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MINING the EUROPEAN ANTHROPOSPHERE

PROGRAM & ABSTRACTS

for the Workshop on
"Technologies for material recovery from landfills and mining residues"

23/24 September 2016
University of Novi Sad
Novi Sad, Serbia

Organized by
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IMPRESSUM

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Workshop title
Technologies for material recovery from landfills and mining residues.

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2.0	2016/09/30	Final version	U. Kral

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22. September 2016

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23. September 2016

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Biographies

in alphabetical order

Bučinskas, Algimantas

Algimantas Bučinskas (Boutchinskas) is currently a PhD student in Kaunas University of Technology. His main interest area is landfill mining.

Carvalho, Teresa

Teresa Carvalho is Associate Professor at Department of Civil, Architecture and Georresources Engineering (Mining and Georresources Section) in Instituto Superior Técnico, Lisbon University, Portugal. She is Mining Engineer. She got her Ph.D. in Mining Engineering at Instituto Superior Técnico, Universidade Técnica de Lisboa, Portugal.
She was project and process engineer at Somincor, in Neves Corvo mine, between 1981 and 1998. Then she entered the academy. Her main area of research is Mineral and Waste Processing. The research is made in CERENA (research center for natural resources and environment). She was President of the center from 2011 to 2013. Currently, she is Member of the Instituto Superior Técnico Scientific Council and coordinator of the BSc and MSc programs in Mining Engineering.
She is representative of Portugal in the European Innovation Partnership on Raw Materials (1º and 2nd Working Group) since 2013. She is coordinator of the Geological and Mining Engineering College (south region) of the Portuguese Association of Engineers since 2013. She was member of the Technical Committee on Automation in Mining, Mineral and Metal Processing do IFAC (International Federation of Automatic Control) from 2008 to 2014.

Cleall, Peter

Peter Cleall is currently a Senior Lecturer in Geoenvironmental Engineering at the School of Engineering, Cardiff University. He is a geotechnical and geoenvironmental engineer with a background in the development and use of coupled thermal-hydraulic-chemical-mechanical (THCM) models of the behaviour of porous materials. Current projects include a national consortium investigating in-situ resource recovery from geological repositories.

Gunderson, Pål

Pål Gundersen has been working at the Geological Survey of Norway (NGU) since 2004. He is an environmental chemist by education but has been working within a wide range of projects and administrative tasks like groundwater monitoring, leading the Norwegian well database, data standardization, leading the laboratory at NGU, mining pollution research, building national networks, arranging workshops and coordinating the evaluation of the Norwegian hydrogeology field. Most relevant to MINEA is his interest in developing a good framework for the categorization and use of mineral and mining waste.

Kriipsalu, Mait

Mait Kriipsalu is a professor on water protection at Estonian University of Life Sciences, dept of Water Management. He was graduated as an engineer on land reclamation, and received PhD on Bioremediation of Oily Sludge and Sediments, from Sweden. Since nineties, he has been teaching and researching various issues of water and wastewater treatment, and waste management. He is a

member of a Recycling Cluster in Estonia, and a board member and vice chairman of European Compost Network. He participated in a full-scale LFM project in Estonia 2012-2013.

Maul, Anja

From 2011 to 2016 Anja Maul was working as a research assistant at the Department of Processing and Recycling (I.A.R.) at RWTH Aachen University. Anja Maul recently joined VITOs team ART 'Waste recycling technologies' where she will continue to contribute to the progress in the field of physical separation technologies for waste processing. Her main research topics are resource recovery from landfills and optimization of process chains. With the main lies within the application of mechanical treatment processes for enhanced material recovery.
Since 2014 Anja Maul is a guest lecturer at the Perm National Polytechnic University in Russia. In EURELCO she acted as the country representative for Germany and active member of Working Group 2 "Science & technology for ELFM".

Udodi, Obianuju

Mrs. Obianuju Udodi is a recent master's degree graduate from the department of Environmental Engineering at Technical University of Denmark and Norwegian University of Science and Technology, Trondheim, Norway. I am an environmental engineer with background on solid waste management. My main interest is in continued research on landfill mining and hope on proceeding to acquire a PhD once given the opportunity. Concluded projects include Life Cycle Assessment of Mining an Old Danish Landfill at Copenhagen, Denmark.

