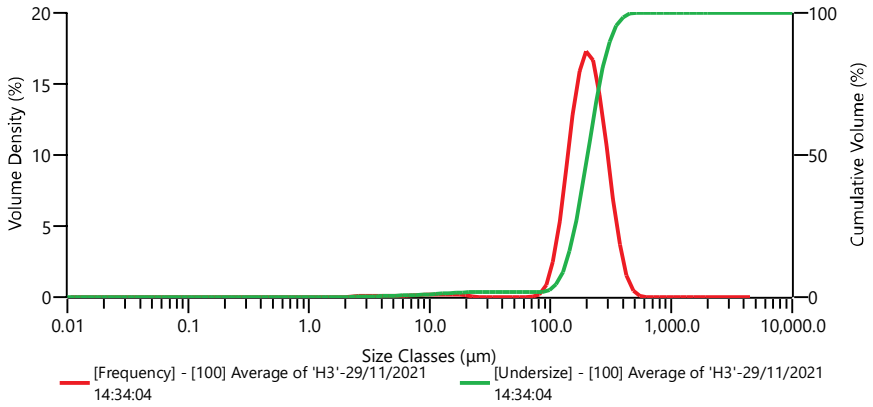
Results

Sample Name	Average of 'H3'
Dv (10)	129 µm
Dv (50)	202 µm
Dv (90)	311 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: .97 Mesokurtic
Inclusive Skewness: .02 Near Symmetrical
Inclusive SD: .49 Well Sorted
Inclsuive Mean: 2.31 Fine Grained

Frequency (compatible) and Undersize



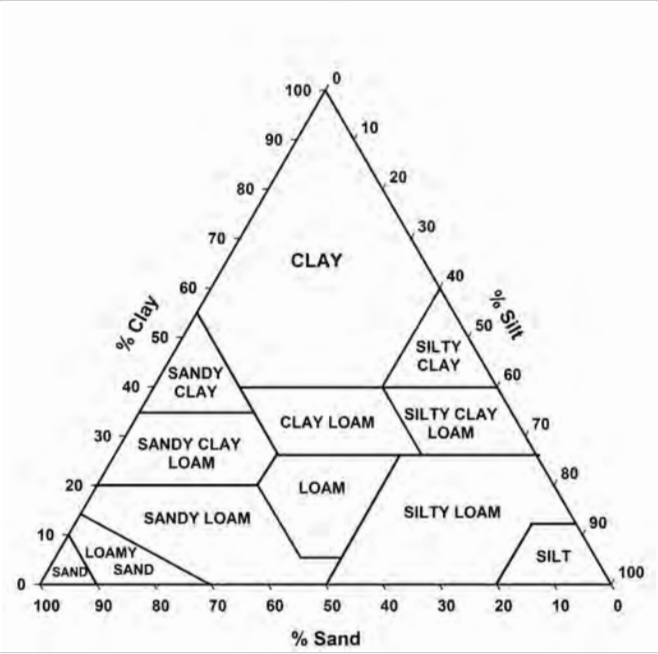
Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	1,65	250	72,82
1,00	0,00	30,0	1,69	300	87,58
2,00	0,00	32,0	1,69	400	98,48
3,00	0,16	40,0	1,69	425	99,05
4,00	0,31	50,0	1,69	500	99,90
5,00	0,42	60,0	1,69	600	100,00
6,00	0,52	63,0	1,69	630	100,00
6,20	0,54	75,0	1,69	700	100,00
7,00	0,61	80,0	1,72	800	100,00
8,00	0,70	100	2,68	900	100,00
9,00	0,80	125	8,29	1000	100,00
10,0	0,90	150	19,74	1500	100,00
16,0	1,45	200	48,77	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0
Silt (2 - 63um)	1.69
Fine sand (63-200um)	47.09
Medium sand (200-630um)	51.23
Coarse sand (630-2000um)	0
Total sand (63-2000um)	98.31

Soil texture triangle (USDA)



Soil Texture

Soil Texture: sand

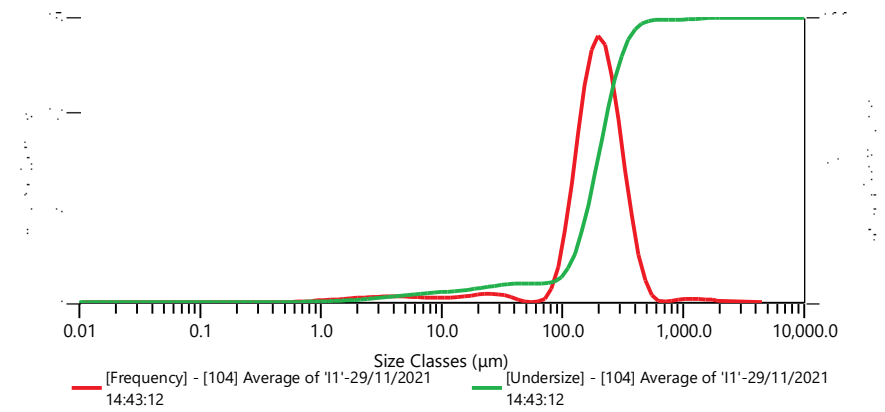
Results

Sample Name	Average of 'I1'
Dv (10)	104 µm
Dv (50)	196 µm
Dv (90)	335 µm
Stirrer Speed Achieved	3000 rpm

Inclusive Soil Statistics

Inclusive Kurtosis: 2 Very Leptokurtic
Inclusive Skewness: .28 Fine Skewed
Inclusive SD: .94 Moderately Sorted
Inclsuive Mean: 2.37 Fine Grained

Frequency (compatible) and Undersize



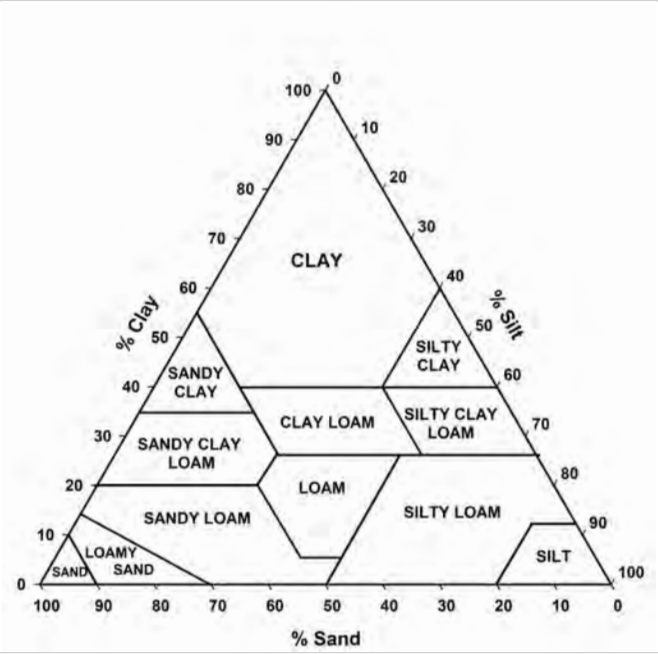
Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0,100	0,00	20,0	4,73	250	71,62
1,00	0,14	30,0	5,84	300	84,46
2,00	0,78	32,0	6,00	400	95,99
3,00	1,44	40,0	6,44	425	96,96
4,00	1,98	50,0	6,56	500	98,71
5,00	2,39	60,0	6,56	600	99,21
6,00	2,70	63,0	6,56	630	99,22
6,20	2,76	75,0	6,65	700	99,22
7,00	2,95	80,0	6,87	800	99,24
8,00	3,16	100	9,15	900	99,30
9,00	3,33	125	16,39	1000	99,38
10,0	3,48	150	27,51	1500	99,80
16,0	4,23	200	51,97	2000	100,00

