

Report on mapping

Analysis of the March 2017

COCOON Questionnaire

June 2018



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Participating EU countries in this questionnaire

Belgium (Region of Flanders)
Cyprus
Germany (State of Brandenburg)
Malta
Netherlands
Spain (Autonomous Community of Andalusia)



Figure 1: Map of Europe. All participants of this survey are indicated in green.

1. Abstract

Since the 1950s Europe has been disposing vast levels of waste in landfills. Estimates have revealed that 90% of Europe's 500.000 landfills are non-sanitary landfills, which predate the EU Landfill Directive and have limited environmental protection measures installed. The EC has acknowledged that a vision for managing Europe's landfills is urgently required. Landfills are to be considered as dynamic stocks of resources (materials, energy, land,...) that can be integrated into the economy, while landfill management (LfM) supports reclaiming land and avoids astronomic remediation and aftercare costs. Although many EU regions are already implementing LfM, no targeted, specific European LfM legislation currently exists. Nor are existing Waste Management and Soil Protection policies integrated in an overarching circular economy framework.

Therefore, the COCOON objective is to improve relevant policy instruments on landfill management, while increasing subsidies through operational programmes (OPs) for LfM projects. COCOON brings together distinct EU regions to share and capitalise on regional good practices.

An important task of COCOON is to collect EU-wide information about landfills, landfill management, LfM activities and policy issues. Therefore an inventory was developed on these landfill issues and filed in by the COCOON partners for their region: Andalusia (Spain), Brandenburg (Germany), Cyprus, Flanders (Belgium), Malta and the Netherlands. This should allow better understanding of potential drivers, barriers and enablers for LfM implementation and how such challenges could vary among regions.

This report summarises our findings on LfM based on the reactions on the questionnaire, but is not a list of all detected landfills with a detailed description of their characteristics. The emphasis is far more on the availability and accessibility of data on landfills and the current policies.

Overall, the EU landfill directive is implemented in all regions although for some regions it took a bit longer than others.

More importantly, there's a strong imbalance in the collection and availability of closed landfills compared to the active ones. Since closed landfills represent the vast majority of the estimated 500.000 landfills in the EU, there's a huge data gap on this section of the circular economy. Also, relevant guidelines on these landfills are currently non-existent whereas the European Landfill Directive is limited to some advises on this domain. Policy makers should be aware that the data collecting happens in a uniform way, since there are already problems on a small scale, i.e. the six COCOON partners, on comparing existing data.

Legislation focusing not only on the management of landfills but also on the potential mining of the sites in the future is poor. A legislative changeover is required, certainly in view of the EU Circular Economy Action Plan and UN Sustainable Development Goals. EU support on this domain is the best way to achieve this.

2. Governance and organisational aspects

The first part of this report clarifies the internal structure of authorities for a number of governmental responsibilities as derived from the answers in the inventory. It deals with:

- Waste management policy
- Permitting of operational landfills
- Control of operational landfills and monitoring of closed landfills
- Groundwater and soil remediation
- Mineral and natural resources supply
- Initiatives on circular economy

2.1. Waste management policy

In terms of responsibilities with regard to waste management policy, quite some differences exist in the level of authority on which the waste management policy is controlled. Roughly all participating regions can be divided into three groups:

- Group 1: a national ministry is the direct manager of the policy (**Cyprus, Malta**)
- Group 2: a regional ministry is the direct manager of the policy (**Brandenburg, Andalusia**)
- Group 3: a governmental organisation linked to a ministry is the practical executor of the policy (**Flanders, Netherlands**)

The political structure of **Cyprus** and **Malta**, both being unitary states, permit to supervise on a national level. In Cyprus this is the Department of Environment of the Ministry of Agriculture, Rural Development and Environment and in Malta the Ministry for Environment, Sustainable Development and Climate Change. Other examples of this kind of government can be found for instance in the Baltic States.

It is not a surprise that both **Brandenburg** and **Andalusia** are found in the second group. The Spanish constitution of 1978 provided sovereignty vested in the nation as a whole, represented in the central institutions of government, but the nation also has asymmetrically power to the communities and therefore is a decentralised state. There is a national government, apart from the regional one, regulating the waste management policy. In this report, the analysis is solely based on the regional government of Andalusia except if the Andalusian authorities themselves indicated national legislation or figures are involved.

Germany on its turn is a Federal state which implies a virtually complete government in each of its sixteen States. Responsibilities concerning waste management are shared between the Federal Government and the states such as Brandenburg. Almost all laws and ordinances are issued by the Federal Government and are applied nationwide. The states enact laws and regulations for the practical implementation of the waste management policy.

For this reason and the fact the questionnaire was taken in the State of Brandenburg, further analysis of the questionnaire will be done in relation to the latter one and not to Germany as a nation unless stated otherwise.

Rijkswaterstaat (**Netherlands**) and the Public Waste Agency of **Flanders** (Dutch: OVAM) both are governmental organisations responsible for waste management policy among other things and thereby belong to the third group.

The difference between the two regions is the level on which the organisation functions: OVAM is a regional organisation depending on the Flemish Minister for Environment, Nature and Agriculture (Department of Environment) while Rijkswaterstaat is the exclusive agency for policies and regulations of the Ministry of Infrastructure and Water Management and is directly placed under this Ministry.

2.2. Permitting of operational landfills

In all participating states, the responsibility for the approval of landfills is at the primary or secondary administrative layer at the most. This is to be recommended as a standard because of the mostly supra-local importance of the operated landfills and the necessary expertise in landfills to all member states of the EU.

Andalusia use its regional jurisdiction to maintain the number of landfills, in other words the Consejería de Medio Ambiente y Ordenación del Territorio de la Junta de Andalucía. The corresponding Ministry on a national level is the Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente.

Brandenburg delegates the permission to its State office of environment (Landesamt für Umwelt, LfU).

In **Cyprus** the Department of Environment is responsible for the permitting of operational landfills.

Flanders use their regional jurisdiction to maintain the number of landfills via the Department of Environment.

Malta takes care of their amount of active landfills nationally, this is the Environment and Resources Authority.

The **Netherlands** assigned the jurisdiction of the permissions of national landfills to its twelve provinces. Also, under the future Environment and Planning Act (EPA), sanitary landfills (EU landfill directive) will stay under jurisdiction of the provinces.

2.3. Control of operational landfills and monitoring of closed landfills

In terms of the control of operational landfills and the monitoring of closed landfills, the same authorities apply as for the permitting of landfills. An exception can be found in **Cyprus** and **Brandenburg**'s organisation.

Although in **Cyprus** the permit of landfills is a national affair, the monitoring of closed landfills is a responsibility of the cities and municipalities on the island. This is achieved via a Council of District Waste Management. The control of operational landfills is a national affair identical to previously mentioned responsibilities.

The **Brandenburg** Waste Responsibility Directive uses an appendix (German: Anhang 1) to determine which governmental organ is responsible for monitoring closed landfills. If mentioned in the appendix, the State office of environment is responsible. When absent on the list of the appendix, the monitoring is transferred to the districts and independent cities which is the administrative layer below the States.

All other regions only use one authority for both monitoring and controlling all landfill sites. More specifically these are the Office of Planning and Environment (Spanish: Consejería de Medio Ambiente y Ordenación) of the Autonomous Community of **Andalusia**; the Department of Environment of **Flanders**; the Environment and Resources Authority of **Malta** and the provinces of the **Netherlands**.

With the future Environment and Planning Act (EPA) (Dutch: Omgevingswet) of the **Netherlands**, the jurisdiction of non-sanitary landfills without any form of aftercare (leachate treatment) will be transferred from provinces to municipalities.

2.4. Groundwater and soil remediation

One of the main questions of this part of the questionnaire is to determine how many regions separate their soil remediation activities from groundwater remediation activities.

For **Andalusia**, the groundwater and soil remediation authority is the Consejería de Medio Ambiente y Ordenación del Territorio.

When financial support by the state of Brandenburg or the Federal Republic is needed in projects concerning groundwater remediation, the Water Department of the LfU of **Brandenburg** will be involved. In all other cases, including soil remediation, the districts are responsible for directing measures and their monitoring.

The Water Development Department of **Cyprus** deals with all cases involving groundwater remediation, the Department of Environment all soil remediations.

In **Flanders**, soil is defined as the unsaturated zone of the earth and thus separated from the definition of groundwater. Soil is a responsibility of the Public Waste Agency (OVAM).

Ground water is for the Flemish Environmental Agency (Dutch: Vlaamse Milieu Maatschappij or VMM).

Groundwater is a responsibility of the **Maltese** Energy and Water Agency. The Environment and Resources Authority is responsible for ground remediation.

The legislation of both remediations is work in progress in the **Netherlands** and could have an impact in the future processing of projects. Based on the current law, the provinces and 29 municipalities are responsible for soil remediation (Bodemloket, s.a.). With the implementation of the Environment and Planning Act there will be no distinction between remediation and landfill mining. 3D spatial developments will be the driving forces.

2.5. Mineral and natural resources supply

When analyzing the answers of the questions about mineral and natural resources supply in the survey, it was clear that a lot of countries treat this subject independently from landfill, soil or groundwater cases. Moreover, the management of mineral and natural resources not uncommonly is a responsibility of another governmental body and/or on another level of authority.

For **Andalusia**, comparable with the Ministry of Planning and Environment for all previous cases, for resources the Ministry of Employment, Business and Commerce (Spanish: Consejería de Empleo, Empresa y Comercio) is the decision making authority on this subject.

Rather remarkable is the federal and thus national jurisdiction of resources in **Germany**. It is directly controlled by the Federal Ministry for Economic Affairs and Energy.

Cyprus has the Department of Geological Survey for doing research. This department works within the same ministry as the Department of Environment does for groundwater and soil remediation.

The only exception on this matter is **Flanders**. Like previously discussed in soil and groundwater remediation, it is the regional Department of Environment (Dutch: Departement Omgeving) under the authority of the Flemish Minister for Environment, Nature and Agriculture that is responsible for natural resources and minerals too.

In **Malta**, the Ministry for Environment, Sustainable Development and Climate Change is responsible for the resources in the Maltese archipelago via the Environment and Resources Authority and the Malta Resources Authority.

Within the boundaries of this survey, the **Dutch** use a unique way of regulation. With some imagination, one could say they use the old Roman tactic 'divide et impera', divide and conquer. The Ministry of Economic affairs on a national level only deals with the exploration of oil, natural gas and coal resources as stated in the Mining Act (Dutch: Mijnbouwwet). The

Ministry of Infrastructure and Water Management is responsible for legislation and environmental standards of gravel, sand and clay. Provinces, Water Boards and municipalities are authorised for the jurisdiction. Over all, the Ministry of Economic affairs is the link between all parties, an important difference in comparison to groundwater and soil remediation.

2.6. Initiatives on circular economy between the authorities of mineral/natural resources and waste/landfill management

The first chapter of the questionnaire ended with an inquiry about the new policy initiatives on circular economy. The level or lack of collaboration between the authorities responsible for waste and landfill management and those for mineral and natural resources management was also investigated.

Andalusia currently has no initiatives on a circular economy between these two authorities.

Brandenburg currently has no initiatives on a circular economy between these two authorities.

Cyprus currently has no initiatives on a circular economy between these two authorities. However, they did indicate that the authorities to establish this a circular economy are part of one and the same Ministry. Therefore, in view of a new policy initiative on circular economy the cooperation can be easily developed.

The previously mentioned authorities of **Flanders** (VMM, OVAM, Department of Environment) work in a coordinated way. Issues are discussed in advance and via working groups that consist of all concerning governmental departments. The reason for this is in order to avoid overlap of regulations of the Material Decree (Dutch: Materialendecreet) and the Decree on surface mineral resources (Dutch: Oppervlakedelfstoffendecreet).

In **Malta** the collaboration dealing with circular economy still is very minimal and based on the answer in the survey not yet fully operational within the complete government apparatus.

The collaboration between the **Dutch** Ministry of Economic Affairs on one hand and the Ministry of Infrastructure and Water management on the other hand targeting circular economy is based on a transition agenda. The first step in becoming a circular economy was made in 2016, when the government issued a policy document in which they commit themselves to a full circular economy by 2050. On the journey to this target, a stepstone was implemented to halve the use of primary raw materials by 2030. From the beginning on, the choice is made to give priority to five sectors to achieve this challenge:

- Biomass and food
- Plastics
- Manufacturing

- Construction
- Consumer goods

The aim in these five sectors is exclusively using sustainably produced, renewable or generally available raw materials, and generating as little residual waste as possible (Ministry of Infrastructure and Environment, Ministry of Economic Affairs, 2016).

3. Available landfill information and data

3.1. National surveys and databases

Although not every region has mentioned it, EU member states are required to report to the PRTR (European Pollutant Release and Transfer Register). Apart from that, every region in this survey has some source of data for its operational and/or closed landfills, but each one also has its own method of collecting and processing of those data.

The authorities of **Andalusia** have made a distinction in this questionnaire between the data collected on a national level and on a regional level. The national government of Spain publishes an annual report, currently up to and including 2014, in which operational municipal solid waste landfills are listed. This includes their location and very brief information about the amount of mass (in tons) of waste is treated and if biogas is collected for electricity production (Ministerio de Agricultura y Pesca, Alimentacion y Medio Ambiente, 2014).

There is also a national database that provides information about operational landfills in relation to the emission of greenhouse gasses. However, it is not possible to make a distinction among different types of landfills in relation to the type of waste (municipal, industrial, non-hazardous...) because the purpose of database is solely to inform about emissions (PRTR España, s.a.)

On a regional level, information can be found about all operational landfills in Andalusia, which are 98 non-hazardous landfills.

There is no proper database about old landfills, not on a regional level nor on a national level.

The main database of **Brandenburg** is named ALKAT (German: Altlastenkataster) or Brownfield Register in English and contains all old landfills of the state. The Statistic office of Germany makes statistics about the number of operational landfills, their remaining volume differentiated to every state of Germany and waste deposit class. Every state of Germany is obligated to make an annual report about the municipal waste. These statistics give an overview about the amounts of waste in the states, the disposal procedures, the amount of recycled waste and so on.

Cyprus did a comprehensive study in 2005 for the elaboration of a Strategic Plan, an Environmental study and a Feasibility study for the redevelopment and management of landfills. The purpose of the study was to record all landfills, assess their status and level of risk, create a restoration priority list based on pollution risk assessments and undertake the appropriate environmental studies as well as feasibility studies for the restoration of the prioritised landfills. These studies were a necessary step for the restoration of all recorded landfills.

Flanders has a variety of databases on landfills.

- Permitted landfills are kept in a database of environmental permits of which the Department of Environment is responsible. Data about landfills in aftercare are stored in an alphanumerical database at the Public Waste Agency of Flanders. In this way it is possible to manage the financial warrants related to the operation and the release of financial securities.
- Simultaneously there is the Land Information Register (Dutch: Grondeninformatieregister or GIR). This register contains an inventory of all land lots of which data of potential or proven soil contamination are known at OVAM and is based on the Municipal inventory (Dutch: Gemeentelijke inventaris or GI). The GI contains information of all current and former industrial operations that were assessed as high risk to soil pollution. Landfills are such 'risk activities'.
- Finally there is also the EFLM-database of OVAM, a steadily progressing inventory of validated old-landfills. For this database the Flaminco tool is used to prioritise the manageable landfills it contains (OVAM, 2013b).

Malta's Environment and Resources Authority holds data for Malta's two permitted landfills, as well as four other closed and rehabilitated dumpsites (not permitted) used prior to Malta's accession to the EU, and a number of other sites that have been discovered along the years that had been used for illegal dumping. The latter sites are also being monitored.

Dutch operational landfills are monitored every year since 1991. The response on this monitoring is a nearly 100%, thus very complete. A yearly questionnaire is conducted by the Working Group on Waste Registration (Dutch: Werkgroep afvalregistratie), in which several stakeholders participate:

- Ministry of Infrastructure & Water management
- Ministry of Economic Affairs
- Association of waste treatment companies (BVOR, etc)
- Interprovinciaal Overleg (IPO) & Rijkswaterstaat
- Rijkswaterstaat Leefomgeving (Bodem+ en Uitvoering Afvalbeheer)).

Yearly reports are available and provide a survey of the annual amount of waste processed (table 1). The response on this monitoring is nearly 100% thus very complete.

By type of facility, these include:

- landfills
- waste incinerators
- organic waste digesters
- composting
- installations and treatment of soils sludge material.

Wate category	Net amounts deposited (ktonnes)				
	2012	2013	2014	2015	2016
Municipal solid waste	0	-	-	-	-
Industrial waste	202	250	297	397	514
Contaminants after sorting and separation of MSW and non-process related industrial waste	92	129	98	140	230
Soil - hazardous waste	51	44	35	7	29
Soil - non-hazardous waste	200	195	74	32	44
Soil remediation residues	1.082	624	529	558	662
Demolishing and construction waste	140	152	72	78	102
Street-cleaning residues	0	-	0	0	0
Shredderwaste	120	135	128	122	121
Flyash residuals - hazardous waste	58	78	92	98	107
Flyash residuals - non-hazardous waste	355	8	14	11	3
Other	436	405	528	521	547
Total	2.737	2.020	1.870	1.981	2.369

Table 1: summary translated by COCOON of all deposited waste per category during a period from 2011 to 2016 (Rijkswaterstaat, 2017).

In the late 1980's a broad preliminary investigation was conducted to collect information on the existing landfills in the Netherlands, known as Verkennend Onderzoek Stortplaatsen (VOS) in Dutch. This investigation predominantly focused on the location of landfills to get an idea of the financial consequences.

Subsequently during the following years more investigations were conducted. For non-sanitary ('former') landfills there was an extensive survey between 1995-2005. The main objective was to determine potential or clear risks for humans and/or groundwater. A total of 3800 landfills were inspected. The results are described both in individual and general NAVOS (Dutch acronym for Nazorg Voormalige Stortplaatsen) reports.

One of the results is a tool to calculate the financial burden of aftercare at the site (Interprovinciale werkgroep nazorg, s.a.). The actual data of all this research is managed by each province. A complete database that provides information from all sites at once does not exist at the moment.

3.1.1. Summary

All countries do keep a good track on their old and operational landfills. Only Andalusia didn't have a database about old landfills at the moment of participating this survey (table 2).

Country/region	Database of old landfills?	Database of operational landfills?
Andalusia	✘	✓
Brandenburg	✓	✓
Cyprus	✓	✓

Flanders	✓	✓
Malta	✓	✓
Netherlands	✓	✓

Table 2: visualizing the presence of two major kinds of datasets in each country or region.

3.2. Data about landfills

In contrast to the intensive gathering of information and amount of data the various landfill authorities work with, all figures demanded in this questionnaire are almost incomparable with each other.

The following problems occurred when asking for specific data:

- Some regions have chosen to categorise a landfill in terms of volume, others by mass. A universal conversion factor does not exist since every landfill is a unique mix of materials with different densities thus both groups of data are incomparable.
- There is no general use of the categories used in the questionnaire, resulting in figures grouped into less categories or categories with other characteristics.
- Some regions gave data about the total size of their landfills and some gave numbers about the annual waste storage, again making it impossible to do a comparison.

Furthermore, the Netherlands maintain an extra category of landfills not included in the graphs:

- Five landfills are closed for further depositing of waste but still are operational for one of these three mentioned reasons and therefore are treated as a category on its own:
 - Extraction of landfill gas
 - Financial reasons
 - Waiting on a top covering to seal it off.

Germany makes use of phases rather than categories for determining the type of landfill on their territory:

- Landfills in the deposition phase which can be translated into operational landfills;
- Landfills in the rehabilitation phase which can be interpreted as closed non-sanitary landfills: the waste disposal has ended and the remediation has started;
- Landfills in the aftercare phase which can be interpreted as closed sanitary landfills and the landfills in aftercare treatment or monitoring.

