

THE FLEMISH MINISTER FOR THE ENVIRONMENT, NATURE AND AGRICULTURE

MEMORANDUM TO THE MEMBERS OF THE FLEMISH GOVERNMENT  
(coordinated version of the Decision of the Flemish Government of 16 October 2015 – OVAM website  
version)

Re: Sustainable resource management of landfills<sup>1</sup>

## 1. Situation

In implementation of the Flemish Coalition Agreement 2014-2019 (p.79: ... recovering, among other things, resources from landfills...) the Policy Note on the Environment 2014-2019 mentions (p.55): 'A sustainable resource management of landfills, based on an integrated approach to soil remediation, must provide a substantial answer to the need for raw materials and space. To this end, I am implementing the vision on enhanced landfill mining, I am having an inventory made of landfills with potential and I am carrying out demonstration projects at landfills where soil remediation is needed.' The note *Vision 2050 – A long-term strategy for Flanders* stipulates among the strengths in Flanders when it comes to smart specialisations in the circular economy (p.42): 'Enhanced Landfill Mining to extract valuable resources from landfills and temporarily store products which contain valuable materials until recycling is economically profitable'. This concept note comprises the vision and main objectives with respect to sustainable resource management of landfills.

For many years, Flanders has been an exemplary region when it comes to waste recycling. Over 70% of household waste is collected separately, reused and/or recycled. No other region in the EU does better. Less than 2% of this waste ends up at landfills. For industrial waste a similar trend can be observed. These successful results have led to a situation where only 28 licensed landfill sites are operational in Flanders in 2015. On the other hand, there are 2,033 former landfill sites (OVAM inventory, 2015). Most of these were closed before 1977 (mergers of municipalities) or 1984 (end of transition measures to stricter regulations). Even though the size of each landfill site is usually limited to less than 1 hectare, the total landfill area is estimated at 87.91 km<sup>2</sup>, i.e. the surface area of a major Flemish town. These are often underused sites, and this in a densely populated region with heavy pressure for space. Therefore, there is a need for a general vision on the redevelopment possibilities of landfill sites which are currently rather static storage places for problem materials, sometimes part of an aftercare phase.

Recent research conducted by OVAM has shown that (former) landfill sites could be more than a potential source of pollution and neglected land. The recovery of the waste stored and the underused space are no longer unrealistic scenarios. The total surface area of more than 80 km<sup>2</sup> indicates the importance of this potential space. Thanks to the technological developments and in view of the strong need for a liveable environment and materials, landfill sites could offer

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<sup>1</sup> During Interreg Europe COCOON-project rephrased as Dynamic Landfill Management: sustainable integration of resources (Materials, Energy, Land, Water) from landfill sites into the Circular economy. This includes the safe storage in view of a high valorization potential (ELFM), providing interim uses and bridging the gap to a final safe situation (Sustainable Landfilling), hereby respecting the most stringent social and ecological criteria.

solutions instead of constituting a threat. There is added value for several policy areas and policy levels.

Flanders has expressed the ambition to take important steps towards a 'circular' economy by 2020 with a use as low as possible of materials, energy, water and space with as little impact as possible on the environment and nature in Flanders and the rest of the world. The concept of 'Sustainable Materials Management' goes beyond the boundaries of traditional waste management to include the management of the complete materials cycle. We base ourselves on the vision that today's waste (Urban Mining) and waste from the past (Landfill Mining) should become the raw materials for a green circular economy.

However, until now there has not been an integrated policy for landfill sites (either in the EU or elsewhere) which comprises a systematic approach in a long-term time frame. The new sustainable resource management of landfills (Enhanced Landfill Management & Mining or ELFM<sup>2</sup>) achieves this integration and hence contributes to the new policy guidelines on the circular economy, sustainable development of space and mobility.