Soil classification (EU)

Fraction	% in
Clay (<2um)	0.78
Silt (2 - 63um)	5.78
Fine sand (63-200um)	45.41
Medium sand (200-630um)	47.24
Coarse sand (630-2000um)	0.78
Total sand (63-2000um)	93.44

Soil texture triangle (USDA)



Soil Texture

Soil Texture: sand

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Annex 2. Full XRF analyses of the initial soil samples.

Sample	As	Cd	Cr	Cu	Hg	Pb	Ni	Zn	Sb	Ba	Mo	Se	Fe	Ca	Mn	Sr	Zr	Ti	Rb	Co	Ag	Sn	K	P	Cl	S
	ppm	ppm	ppm	ppm	**ppm**	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
A	119,6	< 18,4	< 12,0	52,2	**402,0**	49,0	< 17,4	38,2	< 38,4	95,2	< 3,0	< 3,0	2.979	53.178	172,0	307,6	42,6	209,4	18,6	< 40,6	< 15,2	< 52,2	4.809	< 588,0	< 382,8	< 1.039
B	56,8	< 18,0	< 9,8	< 15,8	**149,2**	21,0	< 15,0	18,2	< 37,6	61,2	< 3,0	< 3,0	1.719	55.450	108,2	403,8	48,4	172,4	17,8	< 31,6	< 14,4	< 32,2	4.505	< 575,2	< 369,6	< 1.008
C	50,6	< 17,2	< 10,8	< 10,8	**109,6**	< 6,4	< 14,6	< 5,0	< 36,8	49,6	< 3,0	< 2,4	917,0	55.063	92,0	425,2	48,6	114,6	16,4	< 25,0	< 14,0	< 31,2	3.132	< 549,4	< 351,2	< 886,4
D	174,4	< 26,6	30,0	246,4	**423,4**	103,4	44,8	293,2	< 40,6	160,0	< 3,2	< 3,0	15.575	97.486	204,0	357,2	57,2	562,6	17,2	< 90,2	< 16,0	< 40,0	3.974	< 813,8	8.057	< 1.466
E	< 23,2	< 17,8	< 11,3	< 10,8	**34,8**	11,7	< 15,3	21,8	< 38,0	73,5	< 3,0	< 2,3	1.292	49.272	104,2	416,8	51,2	184,5	17,3	< 28,7	< 14,8	< 32,3	3.941	< 539,3	< 355,2	< 951,3
F	171,3	< 59,7	< 34,0	223,8	**552,3**	63,5	39,8	96,3	< 42,2	78,8	< 3,0	< 3,2	6.455	112.906	212,2	337,7	68,7	486,3	15,7	< 61,7	< 16,0	< 39,0	3.363	< 996,3	14.391	< 1.817
G	< 61,2	< 19,6	< 14,6	40,4	**190,0**	16,6	< 20,4	19,6	< 41,6	63,0	< 3,2	< 3,2	1.547	73.177	122,0	368,2	48,4	219,2	15,2	< 33,8	< 16,4	< 35,6	3.786	< 732,4	< 663,4	< 1.342
H	< 58,5	< 18,7	< 12,3	< 14,5	**135,0**	14,0	< 16,8	12,8	< 39,0	58,3	< 3,0	< 3,0	1.599	63.600	99,7	408,7	52,5	219,7	18,3	< 31,5	< 15,0	< 33,3	3.908	< 624,3	< 598,3	< 1.049
I	1.059	< 20,0	35,2	54,4	**2.209**	68,4	137,8	189,8	< 41,6	200,0	< 3,2	< 4,0	5.698	80.770	205,8	340,6	48,4	153,2	19,6	< 59,4	< 16,4	< 35,6	3.517	< 793,6	15.491	1.875
J	636,2	< 19,8	< 28,0	< 24,8	**1.252**	45,8	< 22,2	< 25,2	< 41,6	< 94,0	< 3,2	< 4,0	2.467	54.831*	100,8	419,0	47,6	< 289,0	20,6	< 38,8*	< 16,0	< 35,4	3.653*	< 584,3*	< 525,0*	< 1.114*
K	574,6	< 18,4	< 13,0	27,0	**1.329**	43,4	< 20,4	24,6	< 38,8	115,2	< 3,0	< 3,2	2.146	57.366	119,8	418,4	55,2	302,2	18,8	< 36,0	< 15,0	< 33,0	3.733	< 608,0	< 867,4	< 1.202
L	94,2	< 17,6	< 9,8	< 10,2	**428,4**	< 6,2	< 14,6	< 5,8	< 37,4	55,6	< 3,0	< 2,8	1.154	55.386	93,4	418,8	44,0	133,4	16,4	< 27,2	< 14,4	< 31,8	3.454	< 569,0	< 353,4	< 955,0
M	422,2	< 23,6	< 47,8	< 76,2	**967,4**	120,6	< 39,6	887,6	< 48,4	< 149,2	< 3,6	< 5,0	8.221	78.849*	149,2	422,4	54,4	< 448,0	20,0	< 71,8*	< 19,2	< 45,8	3.483*	< 752,8*	6.916*	< 1.456*
N	294,2	< 18,0	< 10,0	< 22,2	**505,6**	18,8	< 16,8	< 8,0	< 37,8	62,0	< 3,0	< 3,0	1.696	51.323	94,8	436,0	50,0	216,2	19,4	< 31,8	< 14,6	< 32,6	4.483	< 558,4	< 381,8	< 975,4
O	< 546,0	< 18,4	< 10,6	< 38,4	**1.451**	27,2	< 20,6	< 26,2	< 39,0	71,2	< 3,0	< 3,4	2.274	58.651	100,0	452,2	51,2	188,4	20,2	< 36,4	< 15,0	< 33,4	4.361	< 610,2	< 1.851	< 1.233
P	70,0	< 18,0	< 9,7	< 9,8	**180,3**	< 6,8	< 14,8	< 5,7	< 37,8	52,7	< 3,0	< 3,0	1.032	49.596	84,0	413,7	45,7	144,0	16,2	< 26,3	< 14,5	< 32,2	2.966	< 549,2	< 340,7	< 926,0
Q	161,2	< 18,6	20,0	< 15,0	**318,8**	17,4	< 17,0	52,8	< 38,4	70,8	< 3,0	< 3,0	3.266	56.656	396,6	299,6	82,8	421,8	18,6	< 43,8	< 15,2	< 32,8	5.807	< 658,6	12.140	< 1.275
R	1.724	< 45,2	< 20,5	121,3	**3.540**	249,0	40,0	177,8	< 42,0	137,0	< 3,2	< 5,3	10.266	88.150	181,5	451,2	54,0	620,3	25,2	< 80,5	< 16,3	91,5	4.203	< 821,7	11.151	2.891
S	< 271,0	< 22,0	< 38,7	< 30,0	**673,7**	45,3	< 27,8	< 33,3	< 45,8	< 172,5	< 3,5	< 4,2	2.026	63.255*	< 100,3	425,0	48,2	< 358,8	20,5	< 38,8*	< 17,8	< 41,2	3.809*	< 646,0*	< 1.104*	< 1.122*
				,8	**118,4**	8,8	< 14,6	< 5,2	< 37,0	45,8	< 3,0	< 2,2	993,2	47.033	73,2	387,0	45,6	137,8	16,8	< 26,0	< 14,2	< 31,6	3.277	< 529,0	< 340,0	< 921,4

