LATVIJAS UNIVERSITĀTE ANNO 1919 | NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020 | EIROPAS SAVIENĪBA Eiropas Reģionālās attīstības fonds

IEGULDĪJUMS TAVĀ NĀKOTNĒ

What is „landfill fine fraction covering material“?

M 1-1. WP 1. Recovery potential perspective and properties

Inovatīva atkritumu stabilizācija - vides ietekmju mazināšana un resursu potenciāls aprites ekonomikā
Projekta numurs 1.1.1.2/16/I/001
Pētniecības pieteikuma numurs 1.1.1.2/VIAA/3/19/531

Background


Finland
VIKA
(Katrineholm)
Estonia
TORMA
KUDJAPE
Sweden
Latvia
RIGA (BLB)
Baltic Sea
Lithuania
US Dept of State Geographer
© 2015 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Google earth

Characterisation of sites: Kudjape

Kudjape Landfill, Saaremaa island, Estonia

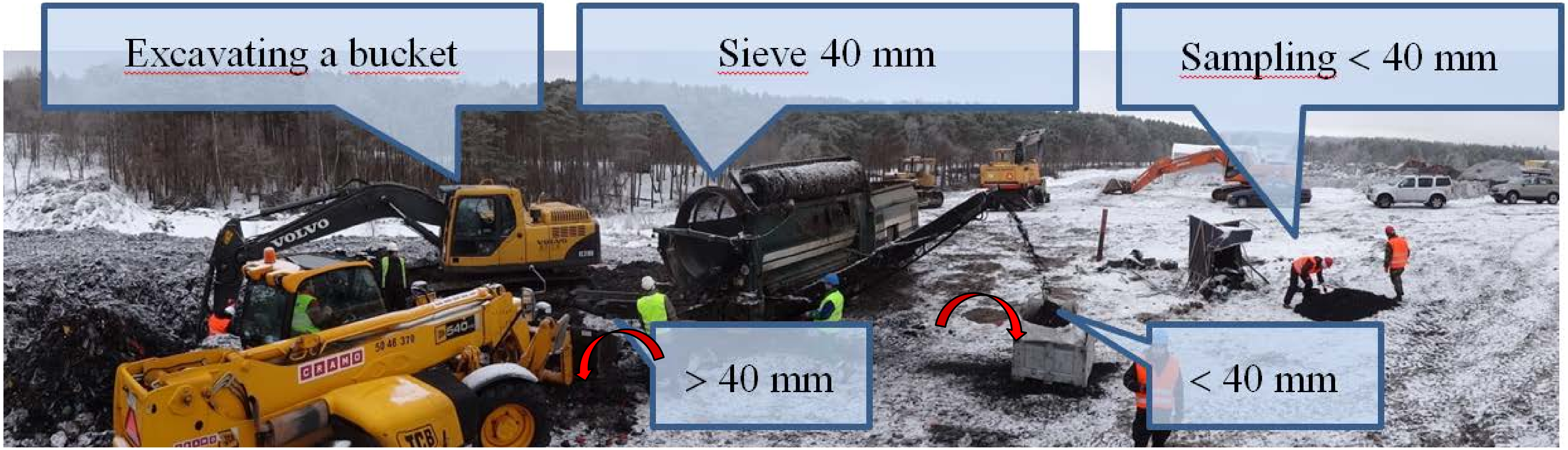
- Mostly municipal waste
- In operation 1970 – 2009
- Estimated volume 200,000 m^3
- By law: capped 2013
  - *This particular fact initiated full-scale LFM, co-operation between partners, and research in REE-s*

Landfill Mining was a tool for final closure of Kudjape landfill

- Simple closure design of a LF was not agreed by the authority;
- Fear of gas → 1,5 m cover layer was prescribed;
- Sorry, but this amount of cover material was not available.
  - Is it even ethical to force LF to take fragile soil and waste it?
  - Is it OK to dig a hole what the local community did not ask for ☹.
- What if we take cover material from the landfill?