## **2. Preparatory OVAM research**

Over the past three years, during the development of the new vision on sustainable resource management of landfills and the ELFM concept, OVAM has carried out various studies, which have been explained at national and international forums. In this sense, OVAM is currently the only government institution in the EU which has performed systematic research into the problem of landfill sites, the circular economy, soil remediation and the supply of land and raw materials. In this context, concrete test projects have been performed in addition to basic research on economic, legal and technological aspects.

OVAM has introduced a method which can be summarised as consisting of three main areas: an inventory of landfill sites in Flanders (Mapping), a detailed characterisation of individual landfill sites (Surveying) and extraction/valorisation (Mining). This simplified breakdown is in line with the work process in traditional mining and enables OVAM to get a good idea of the available supply (resources) and mining potential (reserves).

An additional component which is less relevant in traditional mining is that of the costs in the case of non-mining, i.e. the potential soil remediation. Within the context of globalisation, sustainable development and the circular economy, there is also debate on the so-called externalities (external costs), which are not – or insufficiently – taken into account in traditional mining when the environmental impact is calculated. In economic research, these are pointed out in the social cost-benefit analysis, but further research is necessary in order to better estimate the impact of these phenomena.

Where the technical aspects are concerned, experiments and tests have been (or are being) performed for each component in order to gain practical experience. On a global level only very limited information is available. This OVAM research has already resulted in a number of important findings, which have led to concrete achievements.

The proposed method (Mapping, Surveying, Mining) has been tested, with positive results. A start has been made to translate this approach into the standard procedures of soil remediation. Additional test projects must enable us to refine and provide better support for these technical environmental guidelines. The usefulness and value of this method was also reflected in the drawing up of the first version of a decision support model (Flaminco). Thanks to this development, OVAM is able to assess the 2,000 landfill sites in a structured manner. The system used is quoted in international publications and included in the research on material flow and resource analysis that is being performed by the Doppler institute of the University of Vienna on

behalf of the United Nations.

In practice, an additional inventory in the field has been started. On the one hand, the existing data files are being completed and validated and, on the other hand, additional landfill sites are being located. With a view to the characterisation of individual landfill sites, tests have been performed at approximately ten locations. To this end, diverse geophysical techniques have been applied and their possible applications have been studied. This research is being continued with a view to drawing up a code of best practice for landfill site surveys in the framework of ELFM. Separation tests are performed because these allow OVAM to gather important information about the average composition and quality of the dump material. An additional effect is that they provide opportunities for the development of more efficient separation technology. In Table 1 a schematic overview is provided of OVAM's test projects.

Objective	Description	Result	Location
Characterisation	Geophysical prospecting	Geometry of landfill	West Flanders
	Geophysical prospecting	Geometry of landfill assessment # techniques	Limburg
	Geophysical prospecting	Geometry of landfill assessment # techniques	Limburg
	Geophysical prospecting	Geometry of landfill assessment # techniques	Flemish Brabant
	Geophysical prospecting	Density of landfill	East Flanders
	Remote sensing	Filling history	Flemish Brabant
	Remote sensing	Temperature measurements	Antwerp
Waste to Materials	Off site: excavation/separation	# flows	West Flanders
	Off site: excavation/separation	coal	Limburg
	Off site: excavation/separation	# flows	Antwerp
	Off site: excavation/separation	# flows	East Flanders
	Off site: excavation/separation	# flows	East Flanders
	On site: leaching	recyclate	confidential
Waste to Energy	Off site: excavation/separation	RDF	West Flanders
	On site: gas extraction	Methane	# projects
	On site: solar panels	Electricity	# projects
Waste to Land	Excavation/(partial) removal	Residential living	West Flanders
	Excavation/(partial) removal	Industrial area	Antwerp
	Excavation/(partial) removal	New landfill space	Antwerp
	Solidification	Salix cultivation	West Flanders
	Isolation/processing of waste	Industrial area	East Flanders
	Isolation/processing of waste	Container terminal	East Flanders
	Isolation/processing of waste	Buffer basin	Flemish Brabant

Table 1: Overview of test projects

Thanks to this research, OVAM has already been able to deal with several ex-officio remediations

of landfill sites by applying the ELFM principles. These experiences allow for an accurate description and analysis. The dissemination of this information and the sharing of knowledge are crucial in this new policy component. That is why OVAM participates in the Flemish ELFM consortium and plays an active role in the upscaling to the European level with the creation of Eurelco.