Rosendal, Rene

René Rosendal is a partner in the consultancy company Danish Waste Solutions ApS, which is an independent consulting company offering expert services within the management of waste and resources with particular emphasis on environmental aspects. He has been working as a waste professional for fourteen years both in the public and the private waste sector.

He has from years of experience within the public waste sector in Denmark and consultancy and management and performance of R&D projects for industry, waste management companies and public authorities, mainly working with landfilling of waste, Landfill Mining contaminated soil and reuse of aggregates and C&D waste. He participates in a number of networks and organizations and is a steercom member of EURELCO, IWWG, DAKOFA and ISWA as the national representative in the Working Group on Landfill. René Rosendal holds an MSc Degree in Geography and Technology and Science (TEK-SAM) (University of Roskilde, Denmark, 2003)

Steiner, Martin

Dipl.-Ing. Environmental Technology (Technical University Berlin), specialization solid waste management. Since 1989 CEO of TBU, an independent consultancy firm exclusively (and mainly internationally) engaged in solid waste related issues. Project management in the 'old' EU member states (Italy, Austria, Germany, Portugal) as well as the new members (eg. Bulgaria, Slovenia, Czech Republic, Malta), those aiming at a membership (like Croatia, Serbia, and Turkey) and overseas (China, Pakistan, Australia).

- 25 year experience in design/upgrading of collection schemes, recycling programmes and final treatment with focus on mechanical / biological systems (optimisation of existing as well as design of new facilities).

- 15 year experience with international donorship / development programs (The World Bank, ADB, EBRD, EIB, various EC funds). Regular lecturer at MCI Management Center Innsbruck (lectures on Solid Waste Management). Author of the handbook “The Book of Rubbish” (www.sunnyarea.eu).

Umans, Luk

- Since 1999 working for OVAM (the Public Waste Agency of Flanders - Belgium)
- Used to be "thematic responsable" for any topic on waste incineration (European legislation on waste incineration, transboundary shipment, waste framework directive, Industrial Emission Directive...).
- Senior expert in some European projects on implementatation of European legislation and preparation of waste management plans in Hungary and Romania (TWINNING).
- Currently responsible on policy development of final treatment of waste (incineration, landill, landfill mining, energy efficiency, climat effects)
- Founding member of EURELCO; network on Enhanced Landfill Management and Mining ELFM² (a cooperation between gouvernment, universities & research centers, public actors and private investors) in order to give landfill sites its role in circular economy

Wagland, Stuart

Stuart is a lecturer at Cranfield University, is a chartered chemist and has a PhD in environmental chemistry. He has extensive experience in waste processing technologies and energy from waste processes, including the development and operation of the pilot-scale thermal facilities at Cranfield. Previously he has developed rapid methods of waste characterisation and is currently working on imaging techniques to assess the fuel qualities of waste-derived fuels. His current research spans a number of waste-related areas; in particular, he focuses on ex-situ landfill mining, assessing the available metals and waste-derived fuels from closed landfill sites. Recent work, which is presented at this workshop, has involved characterising samples extracted from UK landfill sites. He is a steering committee member of the European Enhanced Landfill Mining Consortium [EURELCO] and is currently working on an EU Horizon 2020-funded project SMART GROUND.

Winterstetter, Andrea

Andrea Winterstetter holds a bachelor’s degree in “International Business” from the University of Passau (Germany) and a M.Sc. in “Environmental Technology and International Affairs” from TU Wien and the Diplomatic Academy of Vienna (Austria). In 2016, she completed her Ph.D. thesis on the evaluation and classification of anthropogenic resources within the Christian Doppler Laboratory for “Anthropogenic Resources” at the Institute for Water Quality, Resource and Waste Management at TU Wien, Austria, where she is currently still working as a postdoctorate researcher. She is a founding member of and actively involved with the ISWA Young Professional Group. Her main fields of interests are sustainable resource and waste management strategies in a regional and global context.