Excavation in progress

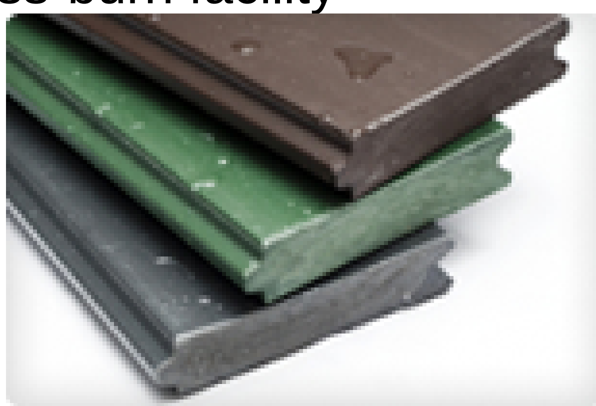
Waste was welll characterised



Series of experiments with LF resources!

- Waste-to-energy in Tallinn Mass-burn facility

- Waste-to-SRF for Kunda Cement factory



- Waste-to-plastic product at Rexest plastic industry

- Waste-to-oil in Oil Shale industry

The main objective: methane degradation layer

Is there anything valuable that we missed?

Characterisation of sites: Torma

- Municipal waste
- In operation today
- Total volume 300,000 tons
- Excavated into layer up to 3 yr

Characterisation of sites: Vika (Sweden)

- Industrial and C&D waste
- In operation

Characterisation of sites: BLB, Riga, Latvia

- Historical industrial waste site – 100 years of hazardous waste dumping
- In operation today – oil terminal on anthropogenic soil
- Total area 21 ha, average depth of contamination 3 to 4 m
  - 1.5 – 2.0 M tons
  - Cd, Cr, **Cu**, Hg, Pb, **Zn**, As, Ni
  - Remediation project!

Characterisation of sites: BLB

- The mobility of contamination **must be reduced**
- Result **must be quick**
- Choosing the Technology:
  - Some remediation technologies are not appropriate because of high groundwater level, concentration of contaminants, or ongoing industrial activities
  - To stabilize or to mine???
  - Is Urban Mining a tool for remediation?