Besides performing its own research, OVAM also closely follows external (Flemish and international) initiatives in the area of ELFM. The research project '*Closing the Circle*' (CtC), which is aimed at the technological breakthroughs that are necessary to make the ELFM concept possible, is an example of such a project. This project also illustrates the combined action of diverse actors with their specific roles in the development of ELFM. We distinguish between private actors (environmental companies), research institutes, the population and the public actors. The interwoven nature of roles and functions is also described as the quadruple helix model. Among other things, OVAM participates in the ELFM consortium. The experience gained in this project and the results are monitored by OVAM. Conclusions are drawn with a view to other projects in Flanders and the ELFM policy to be implemented. In other words: the authorities are involved, but it is a purely private initiative. In fact, in 2014 the consortium was expanded so that the Flemish Eurelco members (in addition to the initial CtC participants) would also be part of this network.

### 3. Current policy insights

The waste legislation and landfill policy are based on European directives which, besides waste prevention, are aimed at a maximum reintroduction into the materials cycle. Within the existing waste hierarchy, the landfilling of waste is the last and least preferable option. In this respect, the EU policy uses Lansink's ladder, in which the following order of preference is established: waste prevention, reuse, recycling, incineration (with energy recovery) and landfilling. The last two options are described as final disposal and imply that the waste is finally removed from the cycle.

This permanent storage is an important condition. Therefore, the construction and operation of landfill sites is aimed at reducing the harmful impact on the environment as much as possible. Since the 1980s, this has resulted in a location policy (in which less vulnerable areas with a natural hydrogeological barrier have preference) and, on the other hand, in a waste-oriented approach. In the latter case, the dump material is isolated by means of containment and drainage layers. There is also the possibility for highly leachable waste to be stored in even more isolated zones or to be additionally immobilised. These measures are aimed at reducing the impact.

In cases where protective measures are absent, are failing or are not having the desired effects, soil remediation is the safety net. The general tendency in remediation concepts is to focus on repairing or installing the capping – the so-called IBC approach: Containing, Maintenance, Monitoring. These concepts are not aimed at the recycling of the dump material and the landfill area. In some cases the aforementioned practices are even a hindrance, resulting in both the content and the surface area of landfill sites remaining un(der)used. The new approach is to treat the (former) landfill sites as a dynamic reserve. This approach fundamentally differs from traditional visions on waste management and the remediation of landfill sites.

The approach proposed by OVAM is based on the ELFM concept which was developed in Flanders and expanded with a management component under the impulse of OVAM, named and internationally promoted as ELFM<sup>2</sup>. The main objective is the maximum reintroduction of the landfill sites into the materials cycle and as space in order to contribute to a sustainable resource management. Three important elements can be distinguished in this process: the content of the landfill, its surface area and its surroundings. The properties of the interaction

between these three elements direct the sustainable resource management in time and space.

This breakdown also shows the possible contributions to the transition to the circular economy. Material recovery must be supported by a broader material flow analysis and its effects are felt at the EU level, especially when it comes to the supply of scarce and valuable raw materials (*Roadmap to a resource efficient Europe*). The spatial impact has a rather regional character and fits into the ambitions to reduce the occupied space (*green paper on the spatial policy plan for Flanders*). The preservation of drinking water supplies has a rather local impact, but the supply of drinking water has been indicated as a future bottleneck worldwide. From a global perspective, landfills can contribute to the climate problem with the production of greenhouse gases. However, the contribution from the Flemish landfills is limited thanks to the waste policy on organic flows (landfill ban for organic waste, policy on fermentation and composting,...) and landfill degassing (followed by energy recovery or, if no longer possible, flaring, so that methane is transformed into less harmful CO<sub>2</sub>).