This has some consequences on the number of landfills as mentioned by the State of Brandenburg:

- Landfills that have been remediated go automatically into the aftercare phase, so there is no distinction between these two in Brandenburg and by extent the whole of Germany;

- Landfills that have not yet started remediation are considered to be closed non-sanitary landfills for the sake of the questionnaire;
- Landfills that have started remediation are included in the closed sanitary landfills category, although this isn't quite right from the German point of view.

3.2.1. Operational landfills

Five regions gave their number of operational landfills in the questionnaire. The figure of **Flanders** is retrieved from a 2013 report (OVAM, 2013a).

Number of operational landfills

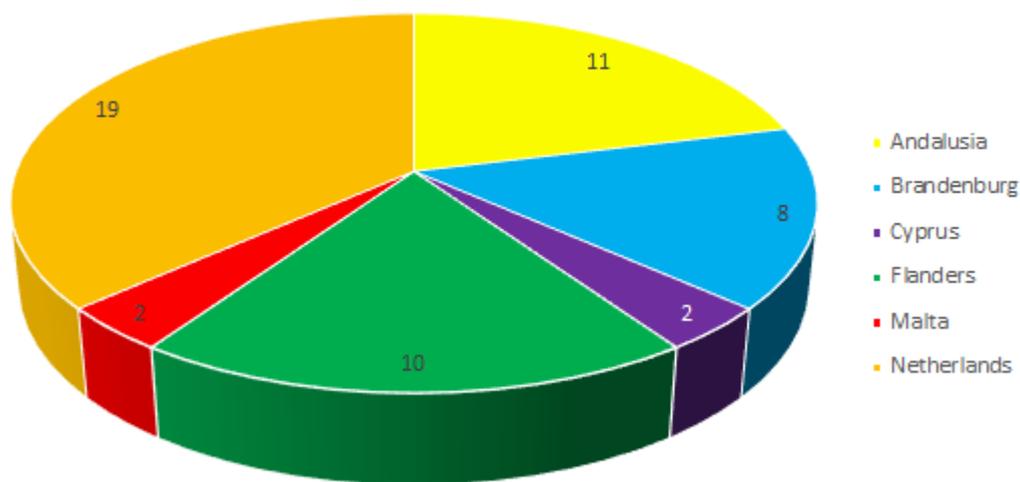


Chart 1: Comparison of the number of active landfills.

Andalusia and **Cyprus** both provided data about the annual deposition of waste.

Brandenburg gave a total volume of their landfills (34 million m³). LfU therefor provided data to add to this chart after the questionnaire was closed.

In the questionnaire was asked for data about municipal solid waste (MSW). Since some of the figures the COCOON partners gave contained also the amount of deposited ash, the resulting chart is not representative as a comparison for the six COCOON partners. This can be seen in the relatively high landfilled deposits e.g. for the Netherlands and Flanders in chart 2. Brandenburg provided data that includes waste from the city of Berlin, because

Berlin has no landfills of its own. **Malta's** figure dates from 2015. Data for **Flanders** and the **Netherlands** are from 2016 (Rijkswaterstaat, 2017).

Deposited mass of waste in landfills (ktonnes)

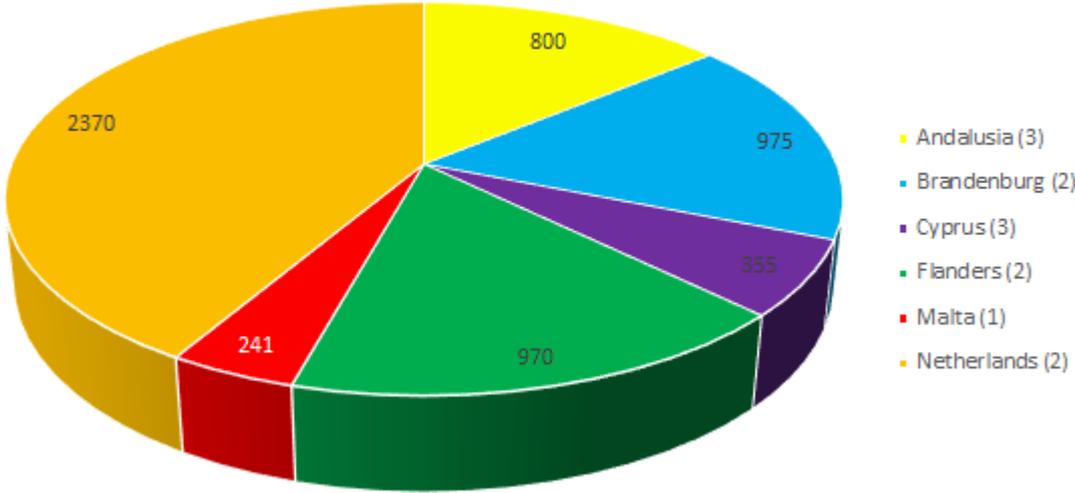


Chart 2: Comparison of the annual deposited waste (in kilotonnes). (1) 2015. (2) 2016. (3) annually.

To make a more realistic estimation of the deposited amount of municipal solid waste of the six regions, COCOON created the table beneath, based on chapter 20 of the European statistics on Waste (2000/532/EG) and population data from Eurostat:

	Population	MSW deposited (kg/inh.)	Total est. MSW deposited (ktonnes)
Andalusia	8.380.000	239	2003
Brandenburg	6.070.000	6	36
Cyprus	855.000	443	379
Flanders	6.516.000	4	26
Malta	440.000	564	248
Nederland	16.901.000	5	85

Table 3: Comparison of the estimated annual deposited municipal solid waste (in kilotonnes) based on EC data.

Deposited MSW per region (ktonnes)

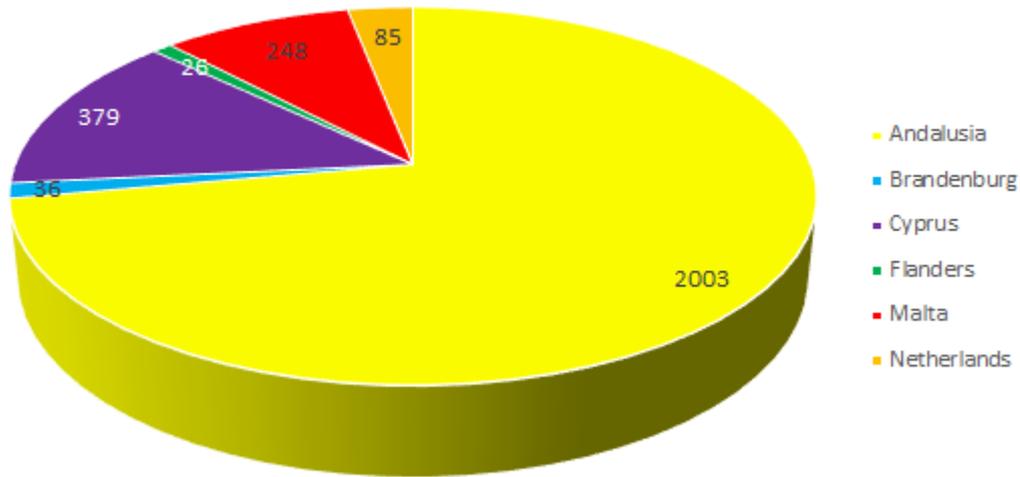


Chart 3: Comparison of the estimated annual deposited municipal solid waste (in kilotonnes) based on EC data.

3.2.2. Sanitary landfills

Andalusia makes a distinction between sanitary and non-sanitary landfills. However, the available public data about landfills, which is limited in Andalusia, shows the information jointly. Therefore it is not possible to show the two categories separately in this report.

Cyprus confirmed they have presently no remediated landfills.

Flanders' own legislation from 1983 (implemented in 1984) is strongly correlated with the later EU directive of 1999. Therefore all landfills prior to 1984 can be considered non-sanitary and all landfills created after 1984 are sanitary landfills.

Malta did not provide data for this type of landfill.

Brandenburg, the **Netherlands** and **Cyprus** make a distinction between their closed sanitary landfills and closed non-sanitary landfills and provided data based on the implementation of the EU directive.

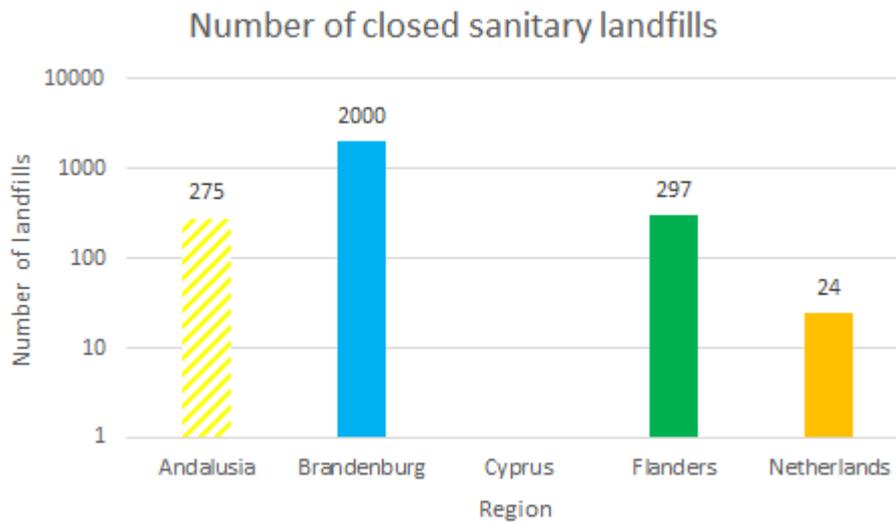


Chart 4: Comparison of the number of closed sanitary landfills.

Only **Andalusia** and **Brandenburg** provided a volume of this type of landfill. For the other regions no data are available. In Andalusia about 2,4 million m³ of waste is preserved in the closed landfills (both sanitary and non-sanitary landfills). For Brandenburg a volume of 45 million m³ is stored in closed sanitary landfills. Some of the largest of these landfills contain the deposited waste of the city of Berlin.

3.2.3. Closed non-sanitary landfills

The graph below (chart 5) shows the amount of closed non-sanitary landfills. Noticeable are the vast number of landfills in the **Netherlands**.

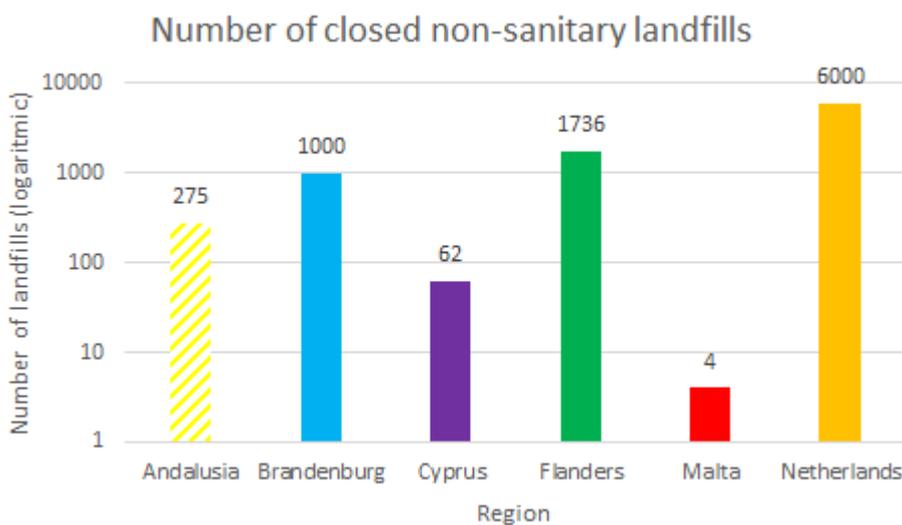


Chart 5: Comparison of the number of closed non-sanitary landfills.

3.2.4. Closed landfills in aftercare treatment or monitoring

Cyprus has the most number of landfills currently taken care of in an aftercare project. The number of closed landfills in aftercare treatment or monitoring is shown in chart 5. In **Flanders** all landfills based on the Flemish Environmental Permit Regulations of 1995 that are closed down go automatically into a monitoring period of 30 years. The current number of these landfills wasn't indicated in the questionnaire.

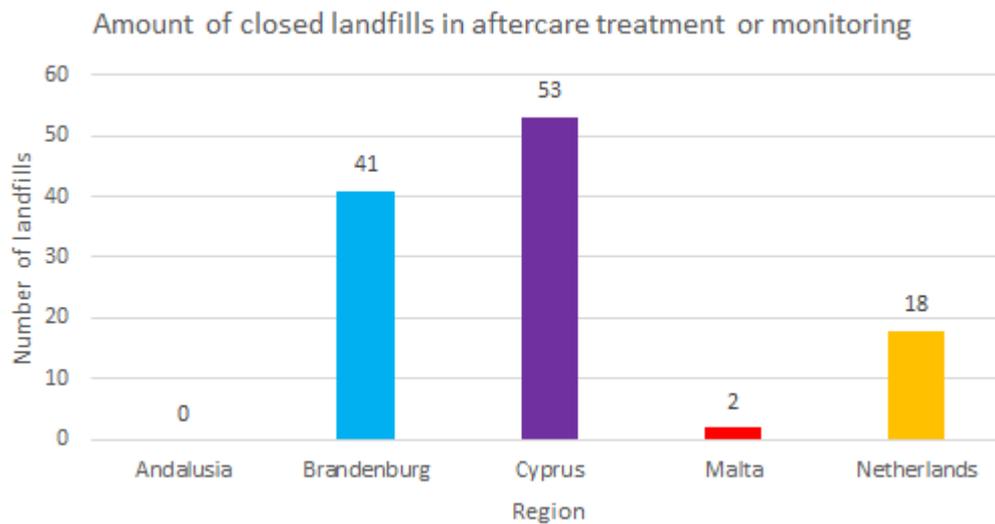


Chart 6: Comparison of the number of closed landfills in aftercare treatment or monitoring.

3.3. Mono- and industrial landfills

Data about this type of landfills was very scarce or absent in the questionnaires except for **Brandenburg**, **Cyprus** and **Flanders**. This can indicate on one hand that some regions don't possess mono- or industrial landfills or on the other hand no(t) (enough) research is done in some regions about the subject. **Brandenburg** has a variety of landfills with only one waste product in it:

Brandenburg's number of mono landfills per category and status

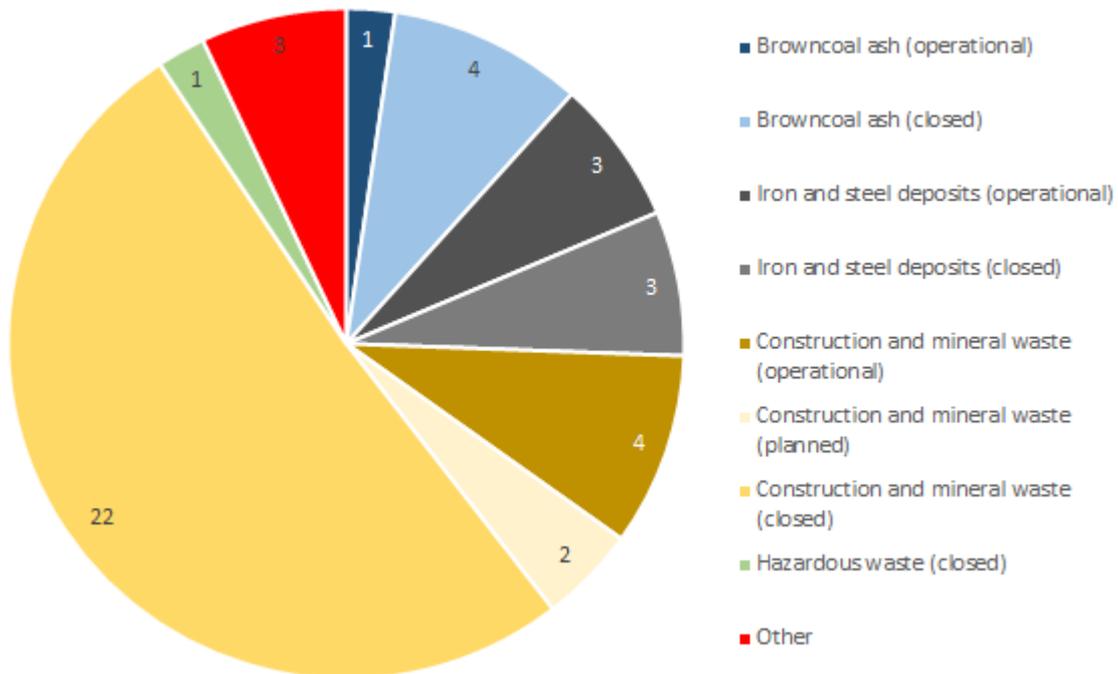


Chart 7: The number of mono landfills in Brandenburg per type of waste.

The volume of these mono landfills and thus the potential economic value of some of them is not really represented by the number of landfills like the chart beneath shows:

Volume (mio m³) of Brandenburg's mono- and industrial landfills

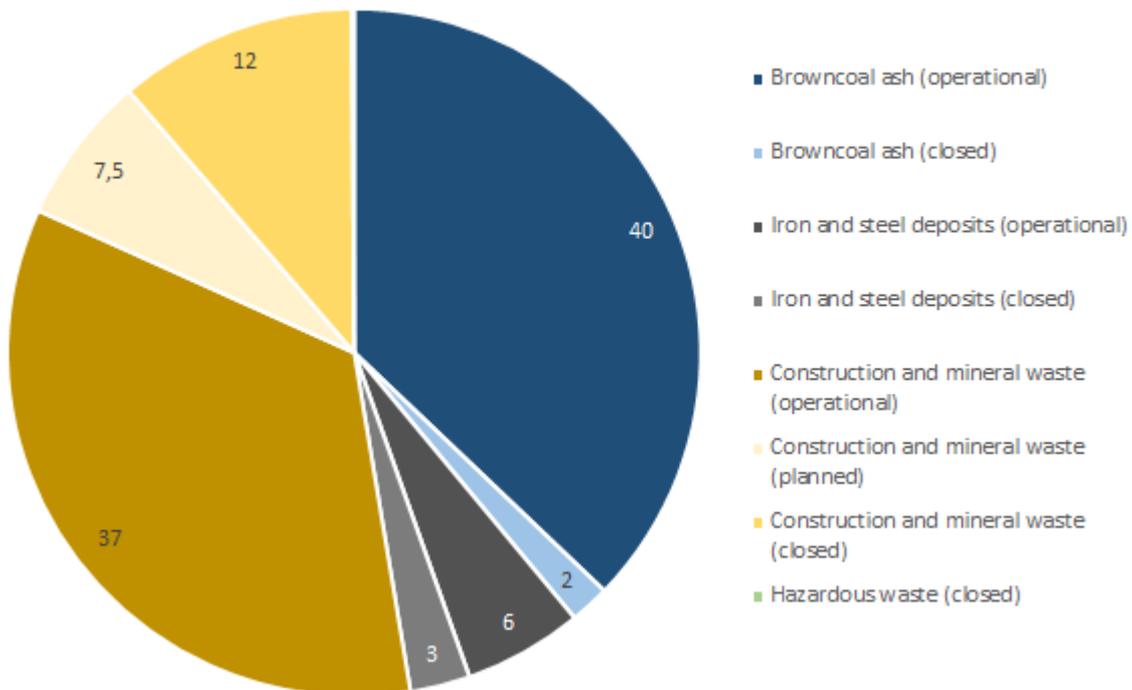
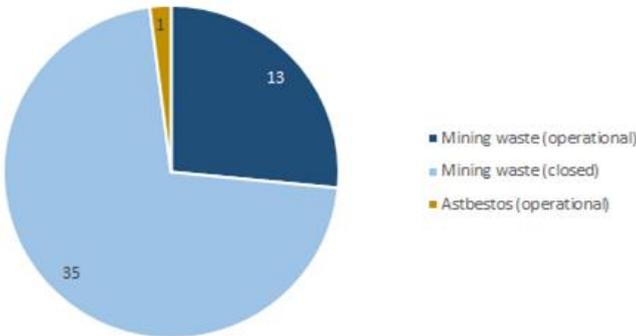


Chart 8: Volume of Brandenburg's mono landfills.