Abstracts

in chronological order

Evaluating and classifying resources from old landfills - A new methodology

Andrea Winterstetter, Technische Universität Wien

Various recent policy initiatives indicate an increasing need for a comprehensive overview of potentially extractable anthropogenic resources, in order to compare them with geogenic resources. Therefore, a new methodology for the evaluation and classification of anthropogenic resources, i.e. for waste flows and material stocks, in analogy to existing concepts used for geogenic resource deposits was established. This study presents how anthropogenic resources can be systematically integrated into the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009). The main goal is to illustrate different settings of anthropogenic resource classification, and to provide specific criteria to map different types of anthropogenic resources within the three dimensions of UNFC-2009, i.e. “knowledge on composition and extractable material content”, “technical and project feasibility” and “socioeconomic viability”. A Project for recovering materials from an old landfill is exemplarily evaluated and classified under UNFC-2009. The economic results depend on the respective scenarios, where the timing of mining is varied, different organizational and societal settings are compared and different choices for technological options are made. While landfill mining under current conditions is not economically viable, the final result might look different in the future with changing key modifying factors, such as increasing secondary raw material prices.

Winterstetter, A., Laner, D., Rechberger, H., Fellner, J., 2015. Framework for the evaluation of anthropogenic resources: A landfill mining case study–Resource or reserve? Resources, Conservation and Recycling 96, 19-30.

Winterstetter, A., Laner, D., Rechberger, H., Fellner, J., 2016. Integrating anthropogenic material stocks and flows into a modern resource classification framework: Challenges and potentials. Journal of Cleaner Production 133, 1352-1362.

Winterstetter, A., Laner, D., Rechberger, H., Fellner, J., 2016a. Evaluation and classification of different types of anthropogenic resources: The cases of old landfills, obsolete computers and in-use wind turbines. Journal of Cleaner Production.

Life cycle assessment on mining of an old Danish landfill

Obianuju Udodi, TU Denmark

With a growing interest in environmental concerns around the globe, this project presents an LCA of mining an old Danish landfill. The 13years old landfill contained mixed waste. The objective of the research is to weigh the environmental benefit from mining the landfill. EASETECH software was used to run the model. Three scenarios were set up; S1 - Do nothing scenario S2 – recovery of only ferrous metal and combustibles and S3 – recovery of metals, plastics and combustibles. All residues are re-landfilled. The life cycle inventory data is based on a real landfill mining project implemented at AV Miljø and additional experimental data were collected from scientific papers.

Within the assumptions made the results show that the recovery of recyclables (metals and plastics) and combustible material – S3 delivers net environmental benefits as opposed to the baseline scenario. Contribution analysis revealed that WtE, excavation and sorting process and leachate treatment at waste water treatment plant are the main contributor to the impacts considered.

The sensitivity analysis showed that increase in electricity and heat recovery, bio-cover efficiency, fuel consumption during the excavation, causes a significant change in the result, revealing these as key parameters in the system.

The scenario analysis showed that with change in the marginal electricity been used and substituted for, the observed savings were reduced and much smaller. This scenario analysis goes further to explain that with changes in the marginal electricity in the future, the S1 presents a better result for global warming and terrestrial acidification potential than S2 and 3 whereas for all other impact category, S3 still remains favorable. Scenario analysis also showed that the environmental cost of setting up a new landfill is much smaller than expected but there is also critical socioeconomic implication e.g. not in my backyard and the financial cost.

Flemish approach on mapping and prioritization of landfill site management in relation to mining potential

Luk Umans, OVAM
Tom Behets, OVAM

The main idea of the ELFM-concept in Flanders is the approach of gathering materials (in its broadest definition) of a recent or an old landfill site or dumping site and reuse it for some purpose by introducing it again in the material chain. The approach makes it possible to gain important resources: materials, energy resources, drinking water and free space. A secondary benefit is that the approach is also suitable for purposes on soil remediation. In general landfill mining is used as a method for reducing the costs in cases of soil and water remediation or in cases of infrastructure activities.

The OVAM developed a three step approach towards ELFM: **mapping** (inventory of the number of landfill sites on level of the Flemish Region, with indication of specific characteristics of the area), **exploring** of individual landfill sites (identification of the specific landfill body, identification of the composition of the landfilled waste, identification of the geo-physical and -chemical characteristics of specific surroundings of the landfill site), **mining** of a specific landfill site (digging up of the waste, (pre-)treatment of the waste to make it suitable for material reuse or valorisation).