This list corresponds to the trend analysis as described in *Vision 2050* on various points and, in addition, offers solutions which perfectly fit into the development paths proposed in this note. In the past, OVAM has already taken part in consultations with a co-author of the McKinsey report (*Remaking the industrial economy*) quoted in *Vision 2050* and amended the representation of the cycle (figure on p. 26 of this note) with the reintroduction of waste from landfills. However, the current proposal for sustainable resource management of landfills goes even further than materials supply and management and also provides an answer to other needs and threats.

## **4. Principles and main objectives in the development of the vision**

### **4.1. Organisational aspects**

In order to maximise the chances of success of this programme, it will follow the structure of approved and ongoing initiatives as closely as possible. This way, resources will be optimised and various actions will be integrated or reinforced. This method comprises:

- fitting into existing budgets;
- detection of common elements with other policy initiatives;
- following existing policy guidelines and similar initiatives as closely as possible (e.g. circular economy, inventory in vulnerable areas, investigation of high-risk land, open space platform);
- fitting into current legislation as much as possible;
- maximum cooperation and integration with external partners.

### **4.2. The time factor**

Analyses have shown that the possibilities of landfill mining under market conditions in the short term are extremely limited. The current reasons for mining are mainly related to the demand for additional space and the need for soil remediation. In the plan period up to 2019 the contribution to the demand for raw materials is estimated to be rather limited. This does not mean that no measures need to be taken in the short term to organise the management of this potential reserve in anticipation of its mining. This is why its interim use is important.

When determining the time component, we take into account a long-term management spanning periods of several decades and an interim use to reinforce the support it receives. This approach also allows for better cost management and interim revenues which contribute to the financing.

### **4.3. Emphasis on the interaction between the landfill site and its surroundings**

The vision presented is based on the interaction between the individual landfill site and its surroundings. In the risk analysis, on the one hand, the risk of the source is determined and, on the other hand, the receptors that may be exposed are detected. It is studied how the location of a landfill site can affect the surroundings. This means the result of an impact approach: how can negative impacts be prevented? In this sense, the measures are mainly aimed at eliminating or mitigating the threats.

### **4.4. Attention to possibilities for valorisation**

From the perspective of the inclusion of landfill sites into a circular economy, the realisation of the potential is crucial. The immobilisation of the waste makes the recycling of the valuable components impossible, or requires extreme processes to make it available. Isolation often hinders the use of the landfill area, so that it often remains an underused space (brownfield). Attention to the possibilities for valorisation of a landfill site means a supply-based approach: how can positive effects be achieved?

This perspective mainly focuses on studying the opportunities. In this process, attention to the three pillars (content, surface area, surroundings) and the needs of society (materials, energy, space, drinking water) is central, and this within a long-term time frame.

### **4.5. The spatial dimension**

The attention to the spatial dimension goes further than the content and surface area of the landfill. The landfill is seen within the context of its immediate and broader surroundings. Furthermore, in this context space must also be understood in the sense of ecological, economic and social space, in other words a multi-dimensional and complex system that is subject to numerous influences. In the development of resource management of landfills, global megatrends and system transitions will be taken into account.

The forecasts indicate a significant increase in the population and the number of households by 2050. Generally speaking, it is assumed that due to the population increase and the reduction in household size around 630,000 additional housing units will be needed. The continued development of the metropolitan area in Flanders leads to an increased demand for space and competition between different uses. At the same time, the open space needs to be preserved. In the green paper on the spatial policy plan for Flanders it is argued that the open space should be regarded as a 'finite resource' which must not be used up.

The principles of 'Lansink's Ladder' in the waste policy can also be applied to a well thought through use of space. First of all, a reduction in the use of space must be achieved (waste prevention). This means that additional activities need to take place in space that is already built up or in use. Secondly, space in a favourable location which has already been used in the past but has been abandoned must be used again (reuse of waste). This comprises the development of brownfields and the mining of old landfills. Thirdly, the use of space must be regarded as a recyclable element. This means that the use of space should be approached in such a way that the original state can easily be restored after the end of the activity.