Cyprus has 48 landfills exclusively for mining waste and one landfill for asbestos waste:

Cyprus' number of mono landfills per category and status



Volume (x10³ m³) of Cyprus' mining waste landfills



Chart 9: Two charts about the mono landfills of Cyprus. The left one shows the total number of landfills, the right one the total volume per category.

In the nineties, **Flanders** had 60 operational mono deposits of which 13 were sludge deposits (OVAM, 1990). The idea to create mono deposits already was introduced ten years earlier (EURELCO, 2014).

The most recent figures available date from 2016. Currently there is a total of 30 mono deposits which still includes 13 deposits for sludge.

Monodeposits in Flanders per category

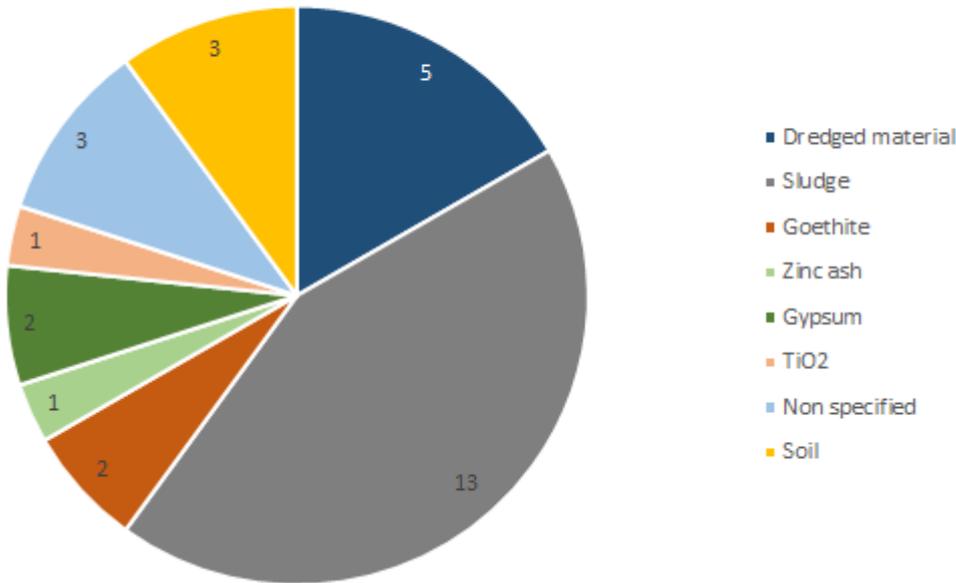


Chart 10: Monodeposits in Flanders per category.

Of these 30 deposits, 13 have exact figures about the total amount of waste deposited on them in 2016 and are displayed in chart 10. These 13 deposits with data shouldn't be confused with the 13 sludge deposits from the previous paragraph.

Deposited waste on mono landfills in Flanders (ktonnes)

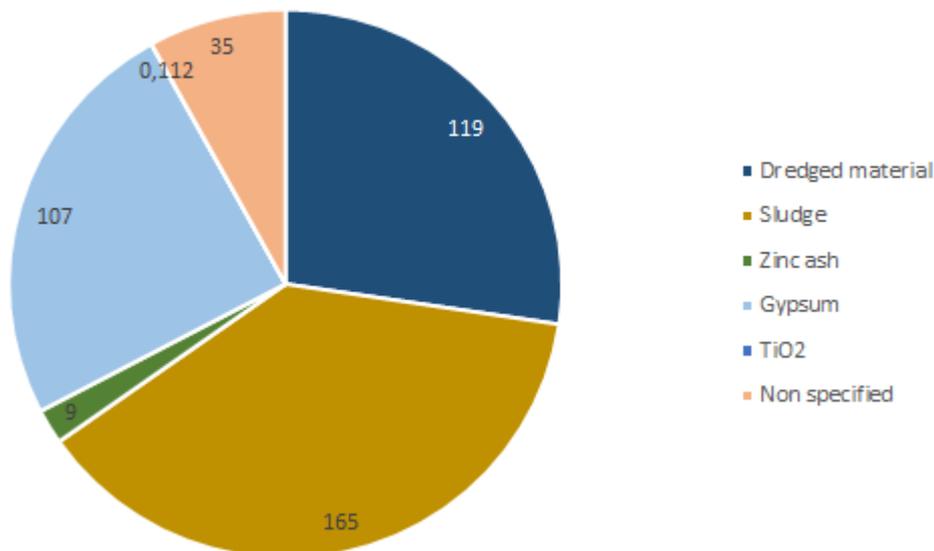


Chart 11: deposited waste on monolandfills in Flanders

It is clear that, comparable with the number of mono landfills, mono deposits of dredged material and sludge are the biggest deposits in Flanders. Also the two deposits of gypsum contribute largely to the total mass.

3.3.1. Detailed information about the content of specific materials in industrial and/or mono LF's

Andalusia indicated they do not possess information on mono deposits.

Landfill owners in **Brandenburg** are obligated to give an annual report. This report includes information about the deposited waste in the reported year based on a six-scaled waste key number. Also owners of landfills for municipal waste have to do this.

Cyprus indicated they do not possess information of this detail on mono deposits.

In some cases in **Flanders** there is a profound knowledge of the content available. These are sites where characterisation operations and sievings are carried out.

Malta indicated they do not possess information of this detail on mono deposits.

Detailed information is currently not available in the **Netherlands**. However, information of this kind will be available in the Environmental permit, in Dutch known as the Wet Milieubeheer vergunning.

3.4. General comparison with other EU-countries

To compare the countries of all six of the COCOON partners with the 28 countries of the European Union the table beneath was created based on figures of the EEA (2014). The countries are sorted on waste production per inhabitant in 2014, going from the highest production per inhabitant to the lowest.

Country	Kg MSW per inhabitant (2004)	Kg MSW per inhabitant (2014)	MSW production in 2014 (10 ⁶ tonnes)	% difference in MSW per inhabitant (2004/2014)
Denmark	620	758	4,3	22%
Germany	587	618	49,9	5%
Cyprus	684	617	0,5	-10%
Luxembourg	679	617	0,3	-9%
Malta	623	600	0,3	-4%
Austria	574	566	4,8	-1%
Netherlands	599	527	8,9	-12%
France	519	509	33,5	-2%
Czechia	455	506	5,3	11%
Italy	540	488	29,7	-10%
United Kingdom	602	482	31,0	-20%
Finland	469	482	2,6	3%
Greece	436	482	5,3	11%
EU-28*	520	477	239,4	-9%
Portugal	445	453	4,7	2%
Bulgaria	599	442	3,2	-26%
Sweden	460	438	4,2	-5%
Belgium	485	436	4,9	-10%
Spain	600	435	20,2	-28%
Lithuania	373	433	1,3	16%
Slovenia	485	432	0,9	-11%
Croatia	304	387	1,6	27%
Hungary	454	385	3,8	-15%
Estonia	445	357	0,5	-20%
Latvia	318	325	0,7	2%
Slovakia	261	321	1,7	23%
Poland	319	272	10,3	-15%
Romania	349	249	5,0	-29%
Ireland	737	-	n/a	n/a

Table 4: figures about the municipal solid waste production of all current EU members in 2004 and 2014.

* The 2014 figures of the EU-28 mean do not include Ireland.

The member states of all COCOON partners except for **Germany** decreased their amount of municipal solid waste output during this decade. Ten of 27 EU countries (including Germany)

increased their output of municipal solid waste. In absolute figures, **Germany** is the biggest producer of MSW with about 50 million tonnes in 2014. 2014 figures for **Ireland** were not available.

Table 5 contains data about the specific amounts of MSW that went to landfills in 2014. To spot the difference more easily, the change in ranking compared to table 3 is represented in the last row.

Country	MSW production (10 ⁶ tonnes)	% to landfills	Kg landfilling per inhabitant	Ranking change
Malta	0,3	80	564	↑4
Cyprus	0,5	76	443	↑1
Greece	5,3	81	394	↑10
Bulgaria	3,2	69	305	↓12
Croatia	1,6	80	301	↑17
Czechia	5,3	56	282	↑3
Latvia	0,7	79	276	↑18
Lithuania	1,3	59	261	↑12
Spain	20,2	55	239	↑10
Portugal	4,7	49	221	↑5
Hungary	3,8	57	219	↑12
Slovakia	1,7	66	207	↑14
Romania	5	72	180	↑15
EU-28*	239,4	32	153	-
Italy	29,7	31	151	↓5
Poland	10,3	53	144	↑11
United Kingdom	31	28	135	↓6
France	33,5	26	132	↓10
Slovenia	0,9	23	100	↑2
Luxembourg	0,3	18	98	↓16
Finland	2,6	17	81	↓9
Estonia	0,5	6	23	↑2
Austria	4,8	4	23	↓17
Denmark	4,3	1	8	↓23
Germany	49,9	1	6	↓23
Netherlands	8,9	1	5	↓19
Belgium	4,9	1	4	↓9
Sweden	4,2	1	4	↓11
Ireland	n/a	38	n/a	n/a

Table 5: Figures about the landfilled municipal solid waste per inhabitant in 2014.

* The figures of EU-28 do not include Ireland.

4. Current landfill management and regulation

4.1. Implementation of EU directive

The EU landfill directive was included in the **Spanish** national law in 2001. However, there are some old landfills that do not fulfil the directive requirement. Spain has been sanctioned for this by European Union Court of Justice in 2016 and 2017.

The EU Directive is fully implemented in **Brandenburg**. However, the requirements of the German Waste deposit law go beyond those of the EU Landfill Directive.

Although the **Cypriote** government has fully harmonised the EU landfill directive into the national legislation. Cyprus has fully implemented the directive in 2001, but was sanctioned in 2016 and 2017 by the EU for having about fifteen old landfills not fulfilling the requirements.

The EU Directive is fully implemented in **Flanders** and **Malta**.

The **Netherlands** applied the directive in the “Raad van 26 april 1999 betreffende het storten van afvalstoffen”. This directive does not apply to non-sanitary landfills, which are those prior to 1996. Some compliances for landfill sites in the Dutch legislation are arguable compared to the EU directive. For example, in the Netherlands the financial responsibility an aftercare is transferred from the operator towards the province. It is obligatory that upon closure of the site an impermeable top cover is applied like the EU imposes.

4.2. Policies implemented per region to reduce landfilling

After a transition period of a couple of years in **Andalusia**, a law became compulsory from May 26, 2017 onwards that dictated one or more waste treatment methods for every LER-waste code (LER meaning Lista Europea de Residuos in Spanish or European List of Waste in English). The majority of non-hazardous waste flows can be recycled, banning direct deposits into landfills (Junta de Andalucía, 2013).

Efforts have been successfully made to reduce the amount of organic wasted in landfills. The most recent figures from June 2016 indicate this fraction is less than 30% of deposited amount in 1995.

There is no regional landfill tax nor one at national level.

Germany created a variety of laws to reduce landfilling which are implemented in states like Brandenburg. Firstly, there is the Circular economy law (German: Kreislaufwirtschaftsgesetz). This law includes the obligation for recycling of usable waste.

Secondly, there is the End-of –life vehicles directive (German: Altfahrzeug-Verordnung) based on European directive 2000/53/EC.

Other laws include the Battery law (German: Batteriegesetz); Electric and electronic device law (German: Elektro- und Elektronikgerätegesetz) and the Packaging directive (German: Verpackungsverordnung).

All these laws and directives include obligations for the trade companies for the correct redemption of these types of waste and enforce them to be recycled and re-used.

In order to reduce landfilling and increase separate collection and recycling rates in **Cyprus**, a series of measures and actions are included in the Waste Management Plan for Municipal Waste 2015-2021 and the Waste Prevention Programme 2015-2021. In general, the measures include legislative, economic, technical infrastructure and educational actions and initiatives.

Specifically, the following measures are in an on-going process:

- i. Legislative:
 - Regulations which will put in place distinct responsibilities for local authorities for their involvement in the rational municipal waste management: Under preparation.
 - The introduction of a landfill tax: Under consideration.
- ii. Co-funded projects to promote separate collection: Three projects are ongoing in co-operation with local authorities to support them with the necessary and appropriate infrastructure to operate separate collection schemes (e.g. in coastal areas, pay as you throw schemes).
- iii. A wide educational and awareness campaign is in place and ongoing involving all the relevant stakeholders (public, local authorities, producers, recyclers etc.)
- iv. increase targets on preparation for reuse/ recycling (ex ante conditionality)

Cyprus in order to reduce landfilling currently through regulations implement the Producer Responsibility Principle for WEEE, packaging, batteries, tyres, “Non-Packaging Paper” and utilizing all existing waste management infrastructure (Koshi, Pentakomo and Paphos MBT Plants) , green points and waste management facilities. .

Also the Municipal Waste Management plan, comprising the period of 2015 till 2021 foresees the introduction of a landfill tax and the ban of specific waste streams into landfills.

In 1998 **Flanders** banned the landfilling of combustible and organic waste. Eight years earlier there was an introduction of a landfill tax and tax on the incineration of waste, which increases year after year. Currently, the tax for incineration of municipal waste is an average of 101 euro/tonne, but in reality it can be as low as €55/tonne and as high as €130/tonne. The same margin can be found for industrial waste incineration. This is because there’s a distinction about what sort of waste will be burned, since each type of waste has its impact on the process and the environment. The types used in Flanders are low-caloric waste, high-caloric waste, solid no-risk medical waste, sludge and recycling residue’s.

The tariff for the deposition of waste on landfills is different per landfill category. Also, the tariff is the sum of a standard environment fee (Dutch: milieuheffing, currently €70,88/tonne) and a variable tax per tonne.

Flanders has three categories of landfills. For category one (hazardous waste) the tariff is based on the composition of the waste, determined via sampling. In 2016 the average price per tonne was €125.

For category 2 landfills (non-hazardous, inorganic waste) there's a distinction for municipal waste and non-combustible waste since 2015. Depositing municipal waste cost €129/tonne and non-combustible waste €126/tonne.

In the third category (inert materials but also asbestocement), the total tax for depositing on a category 3 landfills is €76/tonne. However, in this price, the standard fee only is €19,50/tonne making it the second most expensive landfill to deposit on in terms of variable tax. This is caused by the high price for asbestocement.

Meanwhile, there is the ongoing differentiated waste collection for household waste and comparable industrial waste. The Flemish government worked out a custom target approach: each individual municipality and city has a different goal of reducing its waste production by 2022. This target is based on the number of inhabitants and the economic activity (OVAM, 2017).

Malta is governed by various laws pertaining to waste and its management. These are the following Subsidiary Legislations (S.L.) implemented in the national laws of Malta:

- S.L. 549.63 the 'Waste Regulations', transposes the European Waste Framework Directive 2008/98/EC (adapted and amended accordingly). (Justice Services, 2011). This legislation provides a framework for the waste regime and includes, amongst others, measures relating to waste classification, extended producer responsibility, and separate collection of at least paper, metal, plastic and glass through comingled collection. This legislation promotes waste management in line with the waste hierarchy, and therefore a reduction in waste diverted to landfill.
- S.L. 549.29 the 'Waste Management (Landfill) Regulations', transposes the European Landfill Directive 1999/33/EC and includes the obligation to set up a national strategy for the reduction of biodegradable waste going to landfill. The strategy incorporates measures, such as recycling, composting and biogas production to achieve landfilling reduction targets (Justice Services, 2002).
- S.L. 549.29, also includes penalties for persons who commit an offense against landfill regulations. The penalties can be a fine ranging from €1.164,69 to €4.658,75 or two years of imprisonment.
- S.L. 549.07 'Deposit of Wastes and Rubble (Fees) Regulations' lists waste deposit fees for any person who deposits non-hazardous waste into a public waste deposit site (Justice Services, 1997).

Other waste related EU legislations have also been transposed into national legislation.

Furthermore, Malta has submitted a Waste Management Plan for the Maltese Islands 2014-2020 as well as a policy document named SPED which acknowledges the reality of landfills, waste and its management.

Additionally, a number of instruments are listed that also work towards reducing landfilling. These include:

- An increase in gate fee for landfilling and more diversion of waste to Mechanical Biological treatment over the past years.
- Separate collection of dry recyclables: kerbside collection and bring-in sites
- Separate kerbside collection of organic waste
- Civic Amenity sites and their reform
- Waste Transfer Station in Gozo
- Malta North facility
- National educational and awareness raising campaign on waste management

Considering the 1970s with over 1600 **Dutch** operational landfills as a benchmark, currently only 20 landfills are still operational. The whole evolution indicates a shift in treatment methods, from depositing to recycling and re-use.

An overview of the most relevant Dutch legislations and guidelines in respect to landfill and landfill management include:

- 1980s: Directive Controlled Dumping (Dutch: Richtlijn Gecontroleerd Storten)
- 1985: Second Directive Controlled Dumping (Dutch: Tweede Richtlijn Gecontroleerd Storten)
- 1990s: Introduction of the Environmental Management Act (Dutch: Wet Milieubeheer) and the Soil Protection Act (Dutch: Wet Bodembescherming)
- 1993: Landfill Directive Soil Protection (Dutch: Stortbesluit Bodembescherming) implemented
- 1996: Closure of all (non-sanitary) landfills
- 1996/1997: Directive for Landfills and Waste material Bans (Dutch: Besluit stortplaatsen en stortverboden afvalstoffen) both introduced and implemented
- 2003: Ministry for Housing, Spatial Planning and the Environment draws up a National Waste Management Plan (Dutch: Landelijk Afvalbeheer Plan or LAP) every six years. The 3rd LAP was implemented on December 28th 2017.
- 2010: implementation of compulsory separate collection of plastics.

Furthermore one of the most important factors for the realisation of a successful waste management system was the Waste Council (Dutch: Afval Overleg Orgaan), which was established prior to 1993. All members of the waste management system (national, local, decentralised responsible authorities and waste management companies) were part of this committee. All possible legislative measures were first discussed and approved in this committee before being discussed in the Dutch parliament. Furthermore the gradual introduction of specific bans on landfilling of specific materials, was successful in reducing the amount of waste ending up in landfills. This ban prohibited the landfilling of materials if recycling was possible.

Financial instruments include taxes on landfilling and differentiated rate schemes (Dutch, abbreviated: diftar) on the collection of household waste.

4.2.1. Summary

Table 6 beneath shows some general policies that were nationally implemented. The specific translation of these general categories were discussed in the paragraphs above. Mind the fact only those policies the COCOON partners indicated in the questionnaire are in this table. In reality it is possible some countries already have national policies for one or more categories currently marked with ✖. Future implementations are indicated with ⌚.

	Andalusia	Brandenburg	Malta	Flanders	Cyprus	Netherlands
Separate collecting/changed treatment methods	✓	✓	✓	✓	✓	✓
Reducing waste production/prevention	✓	✓	✓	✓	✓	✓
Ban wastes in landfills	✓	✖	✖	✓	⌚	✓
Taxes/fines	✖	✖	✓	✓	⌚	✓

Table 6: Overview which countries have implemented policies containing the categories mentioned. ✓ means policies are implemented, ✖ means no policies exist. Hourglasses indicate future implementations.

4.3. Investigations on occurrence and management of contaminated areas

In **Andalusia** there are no such investigations found in a short term.