(values with asterisk are based on less analyses than other parameters)

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Annex 3. Description of mercury speciation method.

Mercury Speciation by Sequential Extraction

Background (from Gilli et. al., 2018)

Chemical forms of Hg in soils can include elemental Hg(0), Hg in sulfide minerals (e.g., metacinnabar, -HgS), Hg chlorides (e.g., calomel, Hg_2Cl_2), inorganic Hg(II) adsorbed to surfaces of clay minerals, iron (oxy)hydroxides, or soil organic matter (collectively referred to as "matrix-bound Hg(II)"), and methylated Hg species (MeHg).

Of particular importance are the presence and quantities of Hg(0) and MeHg. For example, the presence of Hg(0) could lead to elevated gaseous Hg emissions to the surrounding atmosphere especially during soil remediation works, and to losses of Hg during the sampling and sample preparation for soil analyses.
Organic matter can both mobilize and immobilize Hg, depending on the prevailing soil pH, redox, and flooding conditions. In addition, in well-oxygenated soils, Hg can be mobilized by the presence of high concentrations of Cl ions that act as a complexing agent, and conditions potentially found in areas with high usage of road deicing salts.

In soils with variable redox conditions, sulfide can compete with thiol groups of organic matter and precipitate nanoparticulate HgS in the form of metacinnabar (m-HgS), particularly in contaminated soils. In general, HgS is stable and has a low solubility, though this can be affected by a number of different parameters. The nanoparticles formed in situ in soils can be stabilized by organic matter, but will be structurally disordered when formed in low sulfidic environments, and may be more bioavailable for Hg methylation the most toxic form of mercury. Under reducing soil conditions, the formation of MeHg is predominantly a biotic process, formed by both sulfate-reducing and iron-reducing bacteria. While MeHg is not a major species in predominantly aerated soils, its extreme toxicity is highly relevant for risk assessment.

Method

Appropriate amount of (as received) soil is taken into a tube, the method developed by Bloom et. al. is a sequential extraction which produces the fractions:

F1	Water soluble	$HgCl_2$	To obtain F1 fraction the sample is extracted with distilled/deionised water
F2	Weak acid	HgO $HgSO_4$	To obtain F2 fraction the sample is extracted with mixture of acetic acid and HCl
F3	Organo- complexed	Hg-humic Hg_2Cl_2 CH_3Hg	To obtain F3 fraction the sample is extracted with KOH
F5	Mineral bound	HgS m-HgS HgSe HgAu	To obtain F5 fraction the sample is extracted with *aqua regia*

Each fraction is filtered and analysed by mercury analyser (LOD for each undiluted fraction is 5 µg/kg).

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Annex 4. Reports i2 Analytical Ltd.

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Analytical Report Number : 21-28611

Project / Site name:	El Site	Samples received on:	13/12/2021
Your job number:		Sample instructed on/ Analysis started on:	14/12/2021
Your order number:		Analysis completed by:	23/12/2021
Report Issue Number:	1	Report issued on:	23/12/2021
Samples Analysed:	20 leachate samples - 20 soil samples		

Agnieszka Czerwińska
Młodszy Specjalista Działu
Analiz Raportów

i2 Analytical Limited Sp. z o.o.
Oddział w Polsce
ul. Pionierów 39
41-711 Ruda Śląska
NIP 2050000762

Signed:

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113774	2113775	2113776	2113777
Sample Reference				A	B	C	D
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	5.5	9	12	0.6
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	290	190	120	370
Inorganic Mercury	mg/kg	0.005	NONE	152	65.47	61.06	243.7
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	24.43	12.67	9.294	12.98
Elemental Mercury	mg/kg	0.005	NONE	68.86	94.4	15.27	43.18

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113778	2113779	2113780	2113781
Sample Reference				E	F	G	H
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	1.2	0.46	2.4	2.9

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	43	290	300	190
Inorganic Mercury	mg/kg	0.005	NONE	27.38	150.4	176.3	68.49
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	1.639	25.09	18.79	8.983
Elemental Mercury	mg/kg	0.005	NONE	6.673	67.32	57.83	104.2

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113782	2113783	2113784	2113785
Sample Reference				I	J	K	L
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	0.55	2.2	2.4	11

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	3300	2800	5400	1400
Inorganic Mercury	mg/kg	0.005	NONE	408.6	583.2	547.3	133.7
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	51.69	80.19	54.95	50.4
Elemental Mercury	mg/kg	0.005	NONE	2825	1537	4595	984.4

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113786	2113787	2113788	2113789
Sample Reference				M	N	O	P
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	0.66	1.5	2.8	12

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	890	2600	6200	460
Inorganic Mercury	mg/kg	0.005	NONE	286	281.2	676.1	126.2
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	63.44	47.62	74.89	38.22
Elemental Mercury	mg/kg	0.005	NONE	382.9	1978	5060	271.2

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113790	2113791	2113792	2113793
Sample Reference				Q	R	S	T
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	22	0.24	2.2	9.5
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	570	15000	2900	190
Inorganic Mercury	mg/kg	0.005	NONE	462.8	2450	547.3	32.01
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	3.611	266.7	95.98	10.67
Elemental Mercury	mg/kg	0.005	NONE	50.09	11860	1843	129.8