Therefore, in the Policy Note on the Environment 2014-2019 importance is given to facilitating and stimulating the concentration, reuse and renewal of the use of space. To this end, activities are planned in an area-based and more project-oriented way. An important application is the development of suburban areas where the city and the countryside merge into each other and where fragmented landscapes are found. These areas are where old landfills are often located, and their presence has led to a patchy, discontinuous development of the area. Here, landfill mining projects can ensure a higher-quality spatial development.

In this context the importance of mobility must not be underestimated. The clear trend towards urbanisation also leads to the supply becoming an important point of attention. The transport of goods (into and out of the metropolitan areas, linking short and long distance transport) will be crucial for the liveability of cities. In this context, multi-modal systems are being proposed, but new local service provision is also part of the priority scenarios. The landfill sites in themselves constitute a hindrance to urban expansion, but an appropriate approach can contribute to the solution of the problem. These locations can grow into new supply hubs or processing areas for the dumped and recent waste.

## **5. Elaboration and implementation of the vision**

### **5.1. General**

The organisation of sustainable resource management of landfills is aimed at a maximum reduction of the negative effects and an optimal use of materials and space in a budget-friendly manner. This approach is combined with the soil remediation objectives.

The term resource management implies a planning component and the preparatory research in this area has resulted important information which has led to a correction of the interpretation of ELFM and the terminology. The proposed time horizons are in line with related ongoing initiatives: short term (2015-2019), medium term (2020-2027) and long term (2028-2100).

Furthermore, the future storage of waste is recorded and organised with a view to its future valorisation. The storage method must not jeopardise the future processing of the waste, unless environmental risks leave no alternative. This approach fits into the transition from a waste policy to a sustainable materials policy, which aims at achieving a position of data supplier for raw materials based on Urban Mining and Landfill Mining. The link with the circular economy is obvious here, and coordination in this sense is being aimed for.

### **5.2. ELFM<sup>2</sup>**

The limitation to ELFM in the strict sense leads to the perception that the term refers almost exclusively to the technological aspects involved in the mining of a landfill site. The high-quality transformation of the waste into new materials is central to this concept. Nevertheless, in traditional mining as well the actual mining is only a part of a long process of research on resources (definition of resources, reserves) leading up to the sale of the minerals.

The proposed concept of sustainable resource management of landfills requires a transition in waste policy and a time perspective. This is facilitated by broadening ELFM to ELFM<sup>2</sup>. This way, the management of 2,000 landfill sites in Flanders can be planned over a period spanning several decades. In this management model the spatial aspect in the short and medium term will be the most important and decisive component. Hence the emphasis on resource management of landfills instead of a limitation to the dump material itself. Following from this, the term mining is replaced by valorisation because this is more in line with the 'broader' interpretation.

### **5.3. The role of OVAM**

OVAM has always played a central role in the policy on waste, materials and soil remediation. Its policy has had an impact on the entire chain, with a clear evolution from a linear to a circular approach. Among other things, the experience with landfill sites has resulted in extensive data files on diverse aspects of landfill sites. Completing these data and putting them to use with a view to efficient resource management is a first step. For its role as organiser OVAM has sufficient knowledge and basic data at its disposal to accomplish this transition. Its task is

threefold:

- data collection;
- data processing;
- policy development by defining priorities and making choices when it comes to the management of all landfill sites. The elaboration of a policy framework with legal and financial instruments to put ELFM<sup>2</sup> into practice.