Contaminated areas in **Brandenburg** are collected in a database called ALKAT (German: Altlastenkataster) or Brownfield register in English. It contributes to a risk assessment, based on several criteria like the reason of the contamination (military, industrial,...), site description and the pollution found in soil and groundwater. The risk assessment is always mentioned in the official documents (permits) belonging to the site.

Cyprus did not provide an answer on this question.

Flanders uses two parallel programmes for investigating contaminated areas: the ELFM²-programme for landfills and the brownfield covenants (Dutch: brownfieldconvenanten) for old industrial areas.

Malta is working on a list of identified contaminated areas, as well as the assessment of the likelihood, extent and significance of contamination. The requirement for remediation may

depend on the project being proposed for the respective site(s). Soil screening values and groundwater threshold values established are different in cases of “industrial” and “residential” after uses. In different cases, the Authority may require specific techniques ranging from site sealing to full remediation activities.

In the **Netherlands** the National investigation (Dutch: Landsdekkend Beeld Bodemverontreiniging) listed a total of 425.000 potentially contaminated sites in 2005 (Rijksoverheid, 2016). Prior to the implementation of the EPA, the Dutch Soil Covenant 2016-2020 between the Ministry, provinces, water boards and municipalities had as goal to remediate or control all sites with unacceptable risks for humans, ecology or migration of contaminants into groundwater. This is known in Dutch as “Spoedlocaties”. There are a number of former landfill sites on this list. All other contaminated sites will be remediated with the implementation of the EPA in combination with spatial developments. The following years the number of these site dropped strongly due to remediation practices.

4.4. Development of national/regional action plans or funding schemes for environmental and health risks from landfills not eligible to the EU landfill directive

Closed landfills, discussed earlier, are landfills that are outside the scope of the EU Directive. In addition to the information on the numbers of closed landfills, the following information is important.

Andalusia is in a prior stage of generating a database or complete survey with full information about old landfills.

Brandenburg has funding schemes as parts of the operational programme. Brandenburg used about 70 million euros from the ERDF in the period from 2000 to 2013 for the remediation of landfills which was operational after 1992. A lot of money was reserved from the Brandenburg budget too and used for the remediation of the little landfills which were closed up until 1992. Financial resources from social funds were also used to bring people in employment in environmental jobs because Brandenburg had high unemployment rates after the Unification.

Financial support from both the Federal government and the Brandenburg State was granted as a form of liability exemption if an investor wanted to buy a company and found an old landfill on the area of the company that needed to be remediated.

Cyprus does not have an action plan at the moment. There are some actions foreseen in the Municipal Waste Management Plan of 2015-2021 (cfr. Cyprus under ‘Policies implemented nationally to reduce landfilling’). According to the study developed in 2005 the rehabilitation of non-compliance landfills will take place through the cohesion funds (ERD Funds). As mentioned in the chapter about the implementation of the EU directive, 46% has already been funded.

National plans of action in **Flanders** consist of a 2015 memorandum of the Flemish government about sustainable management of landfills (Vlaamse regering, 2015).

Already known/discovered (old) **Maltese** dumpsites have been closed down, and the majority are in the process of being rehabilitated. The rehabilitation of some of these dumpsites such as Maghtab, Qortin and Marsascala is funded under the Operational Programme – Investing in Competitiveness for Better Quality of Life.

The first stage of this project, namely the installation of aerial emissions control systems, was completed with the help of 2004-2006 ERD Funding. The next stages of the rehabilitation and restoration of the landfills project were further funded through the 2007-2013 Cohesion Fund.

In the **Netherlands**, DUIV authorised the NAVOS programme. DUIV is a consultation between the Directorate-General Environment (Dutch: Directoraat Generaal Milieu), Union of Water boards (Dutch: Unie van Waterschappen), Interprovincial Hearing (Dutch: Inter Provinciaal Overleg) and the Association of Dutch Municipalities (Dutch: Vereniging Nederlandse Gemeenten). In this programme direct risks (human, leachate and ecological) of non-remediated landfills were measured. Approximately 4.000 landfills were studied during 1995-2004, the results are described in various NAVOS reports (Interprovinciale werkgroep nazorg, s.a.).

4.5. Policy discussions about EU directive/new circular economy and implications for the national landfill management

Andalusia has currently no policy discussions about the EU directive nor on circular economy.

Brandenburg is obligated to follow the federal Circular economy law (German: Kreislaufwirtschaftsgesetz) (cfr. Policies implemented nationally to reduce landfilling).

Cyprus and **Flanders** currently have no policy discussions about the EU directive nor on circular economy.

The Waste Management Plan for the **Maltese** Islands 2014-2020 incorporates a circular economy outlook by regarding waste as a resource from which, not only recycled materials are derived, thus lengthening the life cycle of virgin resources, and generating energy in the process, but also having a greener economy and the creation of more green jobs.

The focus of the Plan itself is on diverting MSW and biowaste from landfill by moving waste management in Malta up the waste hierarchy through increased prevention, re-use, recycling and recovery. The Plan recognises the need to meet a series of targets not least to reduce the generation of waste and to increase source separation so as to promote recycling and reduce landfilling. Upgrading the capacity of existing facilities and investing in new infrastructure is required to divert MSW from landfills, particularly when considering landfill

void space limitations. An extensive consultation process was undertaken during the compilation of the Plan with various stakeholders from all possible sectors in order to get a holistic approach on waste management. However it is not yet a global plan on circular economy.

5. Landfill management and funding

5.1. Funding for supporting implementation of landfill management

All countries and regions were asked if and to which extent funding is available for project involving landfill management. The funding was divided into private, regional, national en European funding. Table 7 (below) represents these types of funding per country/region:

	Netherlands	Cyprus	Brandenburg	Flanders	Malta	Andalusia
Private funding?	✓	✗	✗	✗	✗	✗
Regional funding?	✓	✗	✓	✗	✗	✓
National funding?	✗	✓	✗	✗	✓	✓
European funding?	✓	✓	✓	✓	✓	✓

Table 7: Overview of the different types of funding as asked in the questionnaire and the subsequent application of them in each country. ✓ means funding is available, ✗ means funding isn't available.

The European Regional Development Fund supported the Operational Programme 2014-2020 in **Andalusia**. There's no other regional funding other than the ERDF Operational programme of 2014-2020. To support landfill management projects nationally, **Spain** developed the CLIMA programme only very recently (2017). The funds are allocated to projects that improve compulsory obligations about greenhouse emissions. In relation to landfills, degasification before landfill closure is eligible to receive these funds. There is no private funding available in the region.

Brandenburg has no private investors for landfill management. On a regional level there was funding via the ERD Fund between 2000 and 2013. On a national level again there is no funding available.

The government of **Cyprus** pays for 15% of the costs. Europe subsidises 85% of the projects via the ERDF. There is no private funding nor regional funding.

Flanders only has European funding for the implementation of landfill management.

Malta has worked with funds coming from the ERDF (European Regional Development Fund).

Currently, the **Netherlands** are the only country with financing from private investors in landfill management projects. Green Deal Sustainable LfM (Dutch: Green Deal introductie Duurzaam Stortbeheer (iDS)) is a good example where private funding from the landfill operators/owners has resulted in the implementation of landfill management trials that focus on developing new techniques for future landfill management. This is a ten year

scientific research programme into sustainable landfill management coordinated by TU Delft (Introductie Duurzaam Stortbeheer, 2017).

The funding is predominately private and the deal between the Ministry of Environment & Water Management, provinces and landfill operators, the legislative conditions for the trials is arranged.

Also regional financings are well developed in the Netherlands. The regional initiatives include funding for reuse/redevelopment of landfill sites. In this way, many former landfills have been redeveloped as part of landfill management (provincie Overijssel, 2011).

5.2. Need and availability of governmental actions on landfill management

The majority of the regions that answered the questionnaire don't have governmental actions to attract general financing. A majority thinks there is a need of this kind of actions. Current funding actions occur in Malta and the Netherlands.

Andalusia has no governmental actions at the moment. The participants of the questionnaire indicated they couldn't find information about official statements that claim the need of governmental actions, but it would be convenient to increase funds allocated to landfill management in order to not only properly rehabilitate closed landfills and old landfills, but also to promote best practices in landfill management

Brandenburg has no governmental actions to attract funding and there is no need for it.

Cyprus has no governmental actions at the moment. There is also no need for the government to attract funding for landfill management projects since the European Union subsidises 85% of the cost of a project in the country.

Flanders supports the need of governmental actions on landfill management, since they are not available at the moment.

Malta uses the Operational Programme 1 which fosters a competitive and sustainable economy to meet the country's challenges; and the Waste Management Plan for the Maltese Islands 2014-2020 which highlights the importance of upgrading existing landfill capacity and investing in further new infrastructure. The latter also includes the national Waste Prevention Programme which lists the priority areas and actions to move towards sustainable waste management.

At the moment, there are already some governmental actions in the **Netherlands**. One of which is the Initiative Sustainable Landfill Management (Introductie Duurzaam Stortbeheer, 2017) is the most important development on landfill management policies for remediated landfills in the Netherlands. The Crisis and Recovery law (Dutch: Crisis en Herstelwet)

facilitated the implementation of a new landfill aftercare approach endorsed by the landfill operators. This approach focuses on a sustainable method for closure of landfill sites.

In terms of additional governmental actions, the general opinion among the COCOON partners is to increase co-financing of projects, more initiatives on policy changes or obligations, promoting best practices and develop new aftercare techniques.

6. Landfill mining activities and policy issues

6.1. Landfill mining projects/programmes/networks on a national level

National networks are still non-existent.

The authorities of **Brandenburg, Cyprus, Malta** and **Flanders** indicated that they don't have any projects, programmes or networks on a national level at the moment of entering this survey.

Even the Netherlands, with their extended number of programmes indicate they only have the current Interreg projects COCOON and RAWFILL as a network to exchange information.

Spain created a municipal solid waste landfill not far from Barcelona in 2015 to promote landfill mining projects in the future, but the technical information available for public use is brief.

6.2. Pilot or full-scale projects on feasibility and performance of landfill mining

There are some projects on this subject, and each country is investigating another method:

Cyprus mentioned they don't have such projects but didn't specify any reasons.

Flanders investigates the method of diverse sieving. This method is tested during the ELM-programme.

Germany did a national research project funded by the Federal ministry of Education and Research and investigated the economic evaluation of LFM. The results are used in speeches on landfill workshops.

Malta mentioned they don't have such projects but didn't specify any reasons.

In the **Netherlands**, a private company has made an inventory of various pilots with regard to sustainable landfill management and mining of landfills.

In Clariana de Cardener in **Spain** the landfill was especially designed to be able to easily recover materials in the future, especially the recovery of organic residues.

6.3. Occurrence of Landfill mining into national policies

Andalusia indicated there are no national policies on landfill mining.

Brandenburg indicated there are no national policies on landfill mining and suspected other States in Germany don't have such policies either.

Rehabilitation of landfills in **Cyprus** is a national matter but the aftercare monitoring is undertaken by the district waste management councils.

Following a concept note, the **Flemish** government developed a short-term and long-term schedule for a systematic approach of the problem of old landfills. The first step is the assessment of landfills from the perspective of the individual mining potential.

The compilation of the list of contaminated areas in **Malta** is an ongoing process, as is the assessment of the likelihood, extent and significance of contamination. The requirement for remediation may depend on the projected after-use of the site. Soil screening values and groundwater threshold values established are different in cases of "industrial" and "residential" after uses. In different cases, the Authority may require specific techniques ranging from site sealing to full remediation activities.

The **Netherlands** indicated there are no national policies on landfill mining.

6.4. Policy discussions or initiatives on landfill mining

Rehabilitated landfills in **Cyprus** will be managed by the districts waste management councils. These currently are in a discussion phase, nothing yet has been decided.

Flanders indicated there are no national policy discussions on landfill mining.

In **German** expert circles there was a discussion about the possibilities and economic effects of landfill mining. The results being that the economic effects were not good enough that investigators would give a recommendation to accelerate landfill mining projects. This doesn't mean that single case landfill mining can't get positive reviews.

Malta indicated there are no national policy discussions on landfill mining.

The **Netherlands** indicated there are no national policy discussions on landfill mining.

During the XV Ategrus Conference on sanitary landfills in **Spain** in October 2015 a debate about landfill mining was organised which addressed the analysis of some preliminary experiences about landfill mining in Spain and Europe. Subjects that were discussed are to offer a prospect of landfill mining in Spain, providing some estimates of the number of potential landfills in Spain, their main features, their estimated waste composition, the prospects for recovery of materials and their relationship with Spanish import / export flows (Puig Ventosa, 2015).

6.5. Potential benefits and opportunities when implementing landfill mining

The following benefits and opportunities are not listed in a particular order of importance.

Benefits

- Mitigating climate change (**Andalusia**)
- Creating new jobs (**Andalusia**)
- Using the revenue of mining to seal the surface and do aftercare (**Brandenburg**)
- Covering a landfill site with PV-panel foil for solar energy production (**Netherlands**).

Opportunities

- Producing raw materials for energy and production (**Brandenburg, Andalusia**)
- Creating new areas for new landfills (**Brandenburg**)
- Developing the surface area whether or not in regions with high population density (**Flanders**)
- Increasing knowledge of landfill mining techniques (**Malta**)
- Combining mining with remediation or redevelopment (**Netherlands**)

The authorities of **Cyprus** haven't yet debated on possible benefits or opportunities for their landfills.

6.6. Priority risks, uncertainties and concerns when implementing landfill mining

The following risks, uncertainties and concerns are not listed in a particular order of importance.

Risks

- Finding unknown hazardous waste (**Brandenburg**)
- The minimal information about the content of a landfill (cfr. **Brandenburg**) making it impossible to estimate the total cost of the project (**Flanders**)

Concerns/uncertainties

- Landfill mining not being a priority method of waste management (**Andalusia**)
- Greenhouse gas emissions (**Brandenburg**)
- Operational safety (**Brandenburg**)
- Legal procedures (**Brandenburg**)
- The technology of ELM is not completely ready and available yet, so economic profitability can't be accurately estimated yet (**Flanders**)
- Price evolution of energy, space and raw materials on the international markets (**Flanders**)
- The current lack of a viable business case from landfill mining (**Netherlands**)

The authorities of **Cyprus** haven't yet debated on possible concerns or uncertainties for their landfills.

6.7. Current national policies or regulations potentially facilitating landfill mining operation

Landfill mining facilitating policies in **Malta** include the Planning Authority, Planning Laws and Environmental Impact Assessments.

All other countries and regions do not have data about such laws in their country.

6.8. Support for developing new policy instruments facilitating landfill mining

Currently there's only a mild support in developing new policy instruments in **Brandenburg** because some expert studies concluded that the economic effects are not good enough that the investigators would give a recommendation to the authorities to push LFM-projects.

The **Netherlands** is working on a new environmental law: the Environment and Planning Act (Rijksoverheid, s.a.), which will be implemented in 2021. In this new law, the municipalities become the responsible authority for the physical environment, including soil. This means that provinces will no longer be the responsible authority for former landfills (NAVOS). In preparation for this change the policies on landfill mining of different provinces are being harmonised.

There is a regional difference in the development of new policy instruments in **Spain**. Most authorities are focused on the improvement of selective waste collection and recycling, whereas the Catalanian administration has policy instruments for regulating landfill mining.

7. General conclusion

This questionnaire collected EU-wide information about landfills, landfill management and landfill mining activities and policy issues. The following conclusions can be made based on the answers the six COCOON-partner regions gave:

1. The regulations of the EU Landfill directive are implemented by the competent authorities in each member state. However, different timeframes of implementation were noted.
2. The information about closed landfills is not on the same level as for the operational landfills. There is no consequent monitoring system for these closed landfills. Each partner indicated that specific regulations were in place but not in every case related to the landfill or waste management laws (e.g. soil remediation act, brownfield act).
3. It is important to note that landfills closed before the implementation of the EU Landfill Directive do not fall within the scope of the Directive. On closed landfills, the Directive only has an advisory function.
4. The current knowledge about the closed landfills is unsatisfying. The experiences show that the introduction of a modern waste management is not possible if the further use of officially closed landfills isn't consistently prevented and the closed landfills aren't remediated. The EU should promote measures to collect data on closed landfills and their remediation throughout its member states.
5. Legislation will be implemented nationally or regionally in the first place when it concerns a mandatory action from a higher governmental body or when incidental events demand a jurisdictional solution. In general, spontaneous initiatives are therefore still limited but could improve when the right stimuli are in place.
6. If legislation does exist, the focus very often includes only managing and not mining. A change of the mindset is needed to achieve a circular economy by 2030, in which urban mining plays a significant role. On the other hand, the potential of landfill mining is mostly neglected.
7. In the past, successful efforts were taken to carry out research and collect data about historical and current landfills, but there is a major problem in the compatibility of these databases since each country has its own approach at the moment. This creates unnecessary delays and potential mistakes. Also the accessibility of the data is suboptimal. A performing management of landfills requires efficient and easy accessible databases and an exchange and collection of data on a European level is needed. Defining those metadata is an important step.
8. Landfill characteristics are not limited to the waste content but also included the broader environment. New policies should embrace concepts like biodiversity and flooding in combination with landfill mining as opportunities and not as threats.
9. The responsibility for the approval of landfills among all COCOON regions is located at the highest or second highest administrative layer. This is to be recommended as a standard because the importance of a landfill itself and the environment around it transcends local interests and needs more expertise than a local governance can deliver.

8. List of relevant authorities

Native name	English translation	Region
Consejería de Empleo, Empresa y Comercio	Office of Employment, Business and Commerce	Andalusia
Consejería de Medio Ambiente y Ordenación	Office of Environment and Planning	Andalusia
Saneamientos de Cordoba (SADECO)	Sanitation Agency of Cordoba	Andalusia
Landesamt für Umwelt (LfU)	State office of environment of the state of Brandenburg	Brandenburg
	Department of Environment	Cyprus
	Department of Geological Survey	Cyprus
	Ministry of Agriculture, Rural Development and Environment	Cyprus
Department Omgeving	Department of Environment	Flanders
Openbare Vlaamse Afvalstoffenmaatschappij (OVAM)	Public Waste Agency of Flanders	Flanders
Vlaams minister van Omgeving, Natuur en Landbouw	Flemish minister of Environment, Nature and Agriculture	Flanders
Vlaamse Milieu Maatschappij (VMM)	Flemish Environmental Agency	Flanders
Bundesministeriums für Wirtschaft und Energie	Ministry of Economic Affairs and Energy	Germany
Directoraat Generaal Milieu	Directorate-General Environment	Netherlands
Ministerie van Economische Zaken en Klimaat	Ministry of Economic Affairs	Netherlands
Ministerie van Infrastructuur en Waterstaat	Ministry of Infrastructure and Water management	Netherlands
Rijkswaterstaat		Netherlands
	Environment and Resources Authority	Malta
	Ministry for Environment, Sustainable Development and Climate Change	Malta

Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente	Ministry of Agriculture and Fisheries, Food and Environment	Spain
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9. List of relevant legislations

Native name	Date (last version)	English translation	Region
	2011	Cyprus Waste Law	Cyprus
	2015	National Municipal Waste Management Plan	Cyprus
Vlaams Reglement betreffende de milieuvergunning	1995 (2015)	Flemish Environmental Permit Regulations	Flanders
Milieuheffing	2006 (2018)	Landfill tax	Flanders
Oppervlaktedelfstoffendecreet	2008 (2014)	Materials Decree	Flanders
Materialendecreet	2011	Decree on surface mineral resources	Flanders
Kreislaufwirtschaftsgesetz	1994 (2012)	Circular Economy Law	Germany
Altfahrzeug-Verordnung	1997 (2016)	End-of-Life Vehicles Directive	Germany
Verpackungsverordnung	1998 (2017)	Packaging Directive	Germany
Elektro- und Elektronikgerätegesetz	2005 (2017)	Electric and electronic device Law	Germany
Batteriegesetz	2009 (2017)	Battery Law	Germany
Deponieverordnung	2009 (2017)	Waste deposit Law	Germany
Richtlijn Gecontroleerd Storten	1980	Directive Controlled Dumping	Netherlands
Tweede Richtlijn Gecontroleerd Storten	1985	Second Directive Controlled Dumping	Netherlands
Wet Bodembescherming	1986 (2017)	Soil Protection Act	Netherlands
Wet Milieubeheer	1993 (2017)	Environmental Protection Act	Netherlands
Stortbesluit Bodembescherming	1993 (2016)	Landfill Directive Soil Protection	Netherlands
Besluit stortplaatsen en stortverboden afvalstoffen	1997 (2018)	Directive for Landfills and Waste material bans	Netherlands
Mijnbouwwet	2002 (2017)	Mining Act	Netherlands
Landelijk Afvalbeheer Plan (LAP)	2003 (2009)	National Waste Management Plan	Netherlands
Transitieagenda Nederland Circulair 2050	2016	Transition agenda Netherlands Circular 2050	Netherlands

Omgevingswet	2021	Environmental and Planning Act (EPA)	Netherlands
	1997	Deposit of Wastes and Rubble Regulations	Malta
	2002	Waste Management and Landfill Regulations	Malta
	2011	Waste Regulations	Malta

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Appendix 1: complete questionnaire of Andalusia

Governance and organisational aspects

1. Responsible authority for waste management policy

Level (national, regional, local): national

Name: Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente.