Objectives

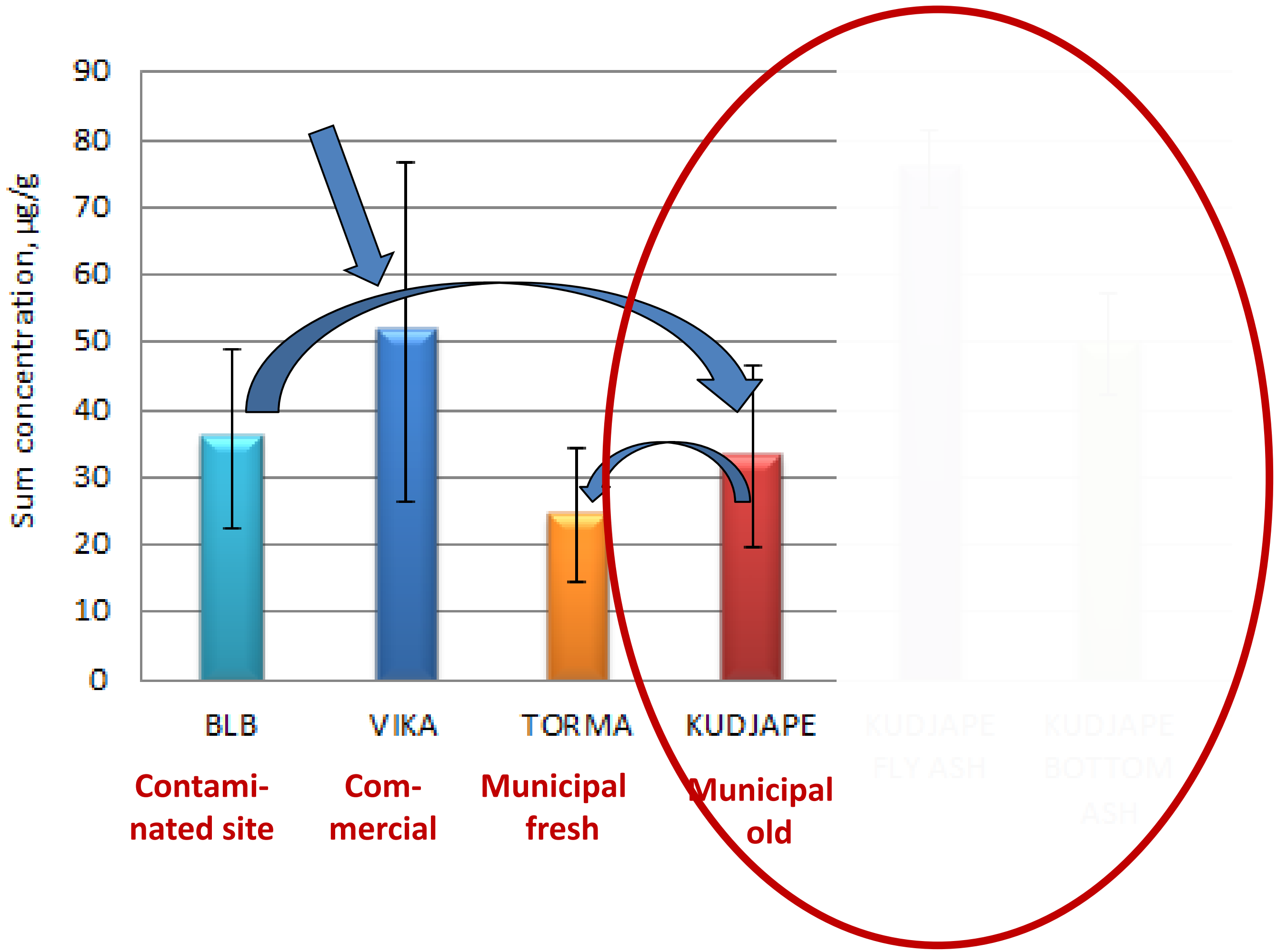
- The aim of this study was to determine elemental content of colloidal, clayey and silty aggregates (very fine fraction) from excavated soil-like material in order to assess recovery potential of metals and REEs.
- Why REEs, they were not the primary objective in any of these projects?
- REEs strategic and expensive (up to 3-5 housand $/kg).
- It is useful to know what do we have in 'stock'.
- If we go for extracting major metals, perhaps we can get REEs too?
  - Advanced leaching and bioextraction (approved technologies).

- Molycorp, Sillamäe, Estonia: producing tantalum and niobium (loparite ore from the Kola Peninsula)