OVAM supports and facilitates ELFM<sup>2</sup> so that researchers and environmental companies are given the necessary short-term incentives to invest in this innovative environmental branch. This way, the sustainable materials policy is further shaped by the inclusion of an assessment of the reintroduction of (old) resources from landfill sites and their possible mining. Thus, the role of landfill sites within the concept of the circular economy becomes a reality. OVAM creates the framework for such management but does not act as a developer of technology or a producer of materials. In its ex-officio projects OVAM does play an active role by applying and promoting ELFM<sup>2</sup> in these projects. However, the contractors/environmental companies are responsible for carrying out the projects. Ex officio remediations of landfill sites can act as demonstration projects. Such projects are also broader than the mere (partial) removal of dumped waste; they must fit into a broader policy framework, in which attention is paid to the use of space, improved mobility and the like. Taking into account the innovative nature of this ELFM<sup>2</sup> concept, OVAM will look for partnerships as much as possible in order to share the experience and knowledge gained. In its role as a pioneer, OVAM will also make efforts at the international level to secure support for this resource management of landfill sites.

When it comes to the legal aspects, OVAM will draw up the necessary proposals to offer ELFM<sup>2</sup> maximum opportunities. This comprises both legal protection for its performance in practice and a facilitating and supportive framework. The legal concept of the soil remediation project is a suitable instrument in this sense for remediation and redevelopment. An adaptation of the standard procedure and the inclusion of a specific procedure for landfill sites is a necessary condition to facilitate and accelerate these projects.

The financial instruments also require streamlining in order to offer this innovative policy optimal opportunities. In addition to support programmes with a financial contribution (subsidies, loans,...), the possibility of participations in innovative techniques and services (VMH, PMV,...) is being studied as well. Another possible scenario is a tax reduction, which would offer ELFM<sup>2</sup> projects additional financial breathing space especially in the initial phase (e.g. reduction of or exemption from environmental taxes or tax on gains resulting from a change of land use). The mining of a completed landfill will rarely result in a 100% recycling efficiency and the conditions of the removal of the residual waste can strongly affect its feasibility. Reduced waste tax in analogy with contaminated land that cannot be remediated may be an option to sell residual waste streams that cannot be valorised more cheaply. However, in this context the possible impact on other policy initiatives remains a point of attention; the trade-offs must be acceptable.

#### **5.4. Management model**

OVAM is designing a management model for the monitoring and redevelopment of all landfill sites in Flanders. Based on its core duties and policy tasks, over the past decades OVAM has not only had access to many relevant data, but also to useful experience and knowledge. Crucial to this is the development of a decision support system. Building on the OVAM model FLAMINCO (*Flanders Landfill Mining, Challenges & Opportunities*), which is in line with existing OVAM databases, flexible prioritisation is possible. This way, landfill site management can be developed further. Furthermore, information provided by other authorities can be processed and an exchange can be set up, facilitating the achievement of mutual objectives.



## 5.5. Monitoring

OVAM will draw up a monitoring plan which, on the one hand, offers guarantees when it comes to the burden on the environment and, on the other hand, reports on the available resources in the framework of a circular economy. This way, the objective of providing information about the impact and the availability of resources is met. This monitoring gets its basic information from the OVAM databases and archives and is in line with the current guarantee regulation for operational landfill sites, which has been managed by OVAM since 1984.

## 5.6. Sustainable interim use

In anticipation of development, sustainable interim use is provided for and the impact on the surroundings is limited as much as possible. To this end, solutions will be worked out in collaboration with other authorities for rural landfill sites (land and nature management) and urban landfill sites (brownfields). Through the collaboration in VITO's spatial model, the spatial offer and demand are mapped more accurately and it is studied how landfill sites can make a contribution in this respect. In this framework it is important to maximise the interim use of landfill sites. Moreover, this generates interim revenues with which management measures can be financed.

Furthermore, this interim use also refers to the interim valorisation of resources (e.g. landfill gas extraction, leaching), the optimisation of the management (better storage) and a more optimal storage of the current dump material with a view to recycling. The definition of the landfill conditions is not part of the ELFM<sup>2</sup> project but it is indicated as a point of attention in the broader context of a circular economy. The trend break with final disposal has already been indicated, and the question arises as to the role of landfilling within a circular model. The ideal cycle with a 100% reintroduction immediately following the end of the use of a product is the ultimate goal, but the interim period during which this condition is not met also requires a specific policy.