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Level (national, regional, local): regional

Name: Consejería de Medio Ambiente y Ordenación del Territorio de la Junta de Andalucía

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

2. Responsible authority for permitting of operational landfills

Level (national, regional, local): regional

Name: Delegación Territorial de Medio Ambiente y Ordenación del Territorio o Consejería de Medio ambiente

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

3. Responsible authority for control of operational landfills

Level (national, regional, local): regional

Name: Delegación Territorial de Medio Ambiente y Ordenación del Territorio o Consejería de Medio ambiente

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

4. Responsible authority for monitoring of closed landfills

Level (national, regional, local): regional

Name: Consejería de Medio Ambiente y Ordenación del Territorio

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

5. Responsible authority for groundwater remediation (If authority for “soil” is different from “groundwater”; please indicate both):

Level (national, regional, local): regional

Name: Consejería de Medio Ambiente y Ordenación del Territorio

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

6. Responsible authority for soil remediation:

Level (national, regional, local): regional

Name: Consejería de Medio Ambiente y Ordenación del Territorio

Website: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/>

Under which governmental ministry is the authority situated:

Junta de Andalucía

7. Responsible authority for mineral and natural resource supply

Level (national, regional, local): Regional

Name: Consejería de Empleo, Empresa y Comercio (Dirección General de Industria, Energía y Minas)

Website:

<http://www.juntadeandalucia.es/organismos/empleoempresaycomercio/areas/industria.html>

Under which governmental ministry is the authority situated:

Junta de Andalucía

8. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management ?

Yes:

No: X

If Yes, please describe short level and status of this collaboration

Available landfill information and data

9. Are there any national landfill surveys and/or landfill databases on both operational and “old” landfills available in your country?

At national level

Yes: There is an annual report (updated to 2014) in which operational municipal solid waste landfills are listed, located and give very short information about tons of waste treated and if biogas is caught for electricity production

http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/publicaciones/memoriaanualdegeneracionygestionderesiduosresiduosdec ompetenc2_tcm7-447278.pdf

There is also a database which provide information about operational landfills in relation with emissions produced. However, it is not possible to distinguish among different types of landfills in relation to kind of waste (municipal, industrial, non-hazardous...) due to the purpose of database is only to inform about emissions

<http://www.prtr-es.es/Informes/InventarioInstalacionesIPPC.aspx>

At regional level

There is information about all operational landfills in Andalusia, which are 98 non-hazardous landfills. However, there is not a proper database about old landfills.

10. If applicable, please specify the following data on municipal solid waste (MSW) landfills

At national level :

Operational landfills

- *Number: 130 (in 80 biogas is caught)*
- *Deposited volume: 12.836.314 t (we have noticed this information is not too precise because data related to SADECO landfill are wrong, therefore we can consider just as a estimation)*
- *Remaining landfill volume: not found (although every year we have to inform to environment ministry about our remaining landfill volume, there is not public information available)*

There is no public information available found about closed landfill, closed non-sanitary landfills or Number of closed landfills in aftercare treatment/monitoring.

At regional level (Andalucía): *Operation landfills are:*

- *Number: 22*
- *Deposited volume: 800.000 t directly deposited (no included rejected from recycling plant)*
- *Remaining landfill volume: not available*

At regional level (Andalucia), the closed landfill (included sanitary and non sanitary) are:

- *Number: 275 (closed from 1995 to 2015)*
- *Deposited volume: 2.398.573 m³*
- *Surface recovered :3.876.061 m²*

At regional level, since 2009 there is not operational non-sanitary landfill, but there are still two inactive non-sanitary landfills which are being closeded currently.

11. If applicable, please specify the following data on mono and industrial landfills

- Mono deposits of gypsum (operational/closed, number, volume): not found*
- Mono deposits of fly ash (specify) (operational/closed, number, volume): not found*
- Mono deposits of red mud (operational/closed, number, volume): not found*
- Mono deposits of coal mining waste (operational/closed, number, volume): not found*
- Mono deposits of goethite (operational/closed, number, volume): not found*
- Mono deposits of mining waste (operational/closed, number, volume): not found*
- Other mono landfills (specify) (operational/closed, number, volume): not found*
- Other industrial landfills (specify) (operational/closed, number, volume): not found*
- Number of closed industrial/mono landfills in aftercare: not found*
- Number of industrial/mono landfills in aftercare treatment/monitoring: not found*

12. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

Yes:

No: X

Current landfill management and regulation

13. Is the EU landfill directive fully implemented in your country?

Yes: X

EU landfill directive was included in national law in 2001. However, there are some old landfills that do not fulfill directive requirement. Actually, Spain has been sanctioned by European Union Court of Justice for this reason in 2016 (about 15 landfills out of law) and 2017.

14. Which policies have been implemented into the national regulatory framework in order to reduce landfilling?

- *At regional level,*
 - *After some years of transitory period, there is a law which starts to be compulsory from 26th May 2017 that set treatment allowed for every LER code waste. Most of non-hazardous waste only can be recycled, banning direct deposit.*
http://www.juntadeandalucia.es/medioambiente/portal_web/web/temas_ambiental_es/residuos_2/quieres_saber_mas/catalogo_residuos.pdf
 - *Reduction of amount of organic wasted landfilled from June 2016 (less than 30% of deposited amount in 1995)*
 - *There is not landfill taxes in our region neither at national level.*
 - *Reduction of rejected material from recycling plant (-20% in 2015 and -30% in 2019 in reference to amount rejected in 2008.)*
 - *Instruments related to prevention of waste generation*

15. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Not found in a short term

16. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

There is no clear public information about old landfills not eligible to EU landfill directive. Actually, Andalusia are in a prior stage because there is not a database or complete survey with full information about old landfills

17. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

Yes: X

Circular economy package promotes a sharp reduction of waste allowed to be landfilled. In Spain, incineration for valorisation is not a frequent elimination method; therefore, new limitations bring about the need of taking decisions.

Landfill management and funding

18. Is private funding available to support implementation of landfill management projects?

Yes:

No: X

19. Is regional funding available to support implementation of landfill management projects?

Yes: X

ERDF Operational Programme 2014-2020 for Andalusia. Priority Axis 6- environment & resource efficiency. Investment Priority 6a "Investment in waste sector"

Specific Objective 6.1.1. "Development of separation and treatment, including actions for cycle closure concerning both management plans and investments in infrastructures such as clean points, transfer stations, treatment plants and landfills".

Among all the aspects addressed for this objective, in relation to landfills Andalusia región focus on "proper landfill management, not only in operational stage but also in closure and post-closure stage"

Total budget supported by Regional funds for axis 6.1 is 4.215.145 €

20. Is national funding available to support implementation of landfill management projects?

Yes: X

CLIMA program is created by Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (National level) in 2017 in order to reduce greenhouse emission. Funds are allocated to project that improve compulsory obligations about greenhouse emissions. In relation to landfills, degasification before landfill closure is eligible to receive these funds.

21. Is European funding available to support implementation of landfill management projects?

Yes: X

ERDF Operational Programme 2014-2020 for Andalusia. Priority Axis 6- environment & resource efficiency. Investment Priority 6a "Investment in waste sector"

Specific Objective 6.1.1. "Development of separation and treatment, including actions for cycle closure concerning both management plans and investments in infrastructures such as clean points, transfer stations, treatment plants and landfills".

Total budget supported by EU funds for axis 6.1, specifically “MSW waste management” is 6 M€ from 2016-2020.

Among all the aspect addressed for this objective, in relation to landfills Andalusia región focus on “proper landfill management, not only in operational stage but also in closure and post-closure stage”

22. Are governmental actions available to attract funding for landfill management projects?

Yes:

No: X

23. Are governmental actions needed to attract funding for landfill management projects?

Information not found

It would be convenient to increase funds allocated to landfill management in order to not only properly rehabilitate closed landfills and old landfills, but also to promote best practices in Landfill management

Landfill mining activities and policy issues

24. Which LFM projects/programmes/networks occur in your country?

There is a MSW landfill located at Clariana de Cardener (Barcelona), which started to operate in 2015. Its management is oriented to promote Landfill mining in the future, according to news published. Waste to be deposited in Clariana de Cardener landfill is which have an organic waste treatment plant related. However, there is no available public technical information about what procedures are applied.

This landfill is dependent of Secretary of Environment and Sostenibility (Secretaría de Medio Ambiente y Sostenibilidad), Catalonian Waste Agency (ARC), the Consejo Comarcal del Solsonés and finally, Clariana de Cardener City hall. Therefore, it is a public small size landfill.

25. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Yes: X

Clariana de Cardener plant, located in Catalonia, is considered a pioneer and innovative project in Catalonia, first and only pilot project about landfill mining. It is a landfill designing to be able to recover material in future. Therefore, it is a modular, flexible and polyvalent installation, whose treatment plant is designed to treat organic waste, water treatment sludge and, as a pilot project, fraction rest of waste already deposited, which let recover materials and reduce environmental impacts derived from the presence of biodegradable waste in landfill. (reduction of leachates and gas emissions)

As this pilot was started in 2015 and there is not public information easily available about technical feature of landfill, its performance is not demonstrated yet.

26. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

No: X

27. Have there been any specific policy discussions or initiatives on LFM during recent years?

Yes: X

In October 2015, in the context of the XV Ategrus Conference on sanitary landfills, sponsored by the entity Fira de Lleida, it is performed a debate about landfill mining which addressed:

analysis of some preliminary experiences about landfill mining in Spain and Europe offer a prospect of landfill mining in Spain, providing some estimates of the number of potential landfills in Spain, their main features, their estimated waste composition, the prospects for recovery of materials and their relationship with Spanish import / export flows.

The debate was in charge of Ignasi Puig Ventosa, responsible for projects of ENT Environment & Management in MUNICIPALIA.

http://www.ategrus.org/wp-content/uploads/2016/12/8a-IGNASI-PUIG-ENT-Environment-PDF_vertederos-2015.pdf

28. Which potential benefits (e.g. economic, environmental, societal...) do the consulted authorities choose to put forward when it comes to LFM implementation?

- *Recovery of discharged materials from 1980 to 2010, with an estimated content of about 10 million tons of ferrous metals and 1.8 million tons of non-ferrous metals, included valuable materials such as gold, Palladium, beryllium, gallium, platinum and elements of the rare earth group (neodymium, scandium, yttrium, etc.)*
- *Landfill mining has environmental potential in terms, for example, of mitigating climate change (reduction of GEI emissions) and reducing the pressure on scarce natural resources.*
- *It also has a social potential, with the creation of new jobs associated.*

29. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Currently Andalusia regional authorities are not considering including landfill mining as priority way of waste management in the short term. Therefore, first hand information is quite limited. However, after some research it is noticed that technological capacity for material recovery, cost of extraction and separation technologies or resources prices in the Market, which in turn depends on their demand; are some uncertainties. Moreover, environmental problems derived from these new technologies not very well

defined and tested yet would be another concern. In conclusion, potential benefits are significant enough to make the authorities be open to studying landfill mining.

30. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

We have not found data about that.

31. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

Although some regional administrations show interest in developing policy instruments regulating landfill mining, such as the Catalan administration; most of authorities are focused on improving selective waste collection, increasing recycling rate or prevention of waste generation in the field of waste management. In relation to landfill, authorities have no policy instrument about landfill mining currently.

Appendix 2: complete questionnaire of Flanders

Governance and organisational aspects

1. Responsible authority for waste management policy

Level (regional):

Name: OVAM

Website: www.ovam.be

Under which governmental ministry is the authority situated:

Flemish Minister for Environment, Nature and Agriculture

2. Responsible authority for permitting of operational landfills

Level (national, regional, local):

Name: Department Omgeving

Website: <https://www.lne.be/>

Under which governmental ministry is the authority situated:

Flemish Minister for Environment, Nature and Agriculture

3. Responsible authority for control of operational landfills

Level (national, regional, local):

Name: Department Omgeving

Website: <https://www.lne.be/>

Under which governmental ministry is the authority situated:

4. Responsible authority for monitoring of closed landfills

Level (national, regional, local):

Name: Department Omgeving

*Website: <https://www.lne.be/>
<https://www.lne.be/milieu-inspectie>*

Under which governmental ministry is the authority situated:

Flemish Minister for Environment, Nature and Agriculture

5. Responsible authority for groundwater remediation (If authority for “soil” is different from “groundwater”; please indicate both):

Level (national, regional, local):

Name: VMM

Website: www.vmm.be

Under which governmental ministry is the authority situated:

Flemish Minister for Environment, Nature and Agriculture

6. Responsible authority for soil remediation:

Level (national, regional, local):

Name: OVAM

Website: www.ovam.be

Under which governmental ministry is the authority situated:

Flemish Minister for Environment, Nature and Agriculture

7. Responsible authority for mineral and natural resource supply

Level (regional):

Name: Departement Omgeving

Website: www.lne.be, <https://www.omgevingvlaanderen.be/>

Under which governmental ministry is the authority situated:

Flemish Ministry of Environment; Department of Environment

8. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management ?

Yes: authorities work in a coordinated manner, in which issues are discussed in advance and in working groups that consist of all governmental departments concerned.

This in order to avoid overlap of regulations of the material decree and the decree on surface mineral resources.

Available landfill information and data

9. Are there any national landfill surveys and/or landfill databases on both operational and “old” landfills available in your country?

Yes: there are different inventories of landfills

- *Permitted landfills (database of environmental permits LNE)*
- *Landfills in aftercare (non-digitalized database at Ovam in order to manage the financial warrants related to the operation of landfill and the release of financial securities)*
- *Land information register : inventory of all the parcels of which data are known at the OVAM;*
- *ELFM-database of OVAM : steadily progressing inventory of validated old -landfills (Flaminco tool is used to prioritizing)*

10. If applicable, please specify the following data on municipal solid waste (MSW) landfills

Operational landfills (number, deposited volume, remaining landfill volume):

Closed sanitary landfills (number, deposited volume):

Closed non-sanitary landfills (number, deposited volume):

Number of closed landfills in aftercare treatment/monitoring:

11. If applicable, please specify the following data on mono and industrial landfills

Mono deposits of gypsum (operational/closed, number, volume):

Mono deposits of fly ash (specify) (operational/closed, number, volume):

Mono deposits of red mud (operational/closed, number, volume):

Mono deposits of coal mining waste (operational/closed, number, volume):

Mono deposits of goethite (operational/closed, number, volume):

Mono deposits of mining waste (specify) (operational/closed, number, volume):

Other mono landfills (specify) (operational/closed, number, volume):

Other industrial landfills (specify) (operational/closed, number, volume):

Number of closed industrial/mono landfills (specify) in aftercare:

Number of industrial/mono landfills in aftercare treatment/monitoring:

12. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

Yes: in some cases there is a profound knowledge of the content available. These are cases where characterization operations and sieving are undertaken (ELFM-project)

Current landfill management and regulation

13. Is the EU landfill directive fully implemented in your country?

Yes:

14. Which policies have been implemented into the national regulatory framework in order to reduce landfilling

- Ban on landfilling combustible/organic waste (since 1998)
- Landfill tax steadily increased from 10€/t in 1990 to more maximally then 100 €/t (2017)
- Consistent system of waste planning in period 1986-1996
- Ongoing waste plan for household and comparable waste with tailor-made target approach to the local authorities till 2022

http://www.ovam.be/sites/default/files/atoms/files/UitvoeringsplanHuishoudelijkGelijkenArdigBedrijfsafval_LR_2017_Engelstalig.pdf

15. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Yes

- Managing : the OVAM ELFM²-program
- Technology : Closing-the Circle project

16. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

Yes: conceptual note of Flemish government about sustainable management of landfills(2015)

<https://www.ovam.be/duurzaam-voorraadbeheer-van-stortplaatsen-in-vlaanderen>

17. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

Yes: proposals to amend the EU-landfill directive

- *By Flemish EP-members: Vautmans and Demesmaeker*
- *Technical workgroups*
Still ongoing

Landfill management and funding

18. Is private funding available to support implementation of landfill management projects?

No

19. Is regional funding available to support implementation of landfill management projects?

No

20. Is national funding available to support implementation of landfill management projects?

No

21. Is European funding available to support implementation of landfill management projects?

Yes: Interreg EU projects

22. Are governmental actions available to attract funding for landfill management projects?

No:

23. Are governmental actions needed to attract funding for landfill management projects?

Yes

Landfill mining activities and policy issues

24. Which LFM projects/programmes/networks occur in your country?

- *Managing : the OVAM ELFM²-program*
- *Technology : Closing-the Circle project*

25. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Yes: diverse sieving methods are tested during the OVAM ELFM-program

26. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

Yes: result is the conceptual note of the Flemish government which fixed a Short-term an a longterm schedule for a systematic approach of the problem of old landfills. The first step is the inventarisation of the landfills from the perspective of the individual mining potential of the landfill

27. Have there been any specific policy discussions or initiatives on LFM during recent years?

Yes:

28. Which potential benefits (e.g. economic, environmental, societal...) do the consulted authorities choose to put forward when it comes to LFM implementation?

Regarding the high population density , the development of the occupied surface is a strong incentive.

29. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Risk and uncertainties are the minimal information about the content of the landfills. This made a precise estimation of the costs of excavating and processing the landfilled material impossible.

Please summarize the outcome of your discussions with the authorities:

30. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

Please summarize the outcome of your discussions with the authorities:

31. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

Yes the OVAM has an LFM-project , in which it studied all the aspects of the landfilling. It resulted in directive in which the Flemish government gives a framework to tackle this problem on a long term base.