Materials & Methods

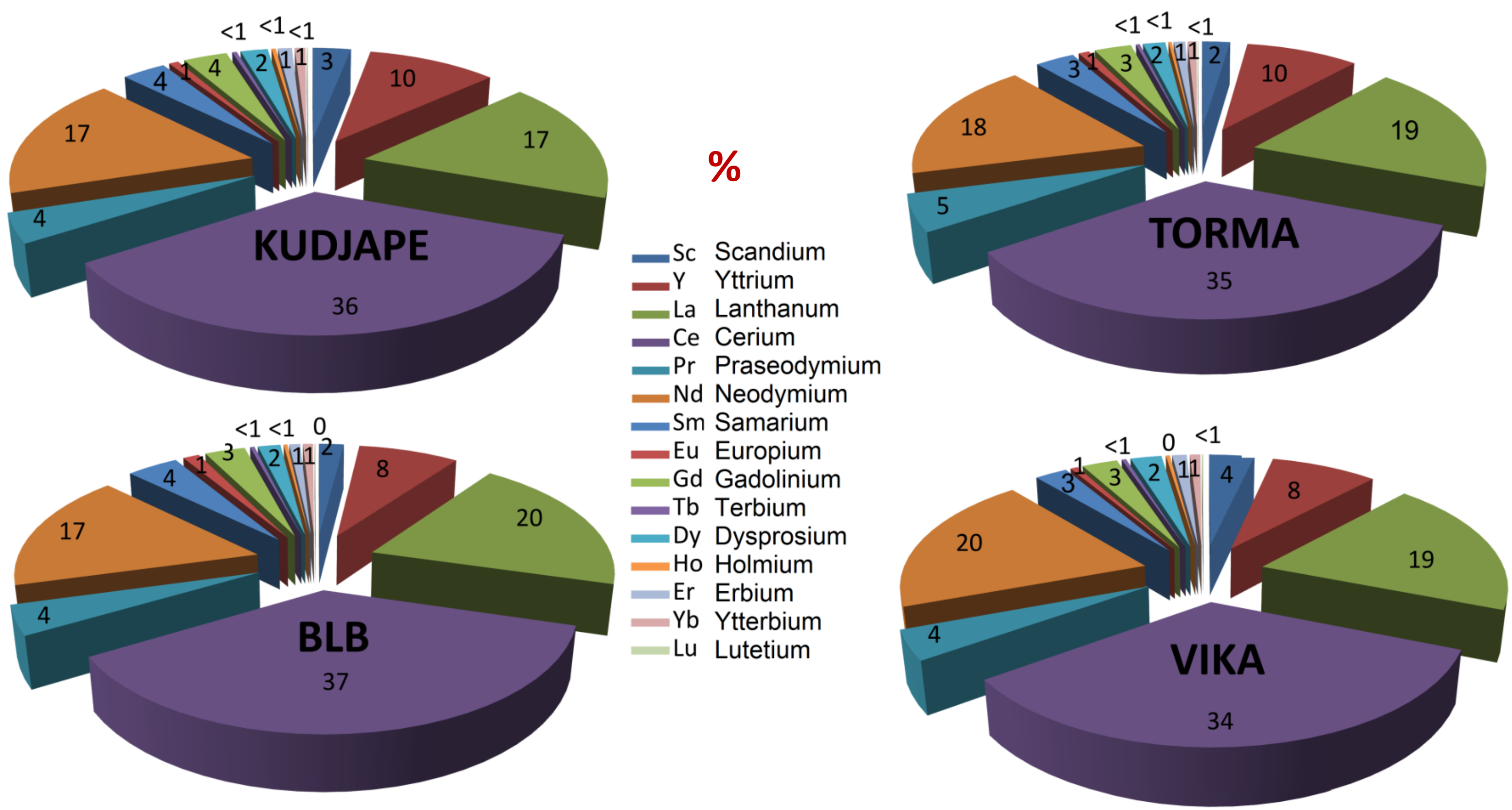
- Excavated waste was shredded, sieved and homogenized until it was recognized as fine fraction.
- Soil was drilled from BLB.
- Bottom and fly ash were collected from incineration plant.
- Acid digestion, followed by ICP-MS and AAS measurements was used.
  - Results from ICP-MS and AAS were compared with results from portable XRF equipment (*publications in Environmental Analytical Chemistry Journal and Waste and Biomass Valorization Journal*)