In the mining phase of the three step approach moreover 2000 sites were located in Flanders. Mining or even investigating all those 2000 sites in a short period was unrealistic, therefore a methodology for prioritization of potential for Landfill Mining based on a multicriteria-analysis calculation tool (FLAMINCO) was developed. The criteria were based on the content of the landfill site, the period of landfilling of the stored waste, the volume of the landfill body, the actual or future use of the location, the accessibility, the proximity to neighboring landfill sites and the need to remediate the location.
The latest years the approach moved towards ELFM² (enhanced landfill mining and management), since the research is more focused on (temporary) special applications of landfill sites.

Enhanced Landfill Mining in the UK: Resources or fuel?

Stuart Wagland, Cranfield University.

With an estimated 500,000 landfills across Europe, and over 20,000 landfills in the UK alone, these represent environmental issues and also present a potentially lucrative opportunity for recovering value. Here the main findings are summarised from a number of UK-specific projects carried. The work has involved sampling 9 landfill sites to assess the presence of critical and valuable metals and understand the chemistry of their mobilisation. Further to this the economic feasibility of landfill mining in the UK for resource recovery and the potential of processing extracted materials into refuse-derived fuels were assessed. The typical proportion of fines and inert material of the waste samples were ≤70%. This presents a challenge in processing extracted materials and significantly affects recovery of recyclable material. However, high quantities of metals are observed in the fines fraction, thus enhancing the overall economics; i.e. aluminium and copper content ranged from 12,000-17,500 mg/kg and 1,000-2,500 mg/kg, respectively. The sorted recyclable materials present included plastics (8-25% w/w) and paper/card (5-10%), however these materials are contaminated and would require further processing before being sold. With a calorific value of the sorted waste on average 12.9±3.8 MJ/kg (gross, as received) and 11±3.9 MJ/kg (net, as received). These materials could yield RDF. While the capital investments are relatively high in all cases which make the mining of small landfills unprofitable, these can be offset through profits from higher tonnage in medium and large sites.

Characterization of a landfill by boreholing

M. Teresa Carvalho, CERENA, Instituto Superior Técnico, Lisbon University.
Graça Brito, GeoBiotec, fct, Universidade nova de lisboa.
Bruno Guedes, CERENA, Instituto Superior Técnico, Lisbon University.

The objective of this talk is to reflect about the characterization methods used in urban landfills aiming at the evaluation of resources for materials recovery. Similarities and differences between the mineral deposits and urban landfills exploration are presented.
Some recent examples of published characterizations are discussed mainly in the view of the sampling method: equipment used, sampling pattern, procedure, sample size and composition analysis.

It is addressed the characterization by means of boreholing that allows the information acquisition at larger depths than other direct methods of sampling. The difficulties in obtaining a precise characterization are addressed.

A case study is presented in the characterization of an urban Portuguese landfill showing the limited potential for materials recovery. Six boreholes were characterized in terms of particle size (-6.3, 6.3-10.0; 10-22.4; +22.4 mm) and materials. The global composition of the boreholes is mainly soil, construction and demolition residues and organic materials (including plastics). It was observed that the global metals content is approximately 5%, varying from 0 to 20% in a few layers.

Landfill Mining in practice: Dismantling and removal of a former dumpsite

Martin Steiner, TBU Environmental Engineering Consultants.

The case study intended to be presented contains in its first part a hands-on assessment of the content of a former landfill which was operated between 1920 and 1985 and accepted all municipal waste streams generated in a predominantly rural environment with tourism as a main economic factor. The assessment was performed – according to the principle "let´s replace assumptions by knowledge" – prior to the complete removal of the landfill content.

The second part gives an overview on the excavation and separation works itself which have been triggered by flood events in summer 2013 (Kössen, a small town located on a river emptying into Chiemsee in Bavaria was the municipality mostly affected by this flood in Western Austria).

The presentation would address practical aspects such as reconnaissance methods prior to starting the works, approval issues, applied technology (in essence screening, windshifting and handsorting), organizing and conducting the dismantling works itself (sorting works have been conducted over a period of 14 months by about 50 asylum seeker from 13 countries), safety issues, mass & volume balance, recovery (in total about 1.250 tons glass, wood, car tyres and scrap metal have been sent to industries utilizing secondary raw materials), cost aspects, lessons learnt, and finally the project´s impact - from local education and cultural initiatives to politics with policies and directives to be expected for the near future.