If yes, why and which types of incentives do they have in mind:

If no, why is that:

Appendix 3: complete questionnaire of Cyprus

Governance and organizational aspects

1. **Responsible authority for waste management policy**
Level (national, regional, local): **National**
Name: **Department of Environment**
Website: <http://www.moa.gov.cy/environment>
Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment**

2. **Responsible authority for permitting of operational landfills**
Level (national, regional, local): **National**
Name: **Department of Environment**
Website: <http://www.moa.gov.cy/environment>
Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment**

3. **Responsible authority for control of operational landfills**
Level (national, regional, local): **National**
Name: **Department of Environment**
Website: <http://www.moa.gov.cy/environment>
Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment**

4. **Responsible authority for monitoring of closed landfills**
Level (national, regional, local): **Local**
Name: **Local communities and municipalities, their unions and councils of District Waste Management**
Website: <http://www.ucm.org.cy/> , <http://www.ekk.org.cy>
Under which governmental ministry is the authority situated: **Ministry of Interior**

5. **Responsible authority for groundwater remediation (If authority for “soil” is different from “groundwater”; please indicate both):**
Level (national, regional, local): **National**
Name: **Water Development Department**
Website: www.moa.gov.cy/wdd
Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment**

6. **Responsible authority for soil remediation:**
Level (national, regional, local): **National**
Name: **Department of Environment**
Website: <http://www.moa.gov.cy/environment>
Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment**

7. Responsible authority for mineral and natural resource supply

Level (national, regional, local): National

Name: Geological Survey Department, Mines Service, Water Development Department

*Website: <http://www.moa.gov.cy/qsd>, <http://www.moa.gov.cy/mines>,
<http://www.moa.gov.cy/wdd>*

Under which governmental ministry is the authority situated: Ministry of Agriculture, Rural Development and Environment

8. Responsible authority for mineral and natural resource supply

*Level (national, regional, local): **National***

*Name: **Geological survey Department***

Website: <http://www.moa.gov.cy/moa/qsd/qsd.nsf>

*Under which governmental ministry is the authority situated: **Ministry of Agriculture, Rural Development and Environment***

9. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management?

Yes:

No: Not at the moment. But all the above responsible Authorities fall under the same Ministry so in the view of a new policy initiative on circular economy the cooperation will be easily developed. Also the Water Development Department is the same responsible authority for water supply and managing the old landfills rehabilitation.

If Yes, please describe short level and status of this collaboration

Available landfill information and data

10. Are there any national landfill surveys and/or landfill databases on both operational and “old” landfills available in your country?

Yes.

If yes, please list available databases, reports, etc. and briefly specify their scope and content:

A comprehensive study was undertaken in 2005 for the elaboration of a Strategic Plan, an Environmental study and a Feasibility study for the restoration and management of landfills. The purpose of the study was to record all landfills, assess their status and level of risk, create a restoration priority list based on pollution risk assessments, undertake the appropriate environmental studies as well as feasibility studies for the restoration of the prioritized landfills. These studies were a necessary step for the restoration of all landfills recorded.

11. If applicable, please specify the following data on municipal solid waste (MSW) landfills

Operational landfills (number, deposited volume, remaining landfill volume): Two (2) landfills are still active in Cyprus but arrangements are made in order to be closed and restored. One will be closed by the end of 2017 and the other will be closed within 2018. According to recent data, these two landfills are feeded with approximately 155.000 ton and 200.000 ton of municipality waste each year respectively (reference year 2012).

Closed sanitary landfills (number, deposited volume): 0

Closed non-sanitary landfills (number, deposited volume): Sixty two (62) non sanitary landfills are planned to be restored appropriately within the following years. According to the preliminary study contacted in 2005, these landfills contain approximately 597.269 m³ of solid waste excluding 2 major landfills that have not been closed yet.

Number of closed landfills in aftercare treatment/monitoring: Fifty three (53) landfills have been restored the last five years and are being monitored. During their restoration a total of 4.902.000 m³ of solid waste were reallocated and properly buried using composite liners and leakage collection systems.

12. If applicable, please specify the following data on mono and industrial landfills

Mono deposits of gypsum (operational/closed, number, volume): 0

Mono deposits of fly ash (specify) (operational/closed, number, volume): 0

Mono deposits of red mud (operational/closed, number, volume): 0

Mono deposits of coal mining waste (operational/closed, number, volume): 0

Mono deposits of goethite (operational/closed, number, volume): 0

Mono deposits of mining waste (specify) (operational/closed, number, volume):

Operational: no=13, volume=220.000m³ per annum

Closed: no=35, volume=26.100.700m³

Other mono landfills (specify) (operational/closed, number, volume): Asbestos mine for asbestos wastes

Other industrial landfills (specify) (operational/closed, number, volume): 0

Number of closed industrial/mono landfills (specify) in aftercare: 0

Number of industrial/mono landfills in aftercare treatment/monitoring: 0

Number of industrial/mono landfills in aftercare treatment/monitoring:

13. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

Yes:

No:no

If yes, please provide the references to this information

Current landfill management and regulation

14. Is the EU landfill directive fully implemented in your country?

Yes

If no, please specify which parts of the directive that are not yet part of the national regulatory frameworks for landfills:

The EU landfill directive is fully harmonized in the national legislation but not fully implemented. Cyprus didn't manage to seize of the operation of non-compliant landfills by 2009. Also Cyprus has rehabilitated only 46% of its closed landfills.

15. Which policies have been implemented into the national regulatory framework in order to reduce landfilling

Provide a list of the main instruments and regulations (e.g. landfill tax, ban on landfilling combustible/organic waste, etc.)

No measures are implemented into the national regulatory framework in order to reduce landfilling. The Municipal Waste Management plan 2015-2021 foreseen the introduction of landfill tax and the ban of specific waste streams.

16. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Yes: Yes

No:

If yes, please specify their scope and content and list available databases, reports and/or other sources of information:

There is a court decision for non-compliance with the closure of the not sanitary landfills.

17. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

Yes:

No: There is not an action plan at the moment. There are some actions foreseen in the Municipal Waste Management Plan 2015-2021.

If yes, please provide a short description of these plans in terms of their scope, budget and time horizons. Also list supporting reports and documents:

According to the study developed in 2005 the rehabilitation of non-compliance landfills will take place through the cohesion funds. As it is mentioned above 46% has already funded.

18. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

Yes: An effort has begun to develop. An action plan for how to comply with the Malagroda Court Decision.

No:

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

Landfill management and funding

19. Is private funding available to support implementation of landfill management projects?

Yes:

No: *no at present*

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

20. Is regional funding available to support implementation of landfill management projects?

Yes:

No: *no at present*

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

21. Is national funding available to support implementation of landfill management projects?

Yes: *Yes.(15% of the eligible cost)*

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information?

The restoration of landfills is undertaken by the national authorities and it is co-funded by Structural Funds (Cohesion Funds). Up to today, the cost of landfill restoration was €24.150.510. All necessary studies for the restoration of the remaining 64 landfills and the overall cost is estimated to be €53.800.000.

22. Is European funding available to support implementation of landfill management projects?

Yes. *(85% of the eligible cost)*

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

The restoration of landfills is undertaken by the national authorities and it is co-funded by Structural Funds (Cohesion Funds). Up to today, the cost of landfill restoration was €24.150.510. All necessary studies for the restoration of the remaining 64 landfills and the overall cost is estimated to be €53.800.000.

23. Are governmental actions available to attract funding for landfill management projects?

Yes:

No: *no at present*

If yes, please specify which actions:

24. Are governmental actions needed to attract funding for landfill management projects?

Yes:

No: *no see point 24*

If yes, please specify which actions:

Landfill mining activities and policy issues

25. Which LFM projects/programmes/networks occur in your country? no

Please provide a list of the active projects/programmes/networks and involved actors (industrial/academic/public): See point 24

26. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Yes:

No: no

If yes, please provide a short description of these projects (landfill, scale, main outcome) and where more information can be found

27. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

Yes: yes

No:

If yes, please specify the document and the phrasing (translated into English) of the section in which LFM is mentioned:

Rehabilitation has taken place by the government but the after care monitoring is undertaken by the district waste management councils.

28. Have there been any specific policy discussions or initiatives on LFM during recent years?

Yes:

No: Rehabilitated landfills will be managed by the districts waste management councils. Discussions but nothing yet has been decided.

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

29. Which potential benefits (e.g. economic, environmental, societal...) do the consulted authorities choose to put forward when it comes to LFM implementation?

Please summarize the outcome of your discussions with the authorities: No discussions took place yet.

30. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Please summarize the outcome of your discussions with the authorities: No discussions took place yet.

31. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

Please summarize the outcome of your discussions with the authorities: No discussions took place yet.

32. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

If yes, why and which types of incentives do they have in mind:

If no, why is that: No discussions took place yet.

Appendix 4: complete questionnaire of Brandenburg

Governance and organisational aspects

1. Responsible authority for waste management policy

Level (national, regional, local): *regional (level of a state)*

Name: *Ministry for rural development, environment and agriculture of the state of Brandenburg (MLUL)*

Website: *mlul.brandenburg.de*

Under which governmental ministry is the authority situated: *The authority is a ministry.*

2. Responsible authority for permitting of operational landfills

Level (national, regional, local):

Name: *State office of environment of the state of Brandenburg (LfU)*

Website: *lfu.brandenburg.de*

Under which governmental ministry is the authority situated: *MLUL*

3. Responsible authority for control of operational landfills

Level (national, regional, local): *regional (level of a state)*

Name: *LfU (see Nr. 4)*

Website: *see Nr. 4*

Under which governmental ministry is the authority situated: *see Nr. 4*

4. Responsible authority for monitoring of closed landfills

Level (national, regional, local): *regional, local*

Name: *If the landfill is named in the appendix 1 of the Brandenburg waste responsibility directive: LfU, if not: the county in which the landfill is situated*

Website: *for LfU: see Nr. 4*

Under which governmental ministry is the authority situated: *MLUL*

5. Responsible authority for groundwater remediation (If authority for “soil” is different from “groundwater”; please indicate both):

Level (national, regional, local): *local*

Name: *the county in which the brownfield area is situated*

Website: *14 counties and 4 county free cities (if necessary I make a list)*

Under which governmental ministry is the authority situated: *under professional view: MLUL*

6. Responsible authority for soil remediation: *see Nr. 7*

Level (national, regional, local):

Name:

Website:

Under which governmental ministry is the authority situated:

Additional information: If financial support of the Federal or Brandenburg government, the LfU (water department) is involved

7. Responsible authority for mineral and natural resource supply

Level (national, regional, local):

Name: national: Federal Ministry for Economic Affairs and Energy

Regional: Ministry for Economic Affairs and Energy

Website: www.bmwi.de; www.mwe.brandenburg.de

Under which governmental ministry is the authority situated:

8. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management ?

Yes:

No:

If Yes, please describe short level and status of this collaboration

Available landfill information and data

9. Are there any national landfill surveys and/or landfill databases on both operational and “old” landfills available in your country?

Yes:

No:

If yes, please list available databases, reports, etc. and briefly specify their scope and content:

The Statistic office of FRG makes statistics about the number of operational landfills, there remaining volume differentiated to every state of Germany. Every state of Germany is obligated to make an annual report about the municipal waste. This report gives an overview about the amounts of waste in the counties, the disposal procedures, the amount of recycled waste and so on.

10. If applicable, please specify the following data on municipal solid waste (MSW) landfills

Operational landfills (number, deposited volume, remaining landfill volume):

(8, approx.. 34 Mio m³, 2.24 Mio m³ in January 2017)

This includes 2 very large landfills with waste from Berlin with together about 31 Mio m³.

Closed sanitary (remediated?) landfills (number, deposited volume): closed landfills in remediation phase

(14, approx.. 46 Mio m³)

Closed non-sanitary landfills (number, deposited volume): remediation not yet begun

(8, approx. 3 Mio m³)

Number of closed landfills in aftercare treatment/monitoring: remediation is completed and ended, landfill is in the after care phase: 41, approx.. 26 Mio m³

This includes 2 landfills which are excavated.

This numbers include the landfills for which the LfU is responsible (appendix 1 of the BB waste responsibility directive: 101 landfills). There are also approx.. 3000 little landfills

in the responsibility of the counties with volumes from a few 1000 to 200,000 m³. If we estimate that the average volume is 30,000 m³ we come to a additional volume of approx.. 100 Mio m³.

11. If applicable, please specify the following data on mono and industrial landfills

Mono deposits of gypsum (operational/closed, number, volume):

Mono deposits of fly ash (specify) (operational/closed, number, volume):

Mono deposits of red mud (operational/closed, number, volume):

Mono deposits of coal mining waste (operational/closed, number, volume):

Mono deposits of goethite (operational/closed, number, volume):

Mono deposits of mining waste (specify) (operational/closed, number, volume):

Other mono landfills (specify) (operational/closed, number, volume):

Other industrial landfills (specify) (operational/closed, number, volume):

Number of closed industrial/mono landfills (specify) in aftercare:

Number of industrial/mono landfills in aftercare treatment/monitoring:

Deposits for browncoal ash: 5 (one operational: 40 Mio m³ deposited, 20 Mio m³ remaining volume for 2 power stations with 3000 and 1000 MW installed capacity; 4 closed with all in all may be 2 Mio m³ deposited volume)

Deposits for waste from iron and steel production: 6 (3 operational: 6 Mio m³ deposited, 4 Mio m³ remaining volume; 3 closed with all in all may be 3 Mio m³ deposited volume)

Deposits for construction and mineralic waste with different origin: 28 (2 approved but not yet built, 4 operational: 37 Mio m³ deposited, 1.14 Mio m³ remaining volume per January 2017, 7.545 Mio m³ volume approved but not yet built, 22 closed with all in all may be 12 Mio m³ deposited volume, 3 are in remediation phase, 11 the sanitary is completed and they are in after care, on 8 the remediation has not yet begun)

Hazardous waste landfill: 1 (closed, 110 Tm³, in remediation phase)

3 special landfills, for example from oil production

The number of landfills is higher than 101 because:

- some landfills are for different kind of waste (former: municipal waste, now: mineralic waste, in this case I counted the deposited volume to the municipal waste)*
- some landfills (3) are approved after establishment of the appendix 1 in 1992)*

To collect all data about landfills would be an object for a degree dissertation.

12. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

Yes:

No:

If yes, please provide the references to this information

The landfill owners are obligated to give an annual report. This report includes informations about the deposited waste in the reported year on the base of a 6scaled waste key number (also owner of landfills for municipal waste).

Current landfill management and regulation

13. Is the EU landfill directive fully implemented in your country?

Yes:

No:

If no, please specify which parts of the directive that are not yet part of the national regulatory frameworks for landfills:

14. Which policies have been implemented into the national regulatory framework in order to reduce landfilling

Provide a list of the main instruments and regulations (e.g. landfill tax, ban on landfilling combustible/organic waste, etc.)

National waste law “Circular economy law” (Kreislaufwirtschaftsgesetz)

– include the obligation for recycling of usable waste

Altfahrzeugverordnung (end-of-life vehicles directive)

Batteriegesetz (battery law)

Elektro- und Elektronikgerätegesetz (electric and electronic device law)

Verpackungsverordnung (package directive)

- These laws and directives include obligations for the trade companies to redemption of old cars, batteries, electric devices and packages and recycling and re-using.

15. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Yes: *risk assessments, ALKAT*

No:

If yes, please specify their scope and content and list available databases, reports and/or other sources of information:

There are a lot of single risk assessments for brownfields and landfills. A part of them are collected in the database ALKAT (Altlastenkataster – brownfield register). They content data about disposed waste, the reason for contamination (military, industrial), site description and the pollution found in soil and water.

Single risk assessments are in the papers of the landfills.

16. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

Yes: *funding schemes as parts of the operational programmes*

No:

If yes, please provide a short description of these plans in terms of their scope, budget and time horizons. Also list supporting reports and documents:

Brandenburg used in the years from 2000 to 2013 about 70 Mio € for the remediation of landfills which was operational after 1992 from ERDF. There was also used a lot of money from Brandenburg budget, also from social funds, for the remediation of the little landfills which was closed till 1992.

And also give the Federal government and the Brandenburg state money in the scope of "liability exemption" if an investor wanted to buy a company and found an old landfill on the area of the company to remediate of this landfill.

17. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

Yes:

No: *The responsible colleague from the Federal Ministry for environment gave information in workshops about the circular economy package and about his opinion about it.*

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

Landfill management and funding

18. Is private funding available to support implementation of landfill management projects?

Yes:

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

19. Is regional funding available to support implementation of landfill management projects?

Yes:

Since 2000 No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

20. Is national funding available to support implementation of landfill management projects?

Yes:

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information?

21. Is European funding available to support implementation of landfill management projects?

Yes: *See No. 18*

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

22. Are governmental actions available to attract funding for landfill management projects?

Yes:

No:

If yes, please specify which actions:

23. Are governmental actions needed to attract funding for landfill management projects?

Yes:

No:

If yes, please specify which actions:

Landfill mining activities and policy issues

24. Which LFM projects/programmes/networks occur in your country?

Please provide a list of the active projects/programmes/networks and involved actors (industrial/academic/public): [in Brandenburg nothing](#)

25. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Yes:

No:

If yes, please provide a short description of these projects (landfill, scale, main outcome) and where more information can be found

[There was a research project funded by the Federal Ministry for Education and Research \(\[www.bmbf.de\]\(http://www.bmbf.de\)\) to investigate the economic evaluation of LFM. The results are also published in speeches on landfill workshops.](#)

26. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

Yes:

No: *not in Brandenburg. I would wonder if in other states of FRG.*

If yes, please specify the document and the phrasing (translated into English) of the section in which LFM is mentioned:

27. Have there been any specific policy discussions or initiatives on LFM during recent years?

Yes:

No:

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

On the level of expert circles there was a discussion about the possibilities and economic effects of LFM. Some investigations were made and published in workshop. See for example no. 27. The results were that the economic effects are not so good that the investigators would give a recommendation to push LFM-projects. That no means, that LFM not can be a positive measure in a single case.

28. Which potential benefits (e.g. economic, environmental, societal...) do the consulted authorities choose to put forward when it comes to LFM implementation?

Please summarize the outcome of your discussions with the authorities:

The discussion – not only with authorities – was conducted under the issues of

- to produce raw materials for energy and production*
- to get new areas, especially for new landfills*
- economise money for surface sealing and after care.*

Results: see Nr. 29

29. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Please summarize the outcome of your discussions with the authorities:

Emissions, operational safety, found of unknown hazardous waste, legal procedures (typical for Germany)

30. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

Please summarize the outcome of your discussions with the authorities:

Was not discussed. I don't know such policies or regulations in Germany.

31. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

If yes, why and which types of incentives do they have in mind:

If no, why is that: see Nr. 29

Appendix 5: complete questionnaire of Malta

Governance and organisational aspects

1. Responsible authority for waste management policy

Level (national, regional, local): National

Name: Ministry for Environment, Sustainable Development and Climate Change

Website: www.msdec.gov.mt

Under which governmental ministry is the authority situated: Ministry for Environment, Sustainable Development and Climate Change

2. Responsible authority for permitting of operational landfills

Level (national, regional, local): National

Name: Environment and Resources Authority

Website: www.era.org.mt

Under which governmental ministry is the authority situated: Ministry for Environment, Sustainable Development and Climate Change

3. Responsible authority for control of operational landfills

Level (national, regional, local):

Name: Environment and Resources Authority

Website: www.era.org.mt

Under which governmental ministry is the authority situated: Ministry for Environment, Sustainable Development and Climate Change

4. Responsible authority for monitoring of closed landfills

Level (national, regional, local):

Name: Environment and Resources Authority

Website: www.era.org.mt

Under which governmental ministry is the authority situated: Ministry for Environment, Sustainable Development and Climate Change

5. Responsible authority for groundwater remediation (If authority for “soil” is different from “groundwater”; please indicate both): Groundwater

Level (national, regional, local): National

Name: The Energy and Water agency

Website: <https://energywateragency.gov.mt>

Under which governmental ministry is the authority situated: Office of the Prime Minister

6. Responsible authority for soil remediation:

Level (national, regional, local): National

Name: Environment and Resources Authority

Website: www.era.org.mt

Under which governmental ministry is the authority situated: Ministry for Environment, Sustainable Development and Climate Change

7. Responsible authority for mineral and natural resource supply

Level (national, regional, local): National

Name: Malta Resources Authority/REWS (Regulator for Energy and Water Systems)

Website: <http://mra.org.mt/>

Under which governmental ministry is the authority situated: Office of the Prime Minister

8. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management?