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113794	2113795	2113796	2113797
Sample Reference				A	B	C	D
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	9.5	9.3	8.7	8.5
Electrical Conductivity	µS/cm	10	ISO 17025	130	87	63	91
Heavy Metals / Metalloids							
Mercury (dissolved)	µg/l	0.5	ISO 17025	210	94	52	40

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113798	2113799	2113800	2113801
Sample Reference				E	F	G	H
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	9.3	8.7	8.9	9
Electrical Conductivity	µS/cm	10	ISO 17025	57	53	67	61
Heavy Metals / Metalloids							
Mercury (dissolved)	µg/l	0.5	ISO 17025	65	110	590	210

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113802	2113803	2113804	2113805
Sample Reference				I	J	K	L
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	8.5	8.9	9	8.8
Electrical Conductivity	µS/cm	10	ISO 17025	60	78	65	56
Heavy Metals / Metalloids							
Mercury (dissolved)	µg/l	0.5	ISO 17025	670	6700	3500	400

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113806	2113807	2113808	2113809
Sample Reference				M	N	O	P
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	8.7	8.7	8.6	8.8
Electrical Conductivity	µS/cm	10	ISO 17025	63	46	50	51
Heavy Metals / Metalloids							
Mercury (dissolved)	µg/l	0.5	ISO 17025	350	1700	810	630

Analytical Report Number: 21-28611
Project / Site name: El Site

Lab Sample Number				2113810	2113811	2113812	2113813
Sample Reference				Q	R	S	T
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	8.8	8.3	8.7	8.6
Electrical Conductivity	µS/cm	10	ISO 17025	2800	82	58	50
Heavy Metals / Metalloids							
Mercury (dissolved)	µg/l	0.5	ISO 17025	36	6600	1600	210

Analytical Report Number : 21-28611
Project / Site name: El Site

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2113774	A	None Supplied	None Supplied	Brown sand with stones.
2113775	B	None Supplied	None Supplied	Brown sand.
2113776	C	None Supplied	None Supplied	Brown sand.
2113777	D	None Supplied	None Supplied	Brown sand with gravel and vegetation.
2113778	E	None Supplied	None Supplied	Brown sand with gravel.
2113779	F	None Supplied	None Supplied	Brown sand with stones.
2113780	G	None Supplied	None Supplied	Brown sand with gravel.
2113781	H	None Supplied	None Supplied	Brown sand with gravel and stones.
2113782	I	None Supplied	None Supplied	Brown sand with gravel and stones.
2113783	J	None Supplied	None Supplied	Brown sand with stones.
2113784	K	None Supplied	None Supplied	Brown sand with stones.
2113785	L	None Supplied	None Supplied	Brown sand with stones.
2113786	M	None Supplied	None Supplied	Brown sand with gravel.
2113787	N	None Supplied	None Supplied	Brown sand.
2113788	O	None Supplied	None Supplied	Brown sand with stones.
2113789	P	None Supplied	None Supplied	Brown sand.
2113790	Q	None Supplied	None Supplied	Brown clay and sand with gravel.
2113791	R	None Supplied	None Supplied	Brown sand with gravel and stones.
2113792	S	None Supplied	None Supplied	Brown sand with gravel and stones.
2113793	T	None Supplied	None Supplied	Brown sand.

Analytical Report Number : 21-28611
Project / Site name: El Site

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Electrical conductivity at 20oC of leachate	Determination of electrical conductivity in leachate by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031-PL	W	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Speciated Mercury in soil by Millennium Merlin Analyzer	Determination of Speciated Mercury in soil by Millennium Merlin Analyzer	In-house method	L085-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report

Analytical Report Number : 21-28611
Project / Site name: EI Site

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
A	None Supplied	L	2113794	a	None Supplied	None Supplied	None Supplied
A	None Supplied	S	2113774	a	None Supplied	None Supplied	None Supplied
B	None Supplied	L	2113795	a	None Supplied	None Supplied	None Supplied
B	None Supplied	S	2113775	a	None Supplied	None Supplied	None Supplied
C	None Supplied	L	2113796	a	None Supplied	None Supplied	None Supplied
C	None Supplied	S	2113776	a	None Supplied	None Supplied	None Supplied
D	None Supplied	L	2113797	a	None Supplied	None Supplied	None Supplied
D	None Supplied	S	2113777	a	None Supplied	None Supplied	None Supplied
E	None Supplied	L	2113798	a	None Supplied	None Supplied	None Supplied
E	None Supplied	S	2113778	a	None Supplied	None Supplied	None Supplied
F	None Supplied	L	2113799	a	None Supplied	None Supplied	None Supplied
F	None Supplied	S	2113779	a	None Supplied	None Supplied	None Supplied
G	None Supplied	L	2113800	a	None Supplied	None Supplied	None Supplied
G	None Supplied	S	2113780	a	None Supplied	None Supplied	None Supplied
H	None Supplied	L	2113801	a	None Supplied	None Supplied	None Supplied
H	None Supplied	S	2113781	a	None Supplied	None Supplied	None Supplied
I	None Supplied	L	2113802	a	None Supplied	None Supplied	None Supplied
I	None Supplied	S	2113782	a	None Supplied	None Supplied	None Supplied
J	None Supplied	L	2113803	a	None Supplied	None Supplied	None Supplied
J	None Supplied	S	2113783	a	None Supplied	None Supplied	None Supplied
K	None Supplied	L	2113804	a	None Supplied	None Supplied	None Supplied
K	None Supplied	S	2113784	a	None Supplied	None Supplied	None Supplied
L	None Supplied	L	2113805	a	None Supplied	None Supplied	None Supplied
L	None Supplied	S	2113785	a	None Supplied	None Supplied	None Supplied
M	None Supplied	L	2113806	a	None Supplied	None Supplied	None Supplied
M	None Supplied	S	2113786	a	None Supplied	None Supplied	None Supplied
N	None Supplied	L	2113807	a	None Supplied	None Supplied	None Supplied
N	None Supplied	S	2113787	a	None Supplied	None Supplied	None Supplied
O	None Supplied	L	2113808	a	None Supplied	None Supplied	None Supplied
O	None Supplied	S	2113788	a	None Supplied	None Supplied	None Supplied
P	None Supplied	L	2113809	a	None Supplied	None Supplied	None Supplied
P	None Supplied	S	2113789	a	None Supplied	None Supplied	None Supplied
Q	None Supplied	L	2113810	a	None Supplied	None Supplied	None Supplied
Q	None Supplied	S	2113790	a	None Supplied	None Supplied	None Supplied
R	None Supplied	L	2113811	a	None Supplied	None Supplied	None Supplied
R	None Supplied	S	2113791	a	None Supplied	None Supplied	None Supplied
S	None Supplied	L	2113812	a	None Supplied	None Supplied	None Supplied
S	None Supplied	S	2113792	a	None Supplied	None Supplied	None Supplied
T	None Supplied	L	2113813	a	None Supplied	None Supplied	None Supplied
T	None Supplied	S	2113793	a	None Supplied	None Supplied	None Supplied

