ENHANCED LANDFILLS INVENTORY FRAMEWORK WITHIN RAWFILL PROJECT CONCEPT

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Landfill Mining is a promising business opportunity in North-West Europe and other countries. The market is expected to develop as soon as enough pressure will be given to the price level of raw materials, refused derived fuels and land. The main challenge for stakeholders is the profitability risk due to the lack of reliable data on the recovery potential of landfills. The RAWFILL project proposes an integrated methodology based first on the setting up of enhanced landfills inventories, filled up with suitable data that will allow stakeholders to take decisions. The RAWFILL methodology is described and first results are presented.

1. INTRODUCTION - The RAWFILL concept

RAWFILL ("Supporting a new circular economy for RAW materials recovered from landFILLs") is a EU-funded landfill mining project gathering partners and associated partners of EU NWE regions and supported by EURELCO, lasting for March 2017 to March 2020 (http://www.nweurope.eu/projects/project-search/supporting-a-new-circular-economy-for-raw-materials-recovered-from-landfills/).

The ultimate goal of RAWFILL is to allow NWE public & private landfills owners & managers to implement profitable resource-recovery driven landfill mining (LFM) projects.

RAWFILL develops a cost-effective standard landfill inventory framework (EIF) based on existing inventories and experiences, an innovative landfill characterization methodology by geophysical imaging and guided sampling and an associated Decision Support Tool (DST) to allow smart LFM project prioritization. The whole concept will be demonstrated in 2 pilot sites in Flanders and France and is presented in Fig.1 hereunder.