Experiences from LFM projects in Denmark - Skaarup Landfill

René Rosendal, Danish Waste Solutions

The LFM project aims at excavating roughly 8.000 tons of waste that was landfilled in the 1979-81s at Renosyd's site in Skårup, Skanderborg, Denmark. The project is made possible by a close collaboration with our partners from Kingo Karlsen A/S, DGE Miljø- og Ingeniørfirma, Biorem Aps, Danish Waste Solutions ApS. The activities are co-funded by the Danish EPA under the MUDP scheme. The excavation is done at the first cell/stage of the landfill consisting of MSW, bulky waste, slags, C&D, sludge, garden waste etc.

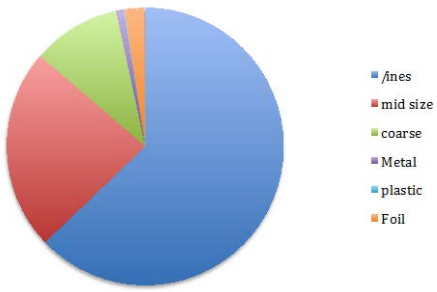
The landfill A desktop study done before the excavation estimated the following potential waste composition:

- 40 % soil (excl. topsoil cover)
- 25-30 % MSW for incineration
- 20-25 % C&D waste
- 1-2 % Metals
- 5-15 % Fines (slag, ashes, glas, sludge etc.)

During the project, the project partners will investigate the content of the waste after separation into various streams such as fines, C&D, plastic, metals, and RDF.
The basic idea is to demonstrate different sorting techniques and try non-invasive geoelectric methods to investigate the surface of the landfill before excavation in order to see if this works landfills.

An integral part of the project is also to assess the potential of reducing the landfills footprint, thereby minimizing both the cost of handling leachate and the aftercare of the landfill. All this data will subsequently be utilized to develop a business model which hopefully will allow large scale LFM operations to become (more) feasible in the future.
An environmental application was done for the project aiming to account:

- Safety: Plan for safety and health, Explosions and risk of fire, Collapse of excavation, Handling of hazardous waste (chemicals/asbestos)
- Extern environment: Noise and vibrations, Odour, landfill gas and dust, Soil and groundwater contamination risk (nearby recipients), Neighbours



Preliminary results from the excavation has shown the following waste composition as shown in table 1.

Table 1: Waste composition (2000 tonnes) excavated from Skaarup Landfill

Fine Fraction (tonnes)	Mid size fraction (tonnes)	Coarse Fraction (tonnes)	Metals (tonnes)	Plastic (tonnes)	Lg. Foil (tonnes)
1181,7	441,5	193,8	17,8	2,1	46
62,8 %	23,4 %	10.3 %	0,9 %	0,1 %	2,4 %

The project is still on-going and will continue for the next 3 weeks before the final conclusions will be started and finalized by the end of the year.

Development, optimisation and modelling of a separation process for ELFM materials

Anja Maul, VITO

To study, design and optimise an industrial separation process for a landfill site in Belgium, VITO evaluated different pre-treatment techniques, as well as dry and wet density separations at pilot or industrial scale and developed WasteSim, a process simulation program for waste treatment.

Materials recovered from trial excavations at the landfill were used to conduct large scale separation tests at different companies on pilot or industrial scale as well as in the lab at VITO to evaluate the efficiencies of different separation units and combinations thereof. Evaluation of these separation units has led to the development of an efficient process flow model for separation of all excavated waste and a concept for a demonstrator plant. Furthermore, the necessity to better understand and optimise the separation processes led to the development of WasteSim.

In WasteSim, by means of a graphical user interface, separation units can be combined into a process flow, unit parameters can be varied and output streams (mass balance and composition) can be visualised. The available unit models make use of partition curves, which express the quantity of a material with specific physical properties that end up in each of the output fractions of the equipment, in function of specific unit parameters and settings. These unit models (including vibrating screens, drum screens, wind sifters, etc.) are calibrated by the above described separation experiments. WasteSim's material stream structure and mathematical backbone allows for great flexibility and complexity in unit model development as it does not limit the unit models to algebraic expressions.