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Analytical Report Number : 22-33240

Project / Site name:		Samples received on:	17/01/2022
Your job number:		Sample instructed on/ Analysis started on:	18/01/2022
Your order number:		Analysis completed by:	25/01/2022
Report Issue Number:	1	Report issued on:	26/01/2022
Samples Analysed:	4 sand samples - 8 other samples - 4 water samples		

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Młodszy Specjalista
Działu Analiz Raportów
Izabela Wójcik

Signed:

Izabela Wójcik
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

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Analytical Report Number: 22-33240

Lab Sample Number				2138177	2138178	2138179	2138180
Sample Reference				Sand C Upstreamed	Sand G Upstreamed	Sand K Upstreamed	Sand L Upstreamed
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Sand Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	19	20	17	19
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	60	100	590	620
Inorganic Mercury	mg/kg	0.005	NONE	38.88	45.02	225.9	210
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	8.316	13.23	122.9	134.2
Elemental Mercury	mg/kg	0.005	NONE	6.417	31.17	210.9	259.7

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-33240

Lab Sample Number				2138181	2138182	2138183	2138184
Sample Reference				Black Particles G	Black Particles K	Fines C	Fines G
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Other Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	2.2	2.3	< 0.01	0.49

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	NONE	2000	3800	2200	2500
Inorganic Mercury	mg/kg	0.005	NONE	-	-	-	-
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	-	-	-	-
Elemental Mercury	mg/kg	0.005	NONE	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-33240

Lab Sample Number				2138185	2138186	2138187	2138188
Sample Reference				Fines K	Fines L	Gravel G Washed	Gravel K Washed
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Other Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	0.91	< 0.01	1	1.8

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	NONE	19000	2400	14	71
Inorganic Mercury	mg/kg	0.005	NONE	-	-	-	-
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	-	-	-	-
Elemental Mercury	mg/kg	0.005	NONE	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-33240

Lab Sample Number				2138173	2138174	2138175	2138176
Sample Reference				Filtered C	Filtered G	Filtered K	Filtered L
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Heavy Metals / Metalloids							
Mercury (total)	µg/l	0.5	ISO 17025	< 0.5	430	2100	130

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-33240
Project / Site name:

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Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2138177	and C Upstreame	None Supplied	None Supplied	Light brown sand.
2138178	and G Upstreame	None Supplied	None Supplied	Light brown sand.
2138179	and K Upstreame	None Supplied	None Supplied	Light brown sand.
2138180	and L Upstreame	None Supplied	None Supplied	Light brown sand.
2138181	Black Particles G	None Supplied	None Supplied	Brown rubble.
2138182	Black Particles K	None Supplied	None Supplied	Brown rubble.
2138183	Fines C	None Supplied	None Supplied	Grey chalk.
2138184	Fines G	None Supplied	None Supplied	Beige chalk.
2138185	Fines K	None Supplied	None Supplied	Beige chalk.
2138186	Fines L	None Supplied	None Supplied	Grey chalk.
2138187	Gravel G Washed	None Supplied	None Supplied	Gravel
2138188	Gravel K Washed	None Supplied	None Supplied	Gravel

Analytical Report Number : 22-33240
Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-OES (total)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW (Al, Fe, Cu, Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Metals in other by ICP-OES	Determination of metals in other by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated Mercury in soil by Millennium Merlin Ana	Determination of Speciated Mercury in soil by Millennium Merlin Analyzer	In-house method	L085-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number : 22-33240
Project / Site name:

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
Black Particles G	None Supplied	S	2138181	a	None Supplied	None Supplied	None Supplied
Black Particles K	None Supplied	S	2138182	a	None Supplied	None Supplied	None Supplied
Filtered C	None Supplied	W	2138173	a	None Supplied	None Supplied	None Supplied
Filtered G	None Supplied	W	2138174	a	None Supplied	None Supplied	None Supplied
Filtered K	None Supplied	W	2138175	a	None Supplied	None Supplied	None Supplied
Filtered L	None Supplied	W	2138176	a	None Supplied	None Supplied	None Supplied
Fines C	None Supplied	S	2138183	a	None Supplied	None Supplied	None Supplied
Fines G	None Supplied	S	2138184	a	None Supplied	None Supplied	None Supplied
Fines K	None Supplied	S	2138185	a	None Supplied	None Supplied	None Supplied
Fines L	None Supplied	S	2138186	a	None Supplied	None Supplied	None Supplied
Gravel G Washed	None Supplied	S	2138187	a	None Supplied	None Supplied	None Supplied
Gravel K Washed	None Supplied	S	2138188	a	None Supplied	None Supplied	None Supplied
Sand C Upstreamed	None Supplied	S	2138177	a	None Supplied	None Supplied	None Supplied
Sand G Upstreamed	None Supplied	S	2138178	a	None Supplied	None Supplied	None Supplied
Sand K Upstreamed	None Supplied	S	2138179	a	None Supplied	None Supplied	None Supplied
Sand L Upstreamed	None Supplied	S	2138180	a	None Supplied	None Supplied	None Supplied

Key: **a** - No sampling date **b** - Incorrect container
c - Holding time **d** - Headspace **e** - Temperature

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Analytical Report Number : 22-33245

Project / Site name:		Samples received on:	17/01/2022
Your job number:		Sample instructed on/ Analysis started on:	18/01/2022
Your order number:		Analysis completed by:	25/01/2022
Report Issue Number:	1	Report issued on:	26/01/2022
Samples Analysed:	1 WAC leachate sample		

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Młodszy Specjalista
Działu Analiz Raportów
Izabela Wójcik

Signed:

Izabela Wójcik
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

Excel copies of reports are only valid when accompanied by this PDF certificate.