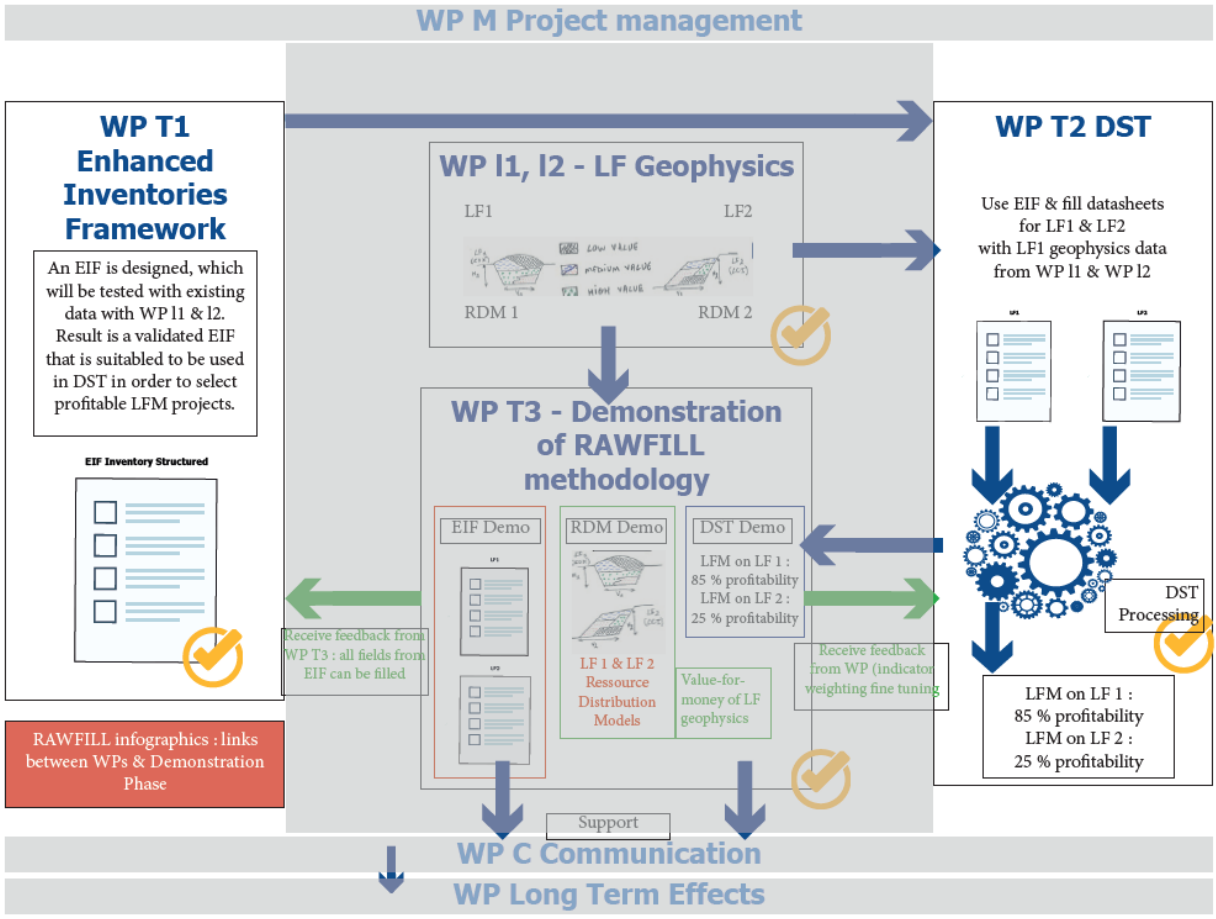

Fig. 1 RAWFILL workflow diagram

2. LANDFILLS INVENTORIES AND ENHANCED LANDFILLS INVENTORIES

2.1 The RAWFILL methodology

The RAWFILL methodology can be summarized as follows:

- From a landfill inventory complying with EIF structure, select a set of landfills that are of interest for a stakeholder interested to perform or prioritize LFM projects;
- Go/No Go approach: quick scan to eliminate landfills that are obviously not suitable for LFM operations (based on a set of easy-to-obtain criteria that can be adapted to a particular context). This approach will be included in RAWFILL first level of DST;
- Search missing information on the remaining sites from historical studies, geophysical imaging and guided sampling in a quick and cost-effective way, as described below;
- Rank the remaining sites by using the DST second level, taking into account economic, social, environmental and technical information (multi-criteria analysis);
- Select the site(s) where more detailed investigations will be performed in order to set up detailed business plans and cost benefits analysis, then take the final decision.

It is interesting to present here how the RAWFILL DST will operate and its interaction with an EIF compatible inventory. The DST is a ranking tool that will allow LFM projects prioritization based on a set of suitable physical, chemical, environmental, technical and social information found on datasheets extracted from a database complying with EIF structure (one datasheet per

considered landfill). It will integrate the multiple aspects involved in LFM projects, i.e. economic, technical, environmental & social factors, operating at 2 levels. Level 1 is “Selection”: screening tool to select sites with a priori interesting potential but which need further historical investigations and geophysics survey. This tool will allow stakeholders to introduce a rapid, first go/no go selection. Level 2 is “Ranking”: prioritising pre-selected and fully investigated landfills of economic interest for raw material and energy recovery as well as land reclamation. The 2nd level of the DST is a more dynamic model integrating the landfills in their physical, economic and social environment.

2.2 Enhanced Inventory Framework for landfill description

The main challenge for stakeholders involved in LFM is the profitability risk due to the lack of reliable data on the recovery potential of a landfill. Even in the NWE region, sheltering some 100 000 sites, existing inventories are uncompleted, as they lack relevant data on landfill economic potential (quantity, quality & value of materials). The EIF concept is to supply stakeholders with an inventory framework that can be filled with “LFM data” suitable to evaluate the landfill potential regarding LFM. Please note that RAWFILL EIF is a database structure that will not contain any information about any particular site. It will have to be filled with information by the users of the system, and the challenge is to present a useful, easy-to-use, cost-effective and reliable structure that can be used in every NWE region or elsewhere.

A brief review of existing inventories (still in progress) shows that most of them describe existing landfills in terms of generic information (name, location, dates of landfilling, ownership, sometimes waste volume estimation, etc.) and, the most advanced of them describe the environmental & risk issues (type of wastes, physical state, presence of leachates and biogas, geology, hydrogeology and hydrology, environmental impacts surrounding population, etc.). Information about the quantity, distribution inside the waste volume and composition of buried wastes is missing. To launch LFM projects, this information is crucial. It is necessary to evaluate the resource-recovery potential of each landfill present in a given area in order to rank them, select the most promising ones for detailed investigations, set up business plans with detailed cost/benefit and finally take decision to mine the most interesting sites.

The challenge is to define the suitable information with a sufficient level of accuracy and the practical way to obtain it at very reasonable cost. Obviously, there will be 2 types of information: the existing one (because already documented in some inventories, i.e. the landfill volume) and the missing one.

Regarding existing information, it will be necessary to determine the level of accuracy of some data, which is sometimes difficult to retrieve from older inventories and is very important for launching a LFM feasibility study. Here are some examples of frequent questions that will have to be asked:

- Was the waste volume measured, calculated or roughly estimated? Which precision is expected?
- How was the waste composition defined: from permits, historical investigation or site visit? Is it accurate?
- Has further landfilling been performed after the completion of the inventory?
- Are ownership information and regional land use information establishing when compiling the inventory still valid?