In this talk, the most prominent results regarding material separation on an enhanced landfill mining project, gained by both experiment and simulation will be discussed. This includes a comparison with conventional waste separation process planning methods, mass balances, output fraction purity, and a specific case regarding unit optimisation.

Technology for manufacturing high grade products from excavated landfill plastic

Mait Kriipsalu, Estonian University of Life Sciences

Plastic packages and other plastic products make significant part of municipal waste. Home-sorting of waste and subsequent processing of single-type plastics into granules or new products are the generally preferred solutions for recycling plastic. Reuse of mixed plastic waste represents a huge challenge. Most of such material is incinerated for energy or just landfilled. The biggest problem with processing of mixed plastics is posed by the fact that polymers of different types are immiscible because of their different molecular weights and long polymer chains, or just because of impurities that cannot be handled by normal plastic industry. Elegro Technology, however, has developed a technology for recycling mixed plastic waste into high grade construction material. This study describes how mixed excavated landfill plastic was processed.

During the closure project of Kudjape landfill in Estonia, 2012 to 2013, about 55 000 m3 of previously disposed waste was excavated and sieved. The main objective was to extract fine fraction and use it for construction of methane degradation cover layer for the whole landfill. Oversize material was sorted into several fractions, whereas mixed soft plastic was separated and shipped to plastic industry. Regardless of being landfilled for over a decade, landfilled plastic had not lost its polymeric properties. In first step, friction-heated plastic mass was formed, and shredded into agglomerates. In the following step, the pellets were mixed with additives, and extruded into various shapes of decking boards.

This study demonstrates that construction materials and products like decking boards, noise barriers, garden furniture etc. could be produced also from landfilled plastic waste. Taking into account vast number of landfills that contain plastic waste, application of this technology saves resources and broadens the market value of previously landfilled materials.

Review on sustainable innovative separation techniques for ELFM

Luk Umans, OVAM
Katrien Van de Wiele, OVAM

Given the demand for space and resources, Enhanced Landfill Mining (ELFM) has been getting more attention. This review, based on a study by OVAM, investigates if current waste separation techniques are sustainable and efficient to use. In this study two landfills have been partially excavated and waste samples have been delivered to different contractors. These contractors processed the waste samples using various separation techniques. The study shows that (1) not all landfills can be used to reclaim materials and/or secondary energy sources (i.e. fuels) and (2) this poses a problem for contractors that need to anticipate the quality of the landfill. Furthermore it is verified that landfills are heavily polluted thus exceeding current norms for re-use in soil applications. It is also stated that more innovative studies could prove beneficial in the field of landfill detection and estimating landfill compositions and energy potentials.

(presentation given on behalf of K. Van De Wiele (OVAM): kvdwiele@ovam.be)

Technological and environmental indicators for rinsing of materials recovered from landfill

Algimantas Bucinskas, TU Kaunas

Investigations were carried out in Alytus regional landfill, using waste samples taken from the landfill. Samples were taken from different depths of borehole, made in the landfill. After analysis of recovered materials quantities and composition two waste fractions were selected for an experimental study: textiles and plastics. These fractions were washed with distilled and tap water. Ash content and volatile substance in textile and plastic waste were determined before and after washing. Permanganate oxidation (ChDS(Mn)) and heavy metal analysis of filtrate from the landfill was performed. The highest values of ChDS(Mn) were located at a depth of between two and seventh borehole depth meter of the landfill, after washing with water: plastics - 19.27 mg O2/l and textiles - 28.8 mg O2/l. In all samples heavy metals (Zn and Cu) were detected, and a number of samples traces of Mn, Ni and Pb were found. After washing, ash content of the two factions decreased by an average of 10% and amount of volatile fraction increased. According to this analysis it is evident, that washing improves energetic properties of materials (if it is used for energy generation), recovered from landfills, and contributes to the reduction of environmental pollution.