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Waste Acceptance Criteria Analytical Results

Report No:	22-33245							
					Client: DEME			
Location								
Lab Reference (Sample Number)	2138208				Landfill Waste Acceptance Criteria Limits			
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	
Sample ID	Fines C + G + K + L							
Depth (m)								
Solid Waste Analysis								
TOC (%)**	-				3%	5%	6%	
Loss on Ignition (%) **	-				--	--	10%	
BTEX (µg/kg) **	-				6000	--	--	
Sum of PCBs (mg/kg) **	-				1	--	--	
Mineral Oil (mg/kg)	-				500	--	--	
Total PAH (WAC-17) (mg/kg)	-				100	--	--	
pH (units)**	-				--	>6	--	
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated	
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test			
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)			
Arsenic *	0.0102			0.101	0.5	2	25	
Barium *	0.0472			0.465	20	100	300	
Cadmium *	0.0003			0.0028	0.04	1	5	
Chromium *	0.0009			0.0087	0.5	10	70	
Copper *	0.0046			0.045	2	50	100	
Mercury *	2.46			24.2	0.01	0.2	2	
Molybdenum *	0.0021			0.0202	0.5	10	30	
Nickel *	0.0027			0.026	0.4	10	40	
Lead *	0.0044			0.043	0.5	10	50	
Antimony *	< 0.0017			< 0.017	0.06	0.7	5	
Selenium *	< 0.0040			< 0.040	0.1	0.5	7	
Zinc *	0.0060			0.059	4	50	200	
Chloride *	5.8			58	800	15000	25000	
Fluoride	0.053			0.52	10	150	500	
Sulphate *	3.4			34	1000	20000	50000	
TDS*	71			700	4000	60000	100000	
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-	
DOC	7.18			70.7	500	800	1000	
Leach Test Information								
Stone Content (%)	-							
Sample Mass (kg)	-							
Dry Matter (%)	-							
Moisture (%)	-							

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 22-33245
Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

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Analytical Report Number : 22-33245
Project / Site name:

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
Fines C + G + K + L	None Supplied	L	2138208	a	None Supplied	None Supplied	None Supplied

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Analytical Report Number : 22-35615

Project / Site name:		Samples received on:	27/01/2022
Your job number:		Sample instructed on/ Analysis started on:	27/01/2022
Your order number:		Analysis completed by:	07/02/2022
Report Issue Number:	1	Report issued on:	07/02/2022
Samples Analysed:	4 soil samples		

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Młodszy Specjalista
Działu Analiz Raportów
Izabela Wójcik

Signed:

Izabela Wójcik
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

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waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Analytical Report Number: 22-35615

Lab Sample Number				2150951	2150952	2150953	2150954
Sample Reference				Sand C scrubbed	Sand G scrubbed	Sand K scrubbed	Sand B scrubbed
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	19	19	19	18
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	52	52	200	62
Inorganic Mercury	mg/kg	0.005	NONE	32.96	32.12	92.64	30.2
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	10.56	9.823	36.37	15.94
Elemental Mercury	mg/kg	0.005	NONE	6.584	8.16	55.12	12.77

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-35615
Project / Site name:

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2150951	Sand C scrubbed	None Supplied	None Supplied	Light brown sand.
2150952	Sand G scrubbed	None Supplied	None Supplied	Light brown sand.
2150953	Sand K scrubbed	None Supplied	None Supplied	Light brown sand.
2150954	Sand B scrubbed	None Supplied	None Supplied	Light brown sand.

Analytical Report Number : 22-35615
Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-PL	W	NONE
Speciated Mercury in soil by Millennium Merlin Ana	Determination of Speciated Mercury in soil by Millennium Merlin Analyzer	In-house method	L085-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number : 22-35615
Project / Site name:

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
Sand B scrubbed	None Supplied	S	2150954	a	None Supplied	None Supplied	None Supplied
Sand C scrubbed	None Supplied	S	2150951	a	None Supplied	None Supplied	None Supplied
Sand G scrubbed	None Supplied	S	2150952	a	None Supplied	None Supplied	None Supplied
Sand K scrubbed	None Supplied	S	2150953	a	None Supplied	None Supplied	None Supplied

Key: **a** - No sampling date **b** - Incorrect container
c - Holding time **d** - Headspace **e** - Temperature

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Deme Group
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Analytical Report Number : 22-35621

Project / Site name:		Samples received on:	27/01/2022
Your job number:		Sample instructed on/ Analysis started on:	27/01/2022
Your order number:		Analysis completed by:	03/02/2022
Report Issue Number:	1	Report issued on:	04/02/2022
Samples Analysed:	12 WAC leachate samples		

i2 Analytical Limited Sp. z o.o.
Oddział w Polsce
ul. Pionierów 39
41-711 Ruda Śląska
NIP 2050000782

Joanna Wawrzeczko
Młodszy Specjalista
Działu Analiz Raportów

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

Excel copies of reports are only valid when accompanied by this PDF certificate.