Missing information can be obtained from 2 sources: one from documentary works prior visiting the sites and anoher one received from site investigations. Documentary works include historical investigations, for which a very specific methodology has been developed and applied by SPAQuE for Walloon landfills and industrial sites (see a short presentation in http://www.spaque.be/documents/HistoricalstudyLD.pdf). The purpose is to obtain as much

information as reasonably possible form various sources as written documents (permits & authorizations, reports, contracts, site pictures, etc.), testimonies of workers and neighbours, maps and aerial pictures. Results are related to wastes volume, wastes types, age and origins and their distribution inside the landfill. Historical investigations will allow to precise some fields of the EIF structure, and supply a guideline for further site investigations, performed with an innovative combination of geophysical imaging and guided sampling. These geophysical imagings will precise the distribution of homogenous zones inside the landfill, and link the identified zones with information about the average waste composition and physical conditions (metal, organic materials, water content, etc.). Result will be a "resource distribution model" specific for each surveyed landfill, that will also feed the EIF with some fields and will be established later on in the RAWFILL project based on true scale operations on 2 pilot sites. Geophysicists have to take into account the facts that, in many cases, no historical information will be obtained at all, or some specific hazardous wastes may have been landfilled on a totally illegal way and will not appear in any document.

2.3 Some examples of EIF fields

We discuss hereunder three fields that have been identified to be part of the EIF. As the process is not completed yet, some changes may occur in the final EIF version that should be completed end of this year and validated for March 2020.

- Waste volume

The volume of a landfill in m³ is a very important field that is sometimes not known or evaluated with sufficient precision. We have some examples of Walloon old quarries where backfilling with wastes has been performed quickly and does not appear by comparing aerial pictures nor during site visit, so that volume estimation and waste qualification made during environmental impact assessment studies missed at least 25% of the real values.

Hopefully, waste volume is generally one of the most easy-to-obtain data with geophysical imaging, as long as a sufficient contrast exists between the wastes and the surrounding soil or rocks. The volume of the landfill and the precision of the measurement will be part of any EIF database.

- Waste type

Type of waste is a common data that can be found in some landfill inventories, mostly related to the regional context and the concerns of the author of the inventory. Most of the time, the categories are domestic, industrial and construction wastes that are the most common types of wastes but an harmonized list should describe industrial wastes more precisely and include other wastes types as hospital waste and military wastes that are very specific and sometimes present in large quantities in some EU regions. It is not our ambition to give a very precise definition of these types, but we will focus on a practical one, material and energy recovery oriented with an indication of potential mining problems that can be encountered (as chemical, physical and biohazards).

- Land pressure

The price of the land in the landfill area and the density of population surrounding a site have first been assumed to be suitable indicators, but further analysis has shown that it should be more effective to replace them by a "land pressure" meta-indicator related also to future land use planning.

To illustrate this, SPAQuE has develop a specific software for site ranking, named Auditsite® (http://www.english.spaque.be/01239/fr/Auditsite). This tool is a 2-steps risk evaluation grid

classifying the sites regarding the probability of intervention due to human and environmental risk evaluation. Some quotation is given to human permanent population nearby the landfill (0 to 300 m, 300 to 1000 m, 1000 to 2000 m, more than 2000 m), type of land use (housing, agricultural, commercial and industrial zone) and visual impact of the site (important, mild, low). Existence of a development project is also noted. This information is highly valuable, but does not take into account what can happen in the future: will the area be included in strategic urban extension plans and take one day very high value justifying to mine the landfill? The EIF related field should gather all these focused on future developments.

3. RESULTS AND DISCUSSION

The consortium is just at the beginning of the RAWFILL project, but promising results have already been collected. EIF should be completed for the end of 2017 and tested next year. The main challenge is to supply the most reliable inventory structure contaning fields that are necessary to launch LFM projects, and for which data collection will be secured, cost-effective and easy to obtain.

4. CONCLUSIONS

We are going on with compiling existing inventories structures with additional fields, setting up gradually the full EIF structure that will be tested on 2 pilot sites and adapted following the results of RAWFILL demonstration phase. We are always interested to get feedback from RAWFILL advisory board members or any stakeholder feedback and we hope to supply a practical tool by the end of 2019.

AKNOWLEDGEMENTS

RAWFILL consortium: Atrasol, BAV, British Geological Survey (Natural Environment Research Council), I-Cleantech Vlaanderen, OVAM, SAS Les Champs Jouault, SPAQuE, University of Liège (Applied Sciences)

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