## 5.7. Exchanging experience and looking for partnerships

Resource management of landfills is a new development and trend in which landfills are no longer by definition regarded as a closed phase in the linear economy. They are part of sustainable development and raw material supply, so that this transition fits into a broader European framework. OVAM will strive for a maximum exchange of information and experience with other authorities and stakeholders in order to achieve policy improvements. In addition, cooperation partnerships will boost integration and offer possibilities to achieve mutual added value.

Via a cooperation partnership on VITO's spatial model for Flanders, we are working towards an optimal coordination of the policy on landfill site management and the need for space. This is also a component in the various ongoing initiatives related to space (T.OP projects, the open space platform, brownfield covenants,...).

Especially for the local authorities the ELFM<sup>2</sup> concept should translate into structural cooperation taking into account the redevelopment and remediation of the old municipal landfill sites. Extensive cooperation and exchange will not only lead to efficiency improvements, but also accelerate the learning process.

The accelerated introduction of new transformation technologies and methods will take place via the platform function OVAM advocates within the ELFM<sup>2</sup> concept. This results in better interaction between companies, research institutions, authorities and citizens, a form of multi-actor action which is already being used within the ELFM consortia.

This structural approach also has to lead to a pioneering position of Flanders in the area of landfill site management. The narrowing down of the concept to sustainable landfilling, like in some other European member states, is mainly aimed at current landfilling practice and does not provide a sufficient answer for an efficient management of the 2,000 former landfill sites. Even so, the Flemish environment administration and business world – based on their long-standing experience in the field of waste treatment and soil remediation – are already able to present the first results of this landfill site management. Thanks to the extensive action as a platform, this results in a greater impact on European policy and support programmes.

## 6. Implementation in practice

In summary, the proposed concept of sustainable resource management of landfills comprises the following priorities and conditions of implementation:

- the introduction of a general and integrated approach for all landfill sites in Flanders, and this under the term of sustainable resource management of landfills;
- the decision support model FLAMINCO is the basis for the general management model of OVAM, which allows for a sufficient degree of individualisation;
- attention to diverse added value and interim use;
- the performance of pilot studies and demonstration projects in the framework of ex-officio remediations of landfill sites;
- gathering and sharing of knowledge and experience via structural networking.

The main features and time aspects are:

- long-term management which focuses on the recycling of materials, energy and space and the preservation of drinking water supplies:
  - efficient, goal-oriented inventory;
  - further development of the Flaminco model by OVAM;
- the organisation of a sustainable interim use:
  - possible approach for rural versus urban landfill sites;
  - development of possibilities for interim use;
- resource management of landfills is a part of sustainable development, raw material supply and a circular economy, which fit into a broader European framework:
  - participation in ELFM platforms (Flanders, EURELCO);
  - facilitating Research & Development.

The implementation plan is linked to the three-step approach (Mapping, Surveying, Mining): inventory of all landfill sites in Flanders, characterisation of individual landfill sites and the possibilities for valorisation of a landfill within the impact and resource approach. This breakdown remains useful within the management model to be developed by OVAM and will be included in the schedule. In the plan three time horizons are distinguished, which are in line with current initiatives.

### 6.1.Short term (2015-2019):

#### 1. Inventory:

- listing of landfill sites in municipalities where no/few landfill sites have been included in the inventory (2015-2017);
- systematic inventory of land filling and elevation with 'waste';
- investigation of landfill sites in drinking water protection areas;
- refining of the decision support system FLAMINCO as a basis for choices in inventory research;
- design of material flow analysis based on conceptual models in which scaling starts at the level of the individual landfill site and information is added up to EU level;

- development of the concept of individual management plans.