The comparison of total REE content in fine fraction



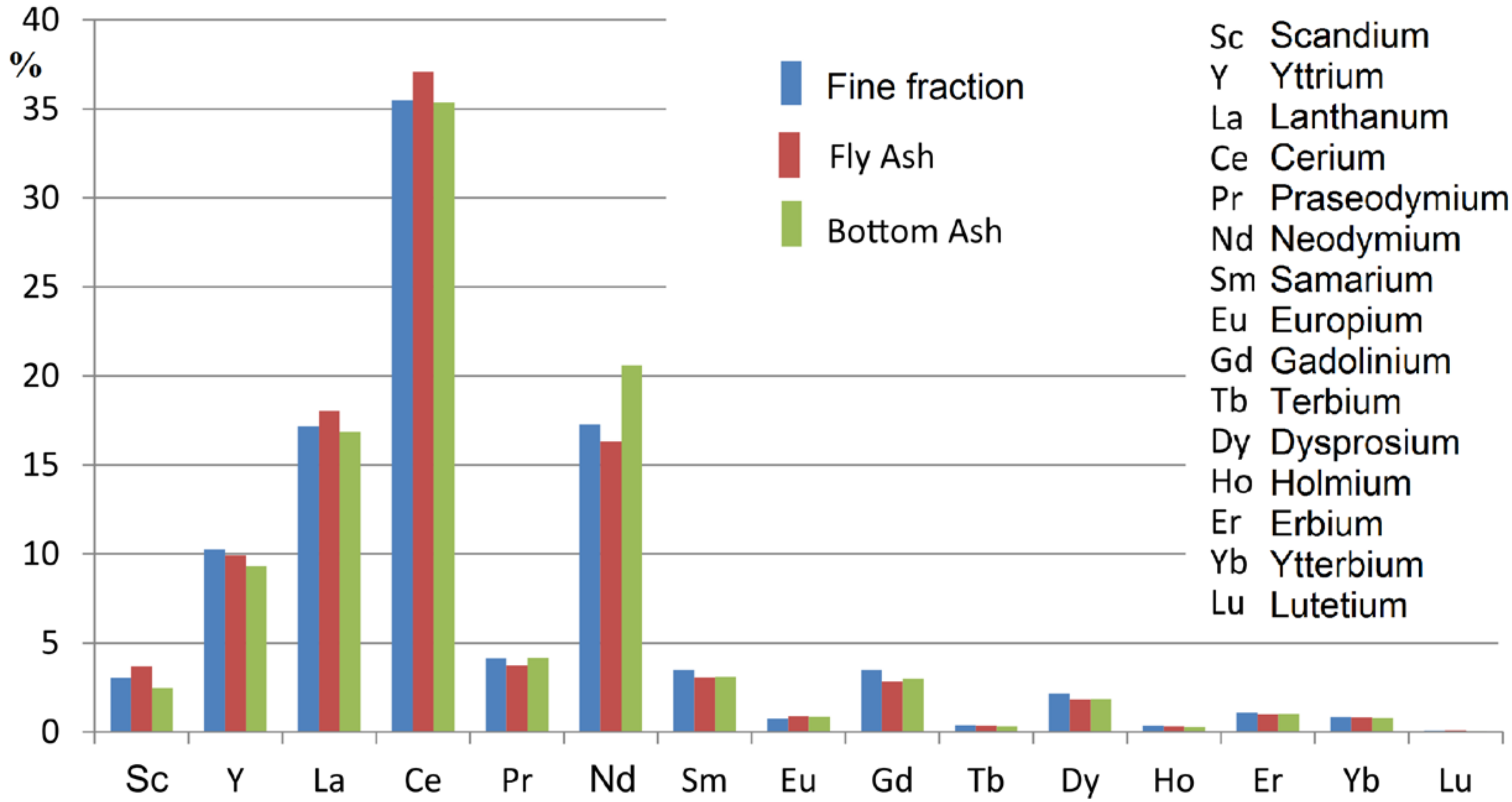
Ditribution of REEs

Municipal, old | **Municipal, fresh**

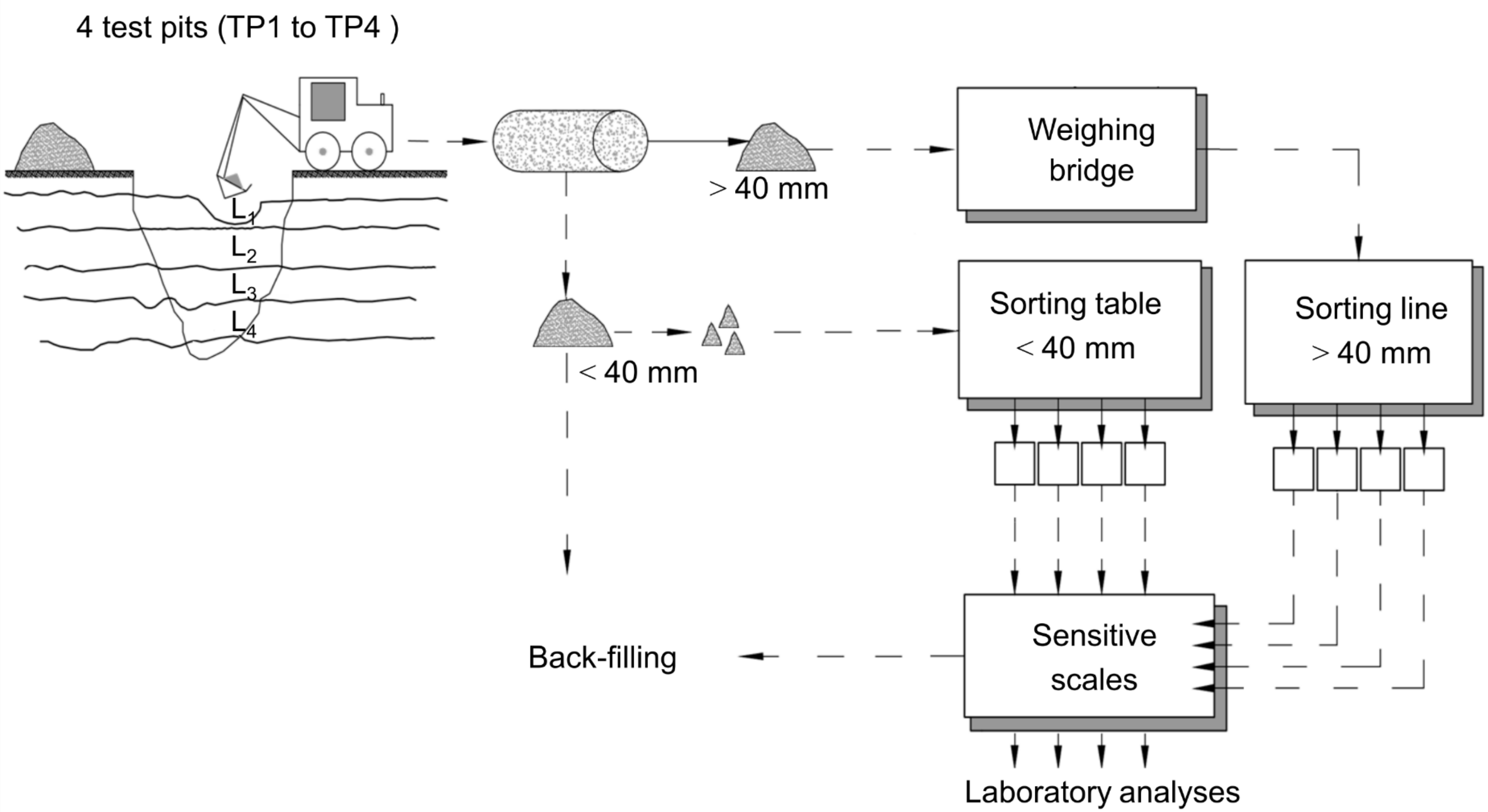


Contaminated soil | **Commercial**

Waste from Kudjape Municipal LF