Yes: Yes

No:

If Yes, please describe short level and status of this collaboration

Minimal collaboration since in Malta, the link between use of raw material and waste policy is not as applicable.

Available landfill information and data

9. Are there any national landfill surveys and/or landfill databases on both operational and “old” landfills available in your country?

Yes: Yes

No:

If yes, please list available databases, reports, etc. and briefly specify their scope and content:

ERA maintains data of the known landfills, both operational and “old” landfills.

10. If applicable, please specify the following data on municipal solid waste (MSW) landfills

Operational landfills (number, deposited volume, remaining landfill volume):

- Zwejra – No waste was landfilled in 2015
- Ghallis – 240,795 tonnes of municipal waste landfilled in 2015.

Closed sanitary landfills (number, deposited volume):

Closed non-sanitary landfills (number, deposited volume):

- Marsascala landfill rehabilitated into a family park;
- Wied Fulija is in the process of being rehabilitated;
- Luqa landfill non-rehabilitated yet.

Number of closed landfills in aftercare treatment/monitoring:

- Rehabilitation of the former Maghtab and Qortin dumps (Cohesion Fund 2007-2013);
- Rehabilitation of the former Zwejra landfill.

11. If applicable, please specify the following data on mono and industrial landfills

Mono deposits of gypsum (operational/closed, number, volume): N/A
Mono deposits of fly ash (specify) (operational/closed, number, volume): N/A
Mono deposits of red mud (operational/closed, number, volume): N/A
Mono deposits of coal mining waste (operational/closed, number, volume): N/A
Mono deposits of goethite (operational/closed, number, volume): N/A
Mono deposits of mining waste (specify) (operational/closed, number, volume): N/A
Other mono landfills (specify) (operational/closed, number, volume): N/A
Other industrial landfills (specify) (operational/closed, number, volume): N/A
Number of closed industrial/mono landfills (specify) in aftercare: N/A
Number of industrial/mono landfills in aftercare treatment/monitoring: N/A

12. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

Yes:

No: No – no such landfills operate in Malta

If yes, please provide the references to this information

Current landfill management and regulation

13. Is the EU landfill directive fully implemented in your country?

Yes: Yes

No:

If no, please specify which parts of the directive that are not yet part of the national regulatory frameworks for landfills:

14. Which policies have been implemented into the national regulatory framework in order to reduce landfilling

Provide a list of the main instruments and regulations (e.g. landfill tax, ban on landfilling combustible/organic waste, etc.)

A number of policies/measures have been implemented within national legislation that promote the reduction of landfilling, including:

- Separate collection, including comingled collection, of at least paper, metal, plastic and glass (S.L. 549.63) which would promote increased recycling and therefore a reduction in waste diverted to landfill;
- The setting up of a national strategy for the reduction of biodegradable waste going to landfill by incorporating measures, such as recycling, composting, biogas production, to achieve landfilling reduction targets (S.L. 549.29);
- Penalties for persons who commit an offence against the landfill regulations (S.L. 549.29)
- Waste deposit fees for any person who deposits non-hazardous waste into a public waste deposit site (S.L. 549.07)

Additionally, in the Implementation plan outlined in the Waste Management Plan for the Maltese Islands 2014-2020, a number of instruments are listed that also work towards reducing landfilling. These include:

- Increase in gate fee for landfilling and more diversion of waste to Mechanical Biological Treatment over the past years.
- Separate collection of dry recyclables (Kerbside collection and Bring-in Sites)
- Separate kerbside collection of organic waste
- Civic Amenity sites and their reform
- Waste Transfer Station in Gozo
- Malta North Facility
- National Waste Educational Campaign

15. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Yes: Yes

No:

If yes, please specify their scope and content and list available databases, reports and/or other sources of information: The compilation of the list of contaminated areas in Malta is an ongoing process, as is the assessment of the likelihood, extent and significance of contamination. The requirement for remediation may depend on the projected after-use of the site. Soil screening values and groundwater threshold values established are different in cases of “industrial” and “residential” after uses. In different cases, the Authority may require specific techniques ranging from site sealing to full remediation activities.

16. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

Yes: Yes

No:

If yes, please provide a short description of these plans in terms of their scope, budget and time horizons. Also list supporting reports and documents:

Old dumpsites have been/are in the process of being rehabilitated as part of the project of closure and rehabilitation of Maltese Landfills, namely Maghtab, Qortin and Marsascala dumpsites. This project was part of Operational Programme – Investing in Competitiveness for a Better Quality of Life.

The first stage of this project – the installation of aerial emissions control systems – was completed with the help of 2004-2006 ERDF funds. The next stages of the rehabilitation and restoration of the landfills project was further funded through the 2007-2013 Cohesion Fund.

17. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

Yes: Yes

No:

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

The Waste Management Plan for the Maltese Islands 2014-2020, which was adopted in January 2014 on the eve of the first Circular Economy Package, which was repealed and proposed again in 2015, had an already forward-looking approach focusing on Resource Efficiency. Extensive consultation was carried out during various phases of its compilation, with both public and private stakeholders, in some cases also taking the form of one-to-one meetings. Consulted stakeholders originated from diverse sectors, including business, social and environmental fields. Key players involved in waste management were also consulted, be they state or non-state actors. Likewise opinions of policy makers and regulators were taken into consideration to encompass economic, social and environmental perspectives.

The focus of the plan is on diverting MSW and bio-waste from landfill by upgrading the capacity of existing facilities and investing in new infrastructure. Some of the proposals are already being executed while others are in the pipeline.

Some of the executed measures include:

- Improving the quality of waste received at the Sant'Antnin facility to improve operation and increase throughput. This is being achieved through the kerbside separate collection of organic waste from households which started in 2015.
- A waste Transfer Station was opened in Gozo towards the end of 2015. Its scope is to receive, sort, process and temporarily store and transfer waste originating from Gozo and Comino to Malta, with the scope of sorting dry recyclables, and separating MSW into organic waste for biological treatment, RDF and rejects.
- A mechanical Biologicval Treatment Plant was inagurated in February 2016 for the North of Malta to treat MSW prior to landfilling. The facility also caters for the biological treatment of plant and animal manure. From MSW, the organic fraction and Refuse Derived Fuel (RDF) are extracted from the remaining waste. Organic waste is then treated through the digestion plant to generate electricity and a compost digestate.

With regards to RDF, rejects from MBT plants and residual MSW, the following options are being considered apart from landfilling:

- Local Energy Recovery (Energy from Waste Facility)
- Export for Energy Recovery

Another proposal is to review the local waste collection systems to increase efficiency, while at the same time reduce waste sent to landfill. The intention is to increase the

weekly collections of separately collected organic waste and consider the possibility of adding more localities to the Organic Waste Project. Reduce further the collection of mixed MSW to once a week. Where feasible, increase the kerbside collection of dry-recyclables. Promote further the use of outputs from the treatment of separately collected organic/bio-waste.

Landfill management and funding

18. Is private funding available to support implementation of landfill management projects?

Yes:

No: No

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

Although no specific private funding supports the implementation of landfill management projects, Wasteserv is the operator of the last resort in the Maltese Islands where some of the companies' responsibilities include landfill management. Wasteserv is supported by national funds however a part of the company's finances come from gate fees for the waste it processes at the landfill.

19. Is regional funding available to support implementation of landfill management projects?

Yes:

No: No

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

20. Is national funding available to support implementation of landfill management projects?

Yes: Yes, a substantial amount of Wasteserv's budget as a landfill operator comes from the central government through national budget.

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information?

21. Is European funding available to support implementation of landfill management projects?

Yes: Yes, in the past Wasteserv was awarded funding for landfill rehabilitation projects.

No:

If yes, please specify the sources and amount of funding scope and and/or other sources of information:

MESDC Lead – Waste to Energy – ERDF - €200,000 study

In the past Wasteserv obtained EU funding through ERDF for the rehabilitation of Zwejra, and Qortin landfills

22. Are governmental actions available to attract funding for landfill management projects?

Yes: Yes

No:

If yes, please specify which actions:

Governmental actions to attract funding include:

- Operational Programme 1 – Fostering a competitive and sustainable economy to meet our challenges. Mainly through Specific Objective 1, under the Thematic objective 06, which focus is on: Increase recycling of waste and reduce the volume of waste going to landfill through investment in waste management related infrastructure including the rehabilitation of closed landfills for other non-waste related uses as well as education campaigns. [Cohesion Policy 2014-2020]
- The Waste Management Plan for the Maltese Islands 2014-2020, highlights the importance of upgrading existing capacity and investing in new infrastructure. It also lists proposed changes to existing capacity and development of new infrastructure.
- The Waste Prevention Programme within the Waste Management Plan, also lists the priority areas and actions that the Government will undertake in order to move towards sustainable waste management.

23. Are governmental actions needed to attract funding for landfill management projects?

Yes: Yes

No:

If yes, please specify which actions: Further actions are needed to continue providing incentives, co-financing and increase in capacity building.

Landfill mining activities and policy issues

24. Which LFM projects/programmes/networks occur in your country?

Please provide a list of the active projects/programmes/networks and involved actors (industrial/academic/public): None

25. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Yes:

No: No

If yes, please provide a short description of these projects (landfill, scale, main outcome) and where more information can be found

26. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

Yes:

No: No

If yes, please specify the document and the phrasing (translated into English) of the section in which LFM is mentioned:

27. Have there been any specific policy discussions or initiatives on LFM during recent years?

Yes:

No: No

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions:

28. Which potential benefits (e.g. economic, environmental, societal...) do the consulted authorities choose to put forward when it comes to LFM implementation?

Please summarize the outcome of your discussions with the authorities: Since this is a relatively new concept for Malta and there have been no local studies, ERA and Wasteserv seek to increase its knowledge of Landfill Mining techniques.

29. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Please summarize the outcome of your discussions with the authorities: Since this is a relatively new concept for Malta and there have been no local studies, ERA and Wasteserv seek to increase its knowledge of Landfill Mining techniques.

30. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

Please summarize the outcome of your discussions with the authorities:

- Planning Authority and Planning Laws
- Environmental Impact Assessments (EIAs)

31. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

If yes, why and which types of incentives do they have in mind:

If no, why is that:

Since this is a relatively new concept for Malta and there have been no local studies, ERA seeks to increase its knowledge of Landfill Mining techniques.

Appendix 6: complete questionnaire of the Netherlands

Governance and organisational aspects

1. Responsible authority for waste management policy

Level: both national and regional (provinces)

Name: Ministry of Infrastructure and Environment ; 12 provinces of the Netherlands

Website: <http://www.rwsleefomgeving.nl/onderwerpen/afval/storten/bssa/>

Under which governmental ministry is the authority situated:

Ministry of Infrastructure and Environment

2. Responsible authority for permitting of operational landfills

Level: Regional

Name: 12 provinces of the Netherlands

Website: <http://www.ipo.nl/>

Under which governmental ministry is the authority situated: It's under authority of the provinces

3. Responsible authority for control of operational landfills

Level: Regional, same as 5

Name:

Website:

Under which governmental ministry is the authority situated:

4. Responsible authority for monitoring of closed landfills

Level: Regional. For non-sanitary landfills at present provinces and a select number of (big) municipalities are responsible. In the future all individual municipalities will become responsible (Environment and planning act, currently being developed). For closed sanitary landfills the province is responsible.

Name: Individual provinces and municipalities

Website: For provinces <http://www.ipo.nl/> for municipalities: <https://vng.nl/>

Under which governmental ministry is the authority situated: Ministry of Infrastructure and Environment

5. Responsible authority for groundwater remediation:

Level: Regional, provinces and a select number of (big) municipalities. In the future individual municipalities may become responsible (Environment and planning act, currently being developed).

Name: 12 provinces of the Netherlands

Website: <http://www.ipo.nl/>

Under which governmental ministry is the authority situated: Ministry of Infrastructure and Environment

6. Responsible authority for soil remediation:

Level: Regional. At present provinces and a select number of (big) municipalities are responsible. In the future (Environment and planning act, currently being developed) individual municipalities may become responsible.

Name: Individual provinces and municipalities

Website: For provinces <http://www.ipo.nl/> for municipalities: <https://vng.nl/>

Under which governmental ministry is the authority situated: Ministry of Infrastructure and Environment

7. Responsible authority for mineral and natural resource supply

Level: National: Ministry of Economic affairs. Only responsible for coal, oil and natural gas. Regional: the provinces are responsible for mining of gravel, sand and clay.

Name: Ministry of Economic Affairs.

Website: <https://www.rijksoverheid.nl/ministeries/ministerie-van-economische-zaken>

Under which governmental ministry is the authority situated: Ministry of Economic Affairs

8. In view of the new policy initiatives on circular economy, is there a link or collaboration between the Responsible authority for mineral and natural resource supply and the Responsible authority on waste and landfill management?

Yes.

There is a transition agenda Circular Economy in which ministries of Economic Affairs and Infrastructure and Environment work together. In 2016 the government issued a policy document in which it proposes a 100% Circular Economy in the Netherlands by 2050. One of the first milestones is a 50% reduction in the use of primary raw materials 2030. <https://www.government.nl/documents/leaflets/2016/09/22/a-circular-economyin-the-netherlands-by-2050> "To accelerate the transition to a circular economy, the government plans to draw up "transition agendas" in which the five following chains and sectors have the highest priority: biomass and food, plastics, manufacturing, construction, and consumer goods. We, as the government, will support these priority chains and sectors so that by 2050 they will only be using sustainably produced, renewable or generally available raw materials, and be generating as little residual waste as possible. Another of our aims is for products that reach their end of life to undergo high-quality recycling and be used to make new products. Smart return and collection systems will be set up to this end."

Available landfill information and data

9. Are there any national landfill surveys and/or landfill databases on both operational and "old" landfills available in your country?

Yes, for both information is available.

Operational landfills

Operational landfills are monitored every year, since 1991, with a nearly 100% response. A yearly questionnaire is conducted by the Working Group on Waste Registration (Werkgroep afvalregistratie), in which several interest groups participate (Ministry of Infrastructure & Environment & Ministry of Economic Affairs, Association of waste treatment companies (BVOR etc), Interprovinciaal Overleg (IPO) & Rijkswaterstaat Leefomgeving (Bodem+ en Uitvoering Afvalbeheer)). Yearly reports are available that provide a survey of the annual amount of waste processed

by landfills, waste incinerators, vegetable-fruit-garden waste digesters, composting installations, treatment of soils sludge material. <https://afvalcirculair.nl/onderwerpen/helpdesk-afvalbeheer/publicaties/downloads/afvalverwerking-6/>

Reference: Afvalverwerking in Nederland gegevens 2015, Rijkswaterstaat

Former landfills

In the late 1980's a broad preliminary investigation was conducted to collect information on the existing landfills in the Netherlands; VOS (Verkennend Onderzoek Stortplaatsen). This investigation predominantly focussed on the location of the landfill sites and to get an idea on the financial consequences. Subsequently in the following years more investigations were conducted. For these non-sanitary ('former') landfills there was a big survey between 1995-2005. In total 3800 landfills were investigated. The results are described in various NAVOS reports. All reports related to NAVOS sites can be found on this website. The main objective of this NAVOS survey was to determine (potential) risks for humans and/or groundwater. In this survey only presence and/or thickness of clean soil top layer and groundwater quality was measured and no measurements were done on the composition or quality of the actual landfill material.

The NAVOS operation focussed on the financial evaluation and estimated a budget that was required for remediation of these landfill sites. Besides gaining insight in the financial consequences of the aftercare of these former landfill sites the project also focussed on organisational aspects as well as technical and policy issues. One of the results is a tool to calculate the financial burden of aftercare at the site.

<http://www.nazorgstortplaatsen.nl/VM/Algemeen.aspx>

In total 3,800 sites were investigated. The results are described both in individual reports and in an overall report. The actual data is managed by each individual province. There is no (one single) database available that provides information from all sites.

10. If applicable, please specify the following data on municipal solid waste (MSW) landfills

Operational landfills (number, deposited volume, remaining landfill volume): 20

Closed sanitary landfills (number, deposited volume): 26

Closed non-sanitary landfills (number, deposited volume): more than 7000

Number of closed landfills in aftercare treatment/monitoring: 220 (former NAVOS sites)

This information on the sanitary landfills was provided by the Working Group Waste Registration (*Werkgroep Afval Registratie*). Information on the former non-sanitary landfills in aftercare was obtained through the internal questionnaire from the ministry to the provinces.

Furthermore these websites provide an overview of all sanitary landfill sites categorized per province. It provides the address, information on the operator (beheerder), the operational status and whether dangerous waste is dumped.

<https://www.bodemplus.nl/onderwerpen/bodem-ondergrond/verwerking-grond/stortplaatsen/stortplaatsen/>

11. If applicable, please specify the following data on mono and industrial landfills

Mono deposits of gypsum (operational/closed, number, volume):
Mono deposits of fly ash (specify) (operational/closed, number, volume):
Mono deposits of red mud (operational/closed, number, volume): -
Mono deposits of coal mining waste (operational/closed, number, volume):
Mono deposits of goethite (operational/closed, number, volume):
Mono deposits of mining waste (specify) (operational/closed, number, volume):
Other mono landfills (specify) (operational/closed, number, volume):
Other industrial landfills (specify) (operational/closed, number, volume):
Number of closed industrial/mono landfills (specify) in aftercare:
Number of industrial/mono landfills in aftercare treatment/monitoring:
Number of sludge depots:

No specific information available on a specific website. There are no (publicly available) documents nor websites which provide an overview of mono- or industrial landfills in the Netherlands. Neither is there an overview of all sludge depot sites. With regard to industrial landfill sites, there are only a few of these in the Netherlands. The list above is based on personal communications with experts in the field. An overview of all mono (industrial) landfills is interesting with regard to mining of resources. Therefore this information could be useful for future redevelopment of landfill sites as part of a circular economy.

12. Is more detailed information about the content of specific materials in different types of industrial and/or mono landfills available?

No, not available for industrial or mono landfills. This information will however be available in the Environmental permit (Wm vergunning).

Information on annual waste disposal per waste category is available for MSW.

(<http://www.rwsleefomgeving.nl/onderwerpen/afval/publicaties/downloads/afvalverwerking-6/>,

table B-3). This however only provides information based on Euralcodes. At the landfill sites, upon landfilling, the waste material is checked for the presence of certain contaminants (based on regulations) not on composition of the waste material.

Information on the composition of the waste material is relevant for possible (future) reuse. Currently in the Netherlands the major part of the materials landfilled are residues of the recycling industry and or dangerous material.

The National Waste Management Plan 2009-2017 (*Landelijk Afvalbeheer Plan*) describes the policy framework for waste management. This plan is drafted every 6-7 years.

<http://www.lap3.nl/beleidskader/21-storten/>

Reference <https://afvalcirculair.nl/onderwerpen/helpdesk-afvalbeheer/publicaties/downloads/afvalverwerking-6/>

Current landfill management and regulation

13. Is the EU landfill directive fully implemented in your country?

Yes, the following directive Directive 1999/31/EC has been implemented through the *Richtlijn 1999/31/EG van de Raad van 26 april 1999 betreffende het storten van*

afvalstoffen. However, this directive does not apply to non-sanitary landfills (landfills prior to 1996).

Some compliances for landfill sites in the Dutch legislation are stricter compared to the EU directive. For example, in the Netherlands it is obligatory that upon closure of the site an impermeable top cover is applied.

14. Which policies have been implemented into the national regulatory framework in order to reduce landfilling

Provide a list of the main instruments and regulations (e.g. landfill tax, ban on landfilling combustible/organic waste, etc.)