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150959				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	N-1						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0875			0.769	20	100	300
Cadmium *	0.0008			0.0067	0.04	1	5
Chromium *	0.0005			0.0048	0.5	10	70
Copper *	0.0093			0.082	2	50	100
Mercury *	0.353			3.10	0.01	0.2	2
Molybdenum *	0.0005			0.0048	0.5	10	30
Nickel *	0.0060			0.053	0.4	10	40
Lead *	0.0041			0.036	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0089			0.078	0.1	0.5	7
Zinc *	0.021			0.19	4	50	200
Chloride *	1400			12000	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	2.4			21	1000	20000	50000
TDS*	1000			9000	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	8.38			73.6	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150960				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	N-2						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0031			0.0278	0.5	2	25
Barium *	0.0116			0.105	20	100	300
Cadmium *	0.0002			0.0021	0.04	1	5
Chromium *	0.0015			0.013	0.5	10	70
Copper *	0.0085			0.076	2	50	100
Mercury *	0.353			3.17	0.01	0.2	2
Molybdenum *	0.0033			0.0296	0.5	10	30
Nickel *	0.0038			0.034	0.4	10	40
Lead *	0.0055			0.050	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0043			< 0.040	0.1	0.5	7
Zinc *	0.057			0.51	4	50	200
Chloride *	1.2			11	800	15000	25000
Fluoride	0.12			1.1	10	150	500
Sulphate *	2.1			19	1000	20000	50000
TDS*	43			380	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	9.50			85.3	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150961				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	N-3						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0180			0.162	20	100	300
Cadmium *	0.0008			0.0069	0.04	1	5
Chromium *	0.010			0.091	0.5	10	70
Copper *	0.017			0.15	2	50	100
Mercury *	1.48			13.2	0.01	0.2	2
Molybdenum *	0.0014			0.0125	0.5	10	30
Nickel *	0.011			0.10	0.4	10	40
Lead *	0.034			0.31	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.041			0.37	4	50	200
Chloride *	72			650	800	15000	25000
Fluoride	0.050			< 0.50	10	150	500
Sulphate *	180			1600	1000	20000	50000
TDS*	140			1300	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	16.5			148	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150962				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	C-1						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0015			0.0124	0.5	2	25
Barium *	0.0664			0.532	20	100	300
Cadmium *	0.0002			0.0014	0.04	1	5
Chromium *	0.0006			0.0048	0.5	10	70
Copper *	0.0009			0.0076	2	50	100
Mercury *	0.0807			0.646	0.01	0.2	2
Molybdenum *	0.0005			0.0043	0.5	10	30
Nickel *	0.0048			0.038	0.4	10	40
Lead *	0.0023			0.019	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0089			0.072	4	50	200
Chloride *	590			4700	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	2.9			23	1000	20000	50000
TDS*	600			4800	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.64			37.2	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150963				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	C-2						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0185			0.151	20	100	300
Cadmium *	0.0003			0.0021	0.04	1	5
Chromium *	0.0021			0.018	0.5	10	70
Copper *	0.025			0.20	2	50	100
Mercury *	0.0867			0.709	0.01	0.2	2
Molybdenum *	0.0036			0.0296	0.5	10	30
Nickel *	0.0062			0.050	0.4	10	40
Lead *	0.0091			0.074	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.16			1.3	4	50	200
Chloride *	0.98			8.0	800	15000	25000
Fluoride	0.12			0.98	10	150	500
Sulphate *	1.5			12	1000	20000	50000
TDS*	39			320	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.76			63.4	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150964				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	C-3						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0127			0.112	20	100	300
Cadmium *	0.0002			0.0017	0.04	1	5
Chromium *	0.0013			0.011	0.5	10	70
Copper *	0.0043			0.038	2	50	100
Mercury *	0.104			0.926	0.01	0.2	2
Molybdenum *	0.0010			0.0088	0.5	10	30
Nickel *	0.0036			0.032	0.4	10	40
Lead *	0.0057			0.051	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0046			0.041	0.1	0.5	7
Zinc *	0.020			0.18	4	50	200
Chloride *	120			1000	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	260			2300	1000	20000	50000
TDS*	160			1400	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	12.9			115	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150965				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	R-1						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	3.63			32.2	20	100	300
Cadmium *	0.0288			0.256	0.04	1	5
Chromium *	0.0012			0.011	0.5	10	70
Copper *	0.011			0.094	2	50	100
Mercury *	0.778			6.90	0.01	0.2	2
Molybdenum *	0.0010			0.0090	0.5	10	30
Nickel *	0.0085			0.075	0.4	10	40
Lead *	0.0030			0.027	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.018			0.16	4	50	200
Chloride *	1200			11000	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	4.0			35	1000	20000	50000
TDS*	1100			9600	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.18			37.1	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150966				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	R-2						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.139			1.26	20	100	300
Cadmium *	0.0008			0.0068	0.04	1	5
Chromium *	< 0.0004			< 0.0040	0.5	10	70
Copper *	0.011			0.10	2	50	100
Mercury *	0.519			4.71	0.01	0.2	2
Molybdenum *	0.0051			0.0459	0.5	10	30
Nickel *	0.0030			0.027	0.4	10	40
Lead *	0.0045			0.041	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0074			0.067	0.1	0.5	7
Zinc *	0.057			0.52	4	50	200
Chloride *	7.2			66	800	15000	25000
Fluoride	0.15			1.4	10	150	500
Sulphate *	2.7			25	1000	20000	50000
TDS*	52			480	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	6.51			59.2	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150967				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	R-3						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0460			0.419	20	100	300
Cadmium *	0.0014			0.0128	0.04	1	5
Chromium *	0.0055			0.050	0.5	10	70
Copper *	0.035			0.32	2	50	100
Mercury *	1.22			11.1	0.01	0.2	2
Molybdenum *	0.0011			0.0101	0.5	10	30
Nickel *	0.0090			0.082	0.4	10	40
Lead *	0.030			0.27	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.099			0.90	4	50	200
Chloride *	54			490	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	100			930	1000	20000	50000
TDS*	140			1200	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	14.2			130	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150968				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	A-1						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.907			7.77	20	100	300
Cadmium *	0.0002			0.0018	0.04	1	5
Chromium *	0.0007			0.0057	0.5	10	70
Copper *	0.0053			0.045	2	50	100
Mercury *	0.720			6.17	0.01	0.2	2
Molybdenum *	0.0007			0.0058	0.5	10	30
Nickel *	0.0038			0.033	0.4	10	40
Lead *	0.0020			0.017	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0072			0.061	0.1	0.5	7
Zinc *	0.014			0.12	4	50	200
Chloride *	1300			11000	800	15000	25000
Fluoride	< 0.050			< 0.50	10	150	500
Sulphate *	4.8			41	1000	20000	50000
TDS*	1200			10000	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	3.16			27.1	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150969				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	A-2						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0017			0.0152	0.5	2	25
Barium *	0.0912			0.799	20	100	300
Cadmium *	0.0005			0.0040	0.04	1	5
Chromium *	0.0041			0.036	0.5	10	70
Copper *	0.058			0.51	2	50	100
Mercury *	0.165			1.44	0.01	0.2	2
Molybdenum *	0.0029			0.0258	0.5	10	30
Nickel *	0.0067			0.059	0.4	10	40
Lead *	0.013			0.11	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.22			1.9	4	50	200
Chloride *	1.7			15	800	15000	25000
Fluoride	0.19			1.6	10	150	500
Sulphate *	3.5			30	1000	20000	50000
TDS*	79			690	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	10.5			92.0	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Waste Acceptance Criteria Analytical Results

Report No:	22-35621						
					Client: DEME		
Location							
Lab Reference (Sample Number)	2150970				Landfill Waste Acceptance Criteria Limits		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	A-3						
Depth (m)							
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0018			0.0168	0.5	2	25
Barium *	0.0649			0.595	20	100	300
Cadmium *	0.0005			0.0042	0.04	1	5
Chromium *	0.0048			0.044	0.5	10	70
Copper *	0.035			0.32	2	50	100
Mercury *	0.338			3.09	0.01	0.2	2
Molybdenum *	0.0018			0.0167	0.5	10	30
Nickel *	0.0062			0.056	0.4	10	40
Lead *	0.030			0.27	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	0.0053			0.049	0.1	0.5	7
Zinc *	0.071			0.65	4	50	200
Chloride *	87			800	800	15000	25000
Fluoride	0.062			0.57	10	150	500
Sulphate *	200			1800	1000	20000	50000
TDS*	180			1600	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	15.9			146	500	800	1000
Leach Test Information							
Stone Content (%)	-						
Sample Mass (kg)	-						
Dry Matter (%)	-						
Moisture (%)	-						

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Analytical Report Number : 22-35621
Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number : 22-35621
Project / Site name:

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
A-1	None Supplied	L	2150968	a	None Supplied	None Supplied	None Supplied
A-2	None Supplied	L	2150969	a	None Supplied	None Supplied	None Supplied
A-3	None Supplied	L	2150970	a	None Supplied	None Supplied	None Supplied
C-1	None Supplied	L	2150962	a	None Supplied	None Supplied	None Supplied
C-2	None Supplied	L	2150963	a	None Supplied	None Supplied	None Supplied
C-3	None Supplied	L	2150964	a	None Supplied	None Supplied	None Supplied
N-1	None Supplied	L	2150959	a	None Supplied	None Supplied	None Supplied
N-2	None Supplied	L	2150960	a	None Supplied	None Supplied	None Supplied
N-3	None Supplied	L	2150961	a	None Supplied	None Supplied	None Supplied
R-1	None Supplied	L	2150965	a	None Supplied	None Supplied	None Supplied
R-2	None Supplied	L	2150966	a	None Supplied	None Supplied	None Supplied
R-3	None Supplied	L	2150967	a	None Supplied	None Supplied	None Supplied

Key: **a** - No sampling date **b** - Incorrect container
c - Holding time **d** - Headspace **e** - Temperature

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Analytical Report Number : 22-37234

Project / Site name:		Samples received on:	17/01/2022
Your job number:		Sample instructed on/ Analysis started on:	03/02/2022
Your order number:		Analysis completed by:	10/02/2022
Report Issue Number:	1	Report issued on:	14/02/2022
Samples Analysed:	4 leachate samples		

i2 Analytical Limited Sp. z o.o.
Oddział w Polsce
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NIP: 2050000782

Joanna Wawrzeczko
Młodszy Specjalista
Działu Analiz Raportów

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 22-37234

Lab Sample Number				2159380	2159381	2159382	2159383
Sample Reference				Sand C upstreamed	Sand G upstreamed	Sand K upstreamed	Sand L upstreamed
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status				
General Inorganics							
pH	pH Units	N/A	ISO 17025	8.3	8.2	8.6	9
Heavy Metals / Metalloids							
Mercury	mg/l	0.0005	ISO 17025	0.0309	0.594	0.11	0.0984
Mercury (total)	mg/kg	0.005	ISO 17025	0.243	4.94	0.876	0.794

Analytical Report Number : 22-37234
Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report

Analytical Report Number : 22-37234
Project / Site name:

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
Sand C upstreamed	None Supplied	L	2159380	a	None Supplied	None Supplied	None Supplied
Sand G upstreamed	None Supplied	L	2159381	a	None Supplied	None Supplied	None Supplied
Sand K upstreamed	None Supplied	L	2159382	a	None Supplied	None Supplied	None Supplied
Sand L upstreamed	None Supplied	L	2159383	a	None Supplied	None Supplied	None Supplied

Key: **a** - No sampling date **b** - Incorrect container
c - Holding time **d** - Headspace **e** - Temperature

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Analytical Report Number : 22-42439

Project / Site name:	EI SITE	Samples received on:	01/03/2022
Your job number:		Sample instructed on/ Analysis started on:	01/03/2022
Your order number:		Analysis completed by:	08/03/2022
Report Issue Number:	1	Report issued on:	09/03/2022
Samples Analysed:	10 soil samples		

i2 Analytical Limited Sp. z o.o.
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NIP: 2050000782

Joanna Wawrzeczko
Młodszy Specjalista
Dział Analiz Raportów

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Other office located at: 7 Woodshots Meadow Croxley Green Business Park Watford Herts WD18 8YS UK

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Sampling and delivery by client.

Excel copies of reports are only valid when accompanied by this PDF certificate.

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Lab Sample Number				2188173	2188174	2188175	2188176
Sample Reference				Sand - E Scrubbed	Sand - E Upstream	C HCl	G HCl
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	0.03	9.1	20	21
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	7.9	48	31	27
Inorganic Mercury	mg/kg	0.005	NONE	4.006	21.21	18.71	11.06
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	1.225	7.191	6.814	8.175
Elemental Mercury	mg/kg	0.005	NONE	1.838	13.31	3.786	6.247

U/S = Unsuitable Sample I/S = Insufficient Sample

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Lab Sample Number				2188177	2188178	2188179	2188180
Sample Reference				K HCl	L HCl	C NaOH	G NaOH
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Moisture Content	%	0.01	NONE	20	20	18	16
Heavy Metals / Metalloids							
Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	99	62	55	46
Inorganic Mercury	mg/kg	0.005	NONE	47.83	17.94	24.04	13.08
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	23.4	23.83	13.66	17.05
Elemental Mercury	mg/kg	0.005	NONE	20.47	13.88	12.61	11.84

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Lab Sample Number				2188181	2188182
Sample Reference				K NaOH	L NaoH
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				Deviating	Deviating
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Moisture Content	%	0.01	NONE	21	19

Heavy Metals / Metalloids

Mercury (aqua regia extractable)	mg/kg	0.3	ISO 17025	190	54
Inorganic Mercury	mg/kg	0.005	NONE	68.24	15.23
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	69.16	23.95
Elemental Mercury	mg/kg	0.005	NONE	46.41	11.03

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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2188173	Sand - E Scrubbe	None Supplied	None Supplied	Brown sandy clay.
2188174	Sand - E Upstrear	None Supplied	None Supplied	Brown sand.
2188175	C HCl	None Supplied	None Supplied	Brown sand.
2188176	G HCl	None Supplied	None Supplied	Brown sand.
2188177	K HCl	None Supplied	None Supplied	Brown sand.
2188178	L HCl	None Supplied	None Supplied	Brown sand.
2188179	C NaOH	None Supplied	None Supplied	Brown sand.
2188180	G NaOH	None Supplied	None Supplied	Brown sand.
2188181	K NaOH	None Supplied	None Supplied	Brown sand.
2188182	L NaoH	None Supplied	None Supplied	Brown sand.

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Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-PL	W	NONE
Speciated Mercury in soil by Millennium Merlin Ana	Determination of Speciated Mercury in soil by Millennium Merlin Analyzer	In-house method	L085-PL	Dry	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
C HCl	None Supplied	S	2188175	a	None Supplied	None Supplied	None Supplied
C NaOH	None Supplied	S	2188179	a	None Supplied	None Supplied	None Supplied
G HCl	None Supplied	S	2188176	a	None Supplied	None Supplied	None Supplied
G NaOH	None Supplied	S	2188180	a	None Supplied	None Supplied	None Supplied
K HCl	None Supplied	S	2188177	a	None Supplied	None Supplied	None Supplied
K NaOH	None Supplied	S	2188181	a	None Supplied	None Supplied	None Supplied
L HCl	None Supplied	S	2188178	a	None Supplied	None Supplied	None Supplied
L NaoH	None Supplied	S	2188182	a	None Supplied	None Supplied	None Supplied
Sand - E Scrubbed	None Supplied	S	2188173	a	None Supplied	None Supplied	None Supplied
Sand - E Upstream	None Supplied	S	2188174	a	None Supplied	None Supplied	None Supplied