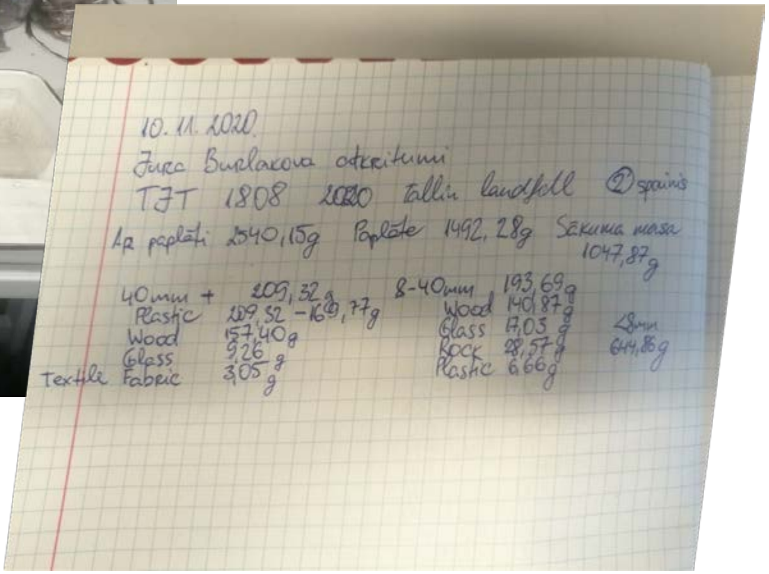
NEW SET OF DATA TO BE PREPARED: Pre laboratory phase defining capping material potential raw properties



Field works

Field works

process

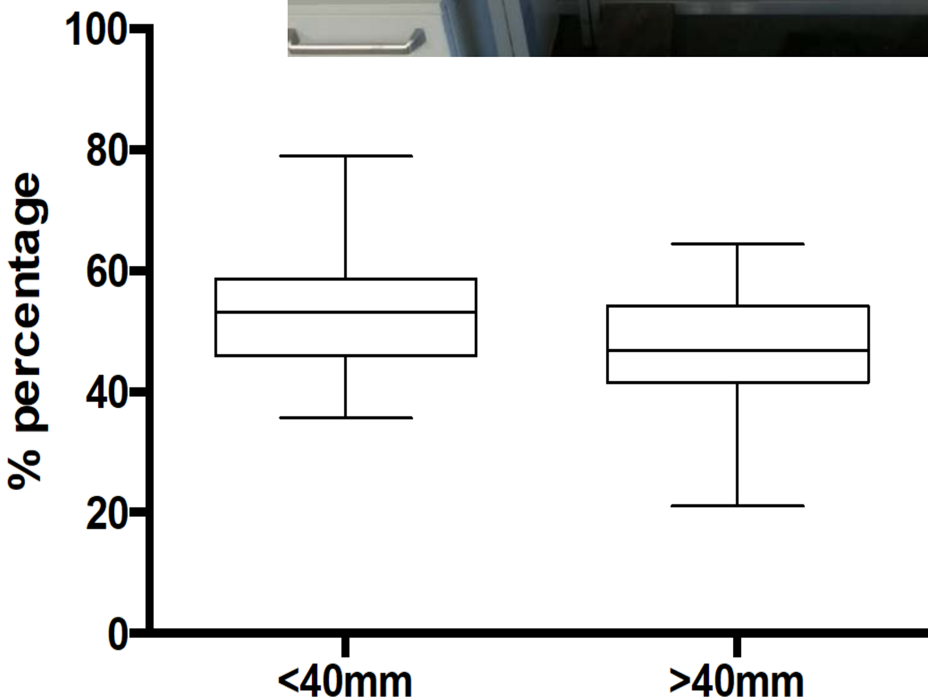

10. 11. 2020.
Jura Burlakova atkritumi
TJT 1808 2020 tallin landfill ② spainis
Ar paplāti 2540,15g Paplāte 1492,28g Sākuma masa 1047,87g
40mm + 209,32 g
Plastic 209,32 − 169,77 g
Wood 157,40 g
Glass 9,26 g
Textile Fabric 3,05 g
8-40mm 193,69 g
Wood 140,87 g
Glass 17,03 g
Rock 28,57 g
Plastic 6,66 g
<8mm 644,86 g