In-situ resource recovery from waste repositories

Peter Cleall, School of Engineering, Cardiff University.
Devin Sapsford, School of Engineering, Cardiff University.
Michael Harbottle, School of Engineering, Cardiff University.
Richard Crane, School of Engineering, Cardiff University.
Danielle Sinnett, University of the West of England

Wastes and the waste repositories in which they reside are becoming targets for resource recovery, both for legacy wastes and for future waste arisings as part of a desire to move toward a circular economy. There is an urgent requirement to explore concepts for practicable technologies that can be applied to these ends. This presentation presents a synthesis of concepts concerning in situ technologies developed from mining and contaminated land remediation industries that have enormous potential for application to technospheric mining. Furthermore potential target waste streams, their mineralogy and character are presented along with a discussion concerning lixiviant systems and metal capture that could be applied. Issues of preferential flow (critical to the success of in situ techniques) and how to control it with engineering measures are discussed. It is clear that in situ recovery of metals from anthropogenic ores is a novel technology area that links new sustainable remediation approaches for contaminated materials and technospheric mining for closing materials loops and warrants further research and development of technologies applicable to major waste streams. This presentation, via reporting the progress of a large national research programme, aims to provide an overview of in situ resource recovery within a conceptual framework that seeks to: (i) Explain why in situ resource recovery technologies are appropriate to waste repositories; (ii) Identify existing technologies that can be transferred to this new area; (iii) Highlight key waste/ waste repositories that could targeted; (iv) Explain how the waste mineralogy will be critical in devising lixviant systems; (v) Discuss the issue of preferential flow and how to control it with engineering measures; (vi) Identify metal capture technologies; (vii) explore current technology development level and international applicability.

SMART GROUND: SMART data collection and inteGRation platform to enhance availability and accessibility of data and infOrmation in the EU territory on SecoNDary Raw Materials

Marco de la Feld, ENCO

Steady Raw Materials supply is essential for the EU economy and increasingly under pressure to sustain the businesses and industries demand. The supply of raw materials is not only a matter of availability of primary but also secondary raw materials (SRM). As such, we need to consider both the scarcity and raising prices of Raw Materials and the EU waste management policies aiming at reducing the environmental and health impacts of waste. To improve Europe's resource efficiency, a higher level of recycling and the minimisation of the extraction of natural resources is needed. A zero-waste production must be reached, finding a new market for each fraction deriving from processing activities, moving from a linear to a circular economy approach.

In Europe there are between 150,000 and 500,000 landfills, thus the SRM potential is significant. Nevertheless, there is to date no inventory of SRM at EU level. SMART GROUND aims to facilitate the availability and accessibility of data and information on SRM in the EU, as well as creating synergy and collaboration between the different stakeholders involved in the SRM value chain. In order to do so, the SMART GROUND consortium is carrying out a set of activities to integrate in a single EU database all the data from existing sources and new information retrieving pilot landfills as progress is made. Such database will also enable the exchange of contacts and information among the relevant stakeholders, interested in providing or obtaining SRM. The project will further spin out the SRM economy and employment by: delivering targeted training on the feasibility of SRM recovery from landfill and establishing a dedicated network of stakeholders committed to cost-effective research, technology transfer and training.

The database; a key tool to redefine wastes to resource

Pål Gundersen, Geological Survey of Norway

Circular economy, sustainable raw material supply and urban mining are hot phenomena in the European jungle of projects and project proposals. To succeed in a new project, the participants need to understand what initiatives already exists and how one can learn from them and relate to them. The author will therefore go through some of the projects that already exist and that MINEA and especially the mining waste part of WG2 would need to relate to. Focus will be on how to collect and facilitate the relevant waste stock and flow data for the end users.

It is the authors personal view that today's problem is not the lack of databases on waste materials. It is the lack of data on waste units within these databases. For European wastes to end up as resources, one need to facilitate that the waste flow/waste stock owners can easily analyze, categorize and then report the waste information. Reporting should be to as few as possible specialized databases, maybe only one. For the owners to do that, they need to be encouraged by legislation, ease of data delivery, and by the expectation that the same information will be widely accessed by potential users of their waste. In short; it should be much easier and more common to deliver data on waste units. And once good data are delivered, they should be accessible on a very limited amount of databases. The lecturer will argue that finding the means to achieve this could be a key issue for WG2.

The author will also present his personal view on what internal philosophy WG2 should adapt to achieve progress and results. Key words that will be discussed are: Keeping the targets clear and condensed. Keeping the language simple, short and without the buzzwords. Technical issues on how to cooperate. The common language and tools we need to master before we start.