In 1970s there were over 1600 operational landfills, this number dropped to approximately 200 in 1980s and to 80 in 1992. Currently only 20 landfills are operational. A number of policy interventions have led to this decrease, these are listed below. Furthermore one of the most important success factors for the realisation of a successful waste management system is the 'Afval Overleg Orgaan', which was established prior to 1993. All actors of the waste management system (national, local/decentral responsible authorities and waste management companies) were a member of this committee and all possible legislative measures were first discussed and approved in this committee before being discussed in the Dutch parliament. This resulted in constructive dialogue and support for implementation and compliance of the legislation by all stakeholders. Furthermore the gradual introduction of specific bans on landfilling of specific materials (based on the best available treatment technology) was successful in reducing the amount of waste ending up in landfills. This ban prohibited the landfilling of materials if recycling was possible, landfilling is the last option in the waste hierarchy. Furthermore financial instruments were implemented by the national government; for example taxes on landfilling and 'Pay-as-you-throw' (Diftar) schemes in the collection of household waste.

Overview of most relevant Dutch legislations and guidelines in respect to landfill and landfill management:

- 1980s: Directive Controlled Dumping ('Richtlijn Gecontroleerd Storten')
- 1985: Second Directive Controlled Dumping ('Tweede Richtlijn Gecontroleerd Storten')
- 1990s: Introduction of the Environmental Management Act (Wet Milieubeheer) and the Soil Protection Act (Wet Bodembescherming)
- 1993: Landfill Directive Soil Protection (Stortbesluit Bodembescherming) implemented
- 1996: Closure of all (non-sanitary) landfills
- 1996/1997: Directive for Landfills and Waste material Bans (Besluit stortplaatsen en stortverboden afvalstoffen) introduced and implemented
- 2003: Ministry for Housing, Spatial Planning and the Environment draws up a National Waste Management Plan (*Landelijk Afvalbeheer Plan*) every six years. Currently 3rd LAP is being drafted
- 2010: implementation of (compulsory) separate collection of plastics.

15. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

Yes.

In 2005 the National investigation (*Landsdekkend Beeld Bodemverontreiniging*) listed a total of 425.000 potentially contaminated sites (<http://www.clo.nl/indicatoren/nl0257-bodemkwaliteit-en-bodemverontreiniging-beleid>). <http://www.clo.nl/indicatoren/nl0261-risicos-vanbodemverontreiniging>

Of these 37.000 sites have been remediated or otherwise dealt with. As of 2009 the total number of contaminated sites that may need further attention was 258.000 Of these possibly contaminated sites approximately 20.000 are dump sites. The actual situation as of 2012 was:

- 281 locations with immediate risks to human health
- 1513 locations with immediate risks to migration of contaminants to groundwater and risks to ecology

The following projects have provided information on contaminated sites in the Netherlands: NAVOS, Bosatex and Onderzoek Spoed locaties. Amongst the 'Spoed locaties' (Sites with potential risks for humans and/or groundwater) there are a number of former landfill sites.

<https://www.bodemplus.nl/onderwerpen/bodem-ondergrond/bodemsanering/publicaties/>

Website voor NAVOS: <http://www.nazorgstortplaatsen.nl/VM/Navos.aspx>

Website voor *Programma Spoed locaties*: <http://www.clo.nl/indicatoren/nl025816-inventarisatie-van-aantal-locaties-met-bodemverontreiniging->

Kibo (Kennis- en Innovatieprogramma Bodem en Ondergrond) is a knowledge exchange platform, facilitated by the ministry of Infrastructure and Environment.

<http://www.programmakibo.nl/nazorg-stortplaatsen/>

16. Have the authorities developed any national action plans and/or funding schemes for addressing environmental and health risks related to old landfills not eligible to the EU landfill directive?

Yes.

In the NAZorg VOormalige Stortplaatsen (NAVOS) program which was authorized by het DUIV overleg (governing bodies consultation). DUIV-overleg is a consultation between Directoraat Generaal Milieu (DGM,) Unie van Waterschappen, Inter Provinciaal Overleg (IPO) & Vereniging Nederlandse Gemeenten (VNG). In this programme direct (human, leachate and ecological) risks of non-sanitary landfills were measured. Approximately 4000 landfills were studied during 1995-2004, the results are described in various NAVOS report <http://www.nazorgstortplaatsen.nl/VM/Algemeen.aspx>.

The NAVOS research also focussed on determining the aftercare actions necessary as well as the financial consequences/financial resources needed to tackle the problem. Other aspects that were studied were the groundwater contamination, thickness and soil quality of the covering layer and Natural Attenuation processes. The results showed that in most cases no unacceptable situations had occurred, that needed urgent immediate measures (www.nazorgstortplaatsen.nl). There where necessary, appropriate measures were taken to prevent spread of contamination and to eliminate human and ecological risks.

Reference: Achtergronden bij het advies Nazorg voormalige stortplaatsen (NAVOS report, april 2005).

As there was no national legislation in place for former landfill sites, the individual provincial authorities developed their own legislation based on the Law on Environmental Management (Wet milieubeheer) and Law on soil protection (Wet bodembescherming). Examples of specific legislation developed by the individual authorities can be found for example in Provinciale milieuverordening Noord-Brabant 2010, Beleidsnota Bodem 2012 Gelderland, Uitvoeringsprogramma voor de ondergrond Overijssel, Beleidsregels hergebruik voormalige stortplaatsen 2007 municipality Groningen. These provincial laws were applicable to all non-sanitary landfills (also those that didn't pose an actual risk). For example the province of Brabant uses this law to prohibit the use/redevelopment of former landfill sites, unless certain precautions are abided by. Contrary to what one would expect this prohibition results in stimulation of redevelopment of these sites.

Programma Spoedlocaties was executed in order to create an overview and tackle all contaminated sites that need Urgent remediation (Spoed).

17. Which policies have been implemented into the national regulatory framework in order to reduce landfilling? Provide a list of the main instruments and regulations (e.g. landfill tax, ban on landfilling combustible/organic waste, etc.)

In 1970s there were over 1600 operational landfills, this number dropped to approximately 200 in 1980s and to 80 in 1992. Currently only 20 landfills are operational. A number of policy interventions have led to this decrease, these are listed below. Furthermore one of the most important success factors for the realisation of a successful waste management system is the 'Afval Overleg Orgaan', which was established prior to 1993. All actors of the waste management system (national, local/decentral responsible authorities and waste management companies) were a member of this committee and all possible legislative measures were first discussed and approved in this committee before being discussed in the Dutch parliament. This resulted in constructive dialogue and support for implementation and compliance of the legislation by all stakeholders.

Furthermore the gradual introduction of specific bans on landfilling of specific materials (based on the best available treatment technology) was successful in reducing the amount of waste ending up in landfills. This ban prohibited the landfilling of materials if recycling was possible, landfilling is the last option in the waste hierarchy.

Furthermore financial instruments were implemented by the national government; for example taxes on landfilling and 'Pay-as-you-throw' (Diftar) schemes in the collection of household waste. Overview of most relevant Dutch legislations and guidelines in respect to landfill and landfill management:

- 1980s: Directive Controlled Dumping ('Richtlijn Gecontroleerd Storten')
- 1985: Second Directive Controlled Dumping('Tweede Richtlijn Gecontroleerd Storten')
- 1990s: Introduction of the Environmental Management Act(Wet Milieubeheer) and the Soil Protection Act (Wet Bodembescherming)
- 1993: Landfill Directive Soil Protection (Stortbesluit Bodembescherming) implemented
- 1996: Closure of all (non-sanitary) landfills
- 1996/1997:Directive for Landfills and Waste material Bans(Besluitstortplaatsen en stortverboden afvalstoffen) introduced and implemented

- 2003: Ministry for Housing, Spatial Planning and the Environment draws up a National Waste Management Plan (Landelijk Afvalbeheer Plan) every six years. Currently 3rdLAP is being drafted
- 2010: implementation of (compulsory) separate collection of plastics.

18. Are there any specific investigations on occurrence and management of contaminated areas incl. landfills available in your country?

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red, that needed urgent immediate measures (www.nazorgstortplaatsen.nl). There where necessary, appropriate measures were taken to prevent spread of contamination and to eliminate human and ecological risks.

Reference: Achtergronden bij het advies Nazorg voormalige stortplaatsen (NAVOS report, april 2005).

Aanpak grondwater	Actieve aanpak d.m.v saneren en/of beheersen	Nader onderzoek & Monitoring	Geen actieve maatregelen	Totaal (afgerond)
Aanpak deklaag	Gem. kosten/loc. e: € 85.000,00 j: € 25.000,00/j	Gem. kosten/loc. e: € 15.000,00 j: € 3.000,00/j		
Aanbrengen of vervangen deklaag	Aantal: 120 e: € 47 milj. j: € 3 milj./j	Aantal: 920 e: € 291 milj. j: € 2,8 milj./j	Aantal: 160 e: € 51 milj. j: € 0 /j	Aantal: 1200 e: € 389 milj. j: € 6 milj./j
Aanvulling deklaag	Aantal: 80 e: € 14,8 milj. j: € 2 milj./j	Aantal: 1840 e: € 212 milj. j: € 5,5 milj./j	Aantal: 520 e: € 49 milj. j: € 0 /j	Aantal: 2440 e: € 276 milj. j: € 7,5 milj./j
Geen aanpassingen nodig	Aantal: 40 e: € 3,4 milj. j: € 1 milj./j	Aantal: 160 e: € 2,4 milj. j: € 0,5 milj./j	Aantal: 160 e: € 0 j: € 0/j	Aantal: 360 e: € 5 milj. j: € 1,5 milj./j
Totaal (afgerond)	Aantal: 240 e: € 65 milj. j: € 6 milj./j	Aantal: 2920 e: € 505 milj. j: € 9 milj./j	Aantal: 840 e: € 100 milj. j: € 0 milj./j	Aantal: 4.000 e: € 670 milj. j: € 15 milj./j

Reference: Achtergronden bij het advies Nazorg voormalige stortplaatsen (NAVOS report, april 2005).

As there was no national legislation in place for former landfill sites, the individual provincial authorities developed their own legislation based on the Law on Environmental Management (Wet milieubeheer) and Law on soil protection (Wet bodembescherming). Examples of specific legislation developed by the individual authorities can be found for example in Provinciale milieuverordening Noord-Brabant 2010, Beleidsnota Bodem 2012 Gelderland, Uitvoeringsprogramma voor de ondergrond Overijssel, Beleidsregels hergebruik voormalige stortplaatsen 2007 municipality Groningen. These provincial laws were applicable to all non-sanitary landfills (also those that didn't pose an actual risk).

For example the province of Brabant uses this law to prohibit the use/redevelopment of former landfill sites, unless certain precautions are abided by. Contrary to what one would expect this prohibition results in stimulation of redevelopment of these sites. Programma Spoedlocaties was executed in order to create an overview and tackle all contaminated sites that need Urgent remediation (Spoed).

20. Have there been any recent policy discussions about the EU landfill directive or the new circular economy package and its implications on landfill management in your country?

No

Landfill management and funding

21. Is private funding available to support implementation of landfill management projects?

Yes: Greendeal Duurzaam stortbeheer is a good example where private funding from the landfill operators/owners has resulted in the implementation of landfill management pilots that focus on developing new techniques for future landfill management. The funding is (predominately) private and in the 'Green deal' (see question 25) between Ministry of Environment & Infrastructure, provinces and landfill operators the legislative conditions for the pilots is arranged. The Initiative Sustainable Landfill Management (*Initiatief Duurzaam Stortbeheer*, abbreviated in dutch: iDS) is a scientific research programme into sustainable landfill management coordinated by TU Delft <http://duurzaamstortbeheer.nl/english-page/>)

22. Is regional funding available to support implementation of landfill management projects?

Yes: there are/were regional initiatives, e.g. funding for reuse/redevelopment of landfill sites

<https://www.fondswervingonline.nl/nieuws/subsidie-voor-onderzoek-naar-hergebruik-vanstortplaats>,

<http://www.nazorgstortplaatsen.nl/VM/docs/Brochure%20Ontwikkelingsmogelijkheden%20op%20vo>

[ormalige%20stortplaatsen,%20februari%202011%20\(Overijssel\).pdf](http://www.nazorgstortplaatsen.nl/VM/docs/Brochure%20Ontwikkelingsmogelijkheden%20op%20vo)

Many former landfills have been redevelopment as part of landfill management, in the Netherlands this is common practice. Besides redevelopment many of the former landfill sites were already being used for living, nature, farming etc.

Many provinces stimulate the redevelopment of landfill sites, though under certain boundary preconditions. Precautionary measures and a number of prohibitions were put in place. In the past, for example the province of Brabant has taken part in a number of pilots with various landfill management measures. These are a few examples:

- Zwaaiikom Oosterhout: park & residential area
- Bavel/Dorst Breda: bussinesspark
- Moergestelseweg Oisterwijk: sportspark
- Vloeiweide Zundert: nature reserve
- Meerendonk 's -Hertogenbosch: afvalmining
- More examples can be found on the website nazorgplaatsen (see below)

<http://www.nazorgstortplaatsen.nl/VM/Praktijkvoorbeelden.aspx>

Reference: <http://www.nazorgstortplaatsen.nl/VM/Praktijkvoorbeelden.aspx>

23. Is national funding available to support implementation of landfill management projects?

No

24. Is European funding available to support implementation of landfill management projects?

Yes: current projects are COCOON and Rawfill. Though, as far as we know, no actual funding for pilots is available for Dutch projects within these EU projects.

25. Are governmental actions available to attract funding for landfill management projects?

Yes: Greendeal sustainable landfill management

“The Green Deal approach in the Netherlands is an accessible way for companies, other stakeholder organizations, local and regional government and interest groups to work with Central Government on green growth and social issues.

The aim is to remove barriers in order to help sustainable initiatives get off the ground and to accelerate this process where possible. Central Government plays a key role in this area. Initiatives often start from the bottom up, in response to societal dynamics”

<http://www.greendeals.nl/stortplaatsen-krijgen-water-en-lucht/>

As part of the Green Deal sustainable landfill management a number of pilots are currently being conducted to develop new aftercare techniques/options. The three pilots are:

- Noord-Brabant (Bergen op Zoom, landfill Kragge II)
- Noord-Holland (Hollands Kroon, landfill Wieringermeer)
- Flevoland (Almere, landfill Braambergen)

The main focus is to develop/validate techniques to reduce/optimize (everlasting) aftercare for landfill sites. For more information see

<http://duurzaamstortbeheer.nl/englishpage/>.

Other landfill sites have been given temporary permission to deviate from current regulations, in respect to capping of the landfill with an impermeable layer, until the results from the pilots are evaluated and may possibly lead to new regulations/legislation.

Reference:<http://duurzaamstortbeheer.nl/wp-content/uploads/2016/06/Wijziging-Uitvoeringregeling-Stortbesluitbodembescherming-3-6-16.pdf>

26. Are governmental actions needed to attract funding for landfill management projects?

Yes: already in progress. See above

Landfill mining activities and policy issues

27. Which LFM projects/programmes/networks occur in your country?

Please provide a list of the active projects/programmes/networks and involved actors (industrial/academic/public):

No other networks exist with regard to Landfill mining project apart from the current Interreg project Cocoon.

28. Are any pilot or full-scale projects undertaken in which the feasibility and performance LFM is demonstrated/tested in practice?

Recently an inventory was made by Royal Haskoning DHV (RHDHV), of various pilots with regard to sustainable landfill management and mining of landfills. A few examples of mining of both non- and- sanitary landfill sites is provided below:

- Boeldershoek in Hengelo (Twence). Sanitary landfill, mining feasible for flammable materials and metals, led to tax-reduction,
- Meerendonk (Municipality of Den Bosch): Sanitary landfill, pilot for mining material, result showed mining not feasible with current techniques.
- Tilburg/Kemperbaan (Municipality of Tilburg): non-sanitary landfill, mining not feasible

as there was too much non-reusable material and landfill remediation was necessary.
Reference: RHDHV report 2015; Verkenning verduurzaming en mining voormalige stortplaatsen in Nederland.

The pilots showed that it is technically possible to mine a former landfill, but in successful projects the main aim was remediation or redevelopment. Recycling of raw materials was at most a secondary activity/goal. Many landfill mining projects have been conducted in-house by landfill operators, where no information is publicly available. Important factors that play a part in the success of these mining projects are: create space within the facility, refund of taxes, information available on (recently) dumped waste, possibilities for redevelopment of the site. Important factors that played a part in the failure of the mining projects are, presence of contamination (including asbestos) and the possibilities of the available techniques.

29. Does LFM occur in any national policies in your country (e.g. waste plans, raw material strategies, environmental programmes, etc.)?

No

30. Have there been any specific policy discussions or initiatives on LFM during recent years?

No

If yes, please provide a short description in terms of the main topics addressed, actors involved and the outcome of the discussions.

31. Which potential benefits (e.g. economic, environmental, societal ...) do the consulted authorities choose to put forward when it comes to LFM implementation?

Please summarize the outcome of your discussions with the authorities:

There are a number of initiatives which show potential benefits of implementation of landfill management (redevelopment). An example is in the province of Zuid-Holland where a landfill site is covered with PV-panel foil for solar energy production. The results so far show an economic benefit. <https://www.zuid-holland.nl/onderwerpen/energie/zonne-energie/@8843/opwekking-zonne/>.

With regard to mining projects, thus far (in most pilots) there was no business case for solely landfill mining, see question 28. But there are good examples where mining of a landfill was successfully combined with the remediation and/or redevelopment of a landfill site (reference RHDHV report 2015 'Verkenning verduurzaming en mining voormalige stortplaatsen in Nederland').

32. What concerns risks and uncertainties, do the authorities stress regarding LFM projects and how do they think that such issues should/could be dealt with?

Please summarize the outcome of your discussions with the authorities:

The authorities mention that landfill management is already vastly implemented in the Netherlands. No specific risks or uncertainties were mentioned with regard to redevelopment provided restrictions are put in place if the site is (slightly)

contaminated. With regard to landfill mining it was mentioned that up till now in most cases no viable business case has emerged from landfill mining.

33. Can the authorities point out any current policies or regulations that could be applicable for facilitating a LFM operation?

Please summarize the outcome of your discussions with the authorities:

Landfill management is already part of current practice at sanitary operational landfill sites and is stimulated at non-sanitary landfill sites.

At the moment, the Initiatief Duurzaam Stortbeheer is the most important development on landfill management policies for sanitary landfills. The 'Crisis en Herstel' law facilitated the implementation of a new landfill aftercare approach put forward by the landfill operators. This approach focusses on a sustainable method for closure of landfill sites and is described in full detail on the website

<http://duurzaamstortbeheer.nl/english-page/>

Currently pilots are being conducted in 3 sites (Almere, Bergen op Zoom, Wieringemeer). The results of these pilots will have a profound effect on current landfill legislation as the research is focussed on reducing the aftercare costs and timeframe.

The law that describes the exemption of the pilot sites is

<http://duurzaamstortbeheer.nl/wp-content/uploads/2016/06/Wijziging-Uitvoeringregeling-Stortbesluit-bodembescherming-3-6-16.pdf>

Furthermore for non-sanitary landfills (NAVOS sites), there are currently two developments taking place:

1) As described in the 'Convenant Bodem en Ondergrond 2016-2020', the responsible government agreed to investigate possibilities to reduce/optimize aftercare for contaminated sites (including former landfill sites).

2) The Netherlands is working on a new environmental law the 'Omgevingswet', which will be implemented in the future. In this new law the municipalities become (solely) the responsible authority for soil protection. This means that provinces will no longer be the responsible authority for former landfills (NAVOS). In preparation for this change the policies on landfill management of different provinces are being harmonised.

34. Do the authorities express any interest in developing new policy instruments for facilitating LFM implementation?

Yes, see 33