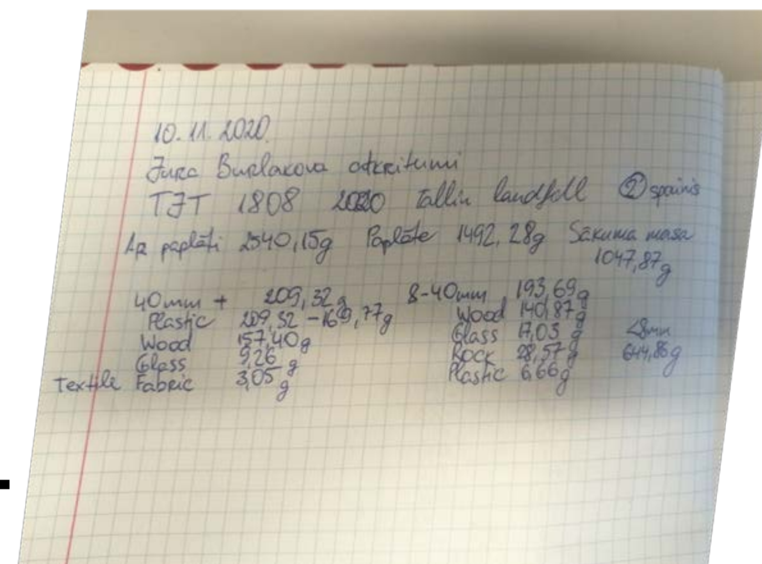
Uikala landfill example

			1028,29							
Coarse fraction >40mm				Middle fraction 8-40mm				Inert mass <8mm		
40-1 0-50cm										
			Total weight,g							
			1104,54							
Coarse fraction >40mm				Middle fraction 8-40mm				Inert mass <8mm		
Type	Weight, g	Weight,%		Type	Weight, g	Weight,%		Type	Weight, g	Weight,%
Total	282,29	25,56		Total	675,89	61,19		Total	146,36	13,25
Plastic	123,4	11,17		Glass	41,37	3,75		Plastic	1,15	0,10
Textile	116,12	10,51		Rock	127,4	11,53		Glass	2,84	0,26
Wood	21,96	1,99		Textile	8,15	0,74		Rock	1,99	0,18
Glass	20,81	1,88		Plastic	477,64	43,24		Unidentified	140,38	12,71
				Wood	7,4	0,67				
				Ceramic	13,93	1,26				
20-1 50-70cm										
			Total weight,g							
			1355,48							
Coarse fraction >40mm				Middle fraction 8-40mm				Inert mass <8mm		
Type	Weight, g	Weight,%		Type	Weight, g	Weight,%		Type	Weight, g	Weight,%
Total	6,61	0,49		Total	783,65	57,81		Total	565,22	41,70
Plastic	6,61	0,49		Glass	21,75	1,60		Plastic	4,2	0,31
				Rock	60,89	4,49		Glass	1,45	0,11
				Textile	5,41	0,40		Metal	0,3	0,02
				Plastic	695,6	51,32		Unidentified	559,27	41,26

Tallinn landfill example

TJT 1808 2020 Tallin landfill 3. spainis										
			Total weight,g							
			1287,1							
Coarse fraction >40mm				Middle fraction 8-40mm				Inert mass <8mm		
Type	Weight, g	Weight, %		Type	Weight, g	Weight,%		Type	Weight, g	Weight,%
Total	353,22	27,44		Total	230,85	17,94		Total	703,03	54,62
Plastic	28,03	2,18		Glass	22,71	1,76		Wood	101,7	7,90
Glass	13,15	1,02		Rock	17,66	1,37		Plastic	5,32	0,41
Bone	1,92	0,15		Plastic	6,42	0,50		Unidentified	567,09	44,06
Wood	226,16	17,57		Wood	184,06	14,30				
Ceramic	72,18	5,61								
Hard pressed cardboard	11,5	0,89								
Ceramic undercategories:										
Ceramic knife blade shard			16,84g							
Ceramic floor tile piece			55,34g							


% percentage
100
80
60
40
20
0
<40mm
>40mm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<8mm
644,86g

Fine fraction material further to be analyzed on:

- Elemental contents; bioavailibility of metals; extraction potential; interaction with organic material; methane degradation potential in field

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