## 2. Characterisation:

- ex officio: three landfill sites/year;
- partnership with public authority: two landfill sites/year;
- support and monitoring of private initiatives;
- delivery of a report containing the average landfill composition based on the filling history.

## 3. Possibilities for valorisation:

- ex officio: two landfill sites/year;
- partnership with public authority: two landfill sites/year;
- support and monitoring of private initiatives.

In the context of this short-term planning, supporting actions will be set up. Experiences will be shared via the follow-up of cases and information provision to the (former) landfill owners and operators. This also comprises the offering of framework contracts for municipalities and other public administrations. This way, work can be performed in a more efficient way and OVAM can systematically increase the quality of the contracts. Furthermore, financial intervention by OVAM can be considered because this will allow for a faster implementation of the remediation policy.

The limited possibilities of material valorisation under market conditions will certainly limit the chances of ELFM<sup>2</sup> in the short term. On the other hand, there is the spatial pressure, which is already providing support and evolving towards initiatives that are in line with market conditions. In the selection of test projects special attention will be paid to proposals with a spatial perspective.

When it comes to administrative policy, legal and economic instruments will be developed in order to create greater chances of success for ELFM<sup>2</sup>. The reduced waste tax that applies to soil remediation operations could boost ELFM<sup>2</sup>, but it could also turn into an obstacle if conditions changed. An initiative is needed to stimulate test projects. There is no loss of income, because currently there is hardly any mining. Just like the exemption from registration duties in the case of brownfield covenants, this reduced tax will encourage new developments, which will eventually lead to additional revenues.

In the short term, additional support by European resources is desirable. To this end, EU research programmes (Interreg, Horizon 2020,...) are screened, and project proposals are elaborated where possible or useful. In this context, the members of Eurelco are preferred partners. In the area of fundamental research, structural collaboration with VITO is advisable. For the concrete test projects we will mainly look towards municipal authorities because these were closely involved in the landfilling activities in the past.

Based on this, in the spring of 2016 there will be extensive communication to the municipalities to explain the advantages of the ELFM<sup>2</sup> concept. For the general communication on ELFM<sup>2</sup> the OVAM website will be used, as well as the forums that are often offered via our network.

## 6.2. Medium term (2020 -2027)

### 1. Inventory:

- implementation of a material flow model that integrates all resources and thus contributes to resource management within a circular economy;
- drawing up of individual management plans for all landfill sites in Flanders.

## 2. Characterisation:

- operational monitoring network for all landfill sites with a high potential or risk profile.

## 3. Possibilities for valorisation:

- redevelopment and valorisation of ten landfill sites/year.

The material flow model referred to places ELFM<sup>2</sup> within the broader framework of raw material supply (materials and energy). The research performed during the plan period 2015-2019 will provide the basic data for this. Besides the content of the landfill, the following material sources can be distinguished: primary raw materials, current waste production and circulating goods which will potentially become available in the future (anthropogenic resources). For the latter, time series can be made so that the release of these resources can be estimated. This allows us to predict Urban Mining and accelerate or delay it when necessary, or proceed to interim use. For landfill sites, the mobilisation of resources and the reintroduction into the cycle will necessarily be driven by demand and will grow as scarcity in the raw material markets increases.

### 6.3. Long term (2028 – 2100)

Monitoring and redevelopment has been performed for all landfill sites. The reporting contributes to a European material flow model which provides sufficient information about anthropogenic flows for the policy on raw materials. At the Flemish level, a programmed approach results in a sustainable use of resources and substantially contributes to spatial redevelopment. Thanks to an optimal adjustment to the needs, this programme requires only a limited financial effort and the benefits are proportional to the costs.

## 7. Decision

The Flemish Government has decided on 16 October 2015:

- 1° to approve the above vision and objectives of the plan for sustainable resource management of landfills, without any additional financial or budgetary commitment;
- 2° to put the Flemish minister responsible for the environment and water policy in charge of the further implementation and monitoring of this management plan.

Joke SCHAUVLIEGE  
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Nature and Agriculture