



Waste Management Planning (WMP)

In the following, the most important elements of waste management planning¹ will be explained. In this context, the requirements defined in EU waste legislation are briefly presented taking into account priority actions for low and middle income economies in relation to hazardous waste management.

WMP should be designed in a way so as to prioritize prevention, general reduction and recovery of hazardous wastes where possible. Given the continuous increase in demand for resources due to economic growth in developing countries and the scarcity of natural resources, the environmental as well as economic rationale for acquiring recyclable resources from wastes has increased. The waste management industry can generate jobs and elevate the standard of living.

WMP needs to take into consideration the challenges that small and/or geographically isolated countries face. Some wastes may be best managed globally as disposal may be challenging or require large economies of scale in order to be effective. Product stewardship schemes for hazardous waste (e.g. waste electrical and electronic equipment) should be promoted.

See Basel Convention Report on Implementation of the Strategic Plan (2009) at: <http://archive.basel.int/stratplan/index.html>

1.1. General aspects of WMP

Political support and understanding of the need to draw up a waste management plan is crucial. If a plan already exists, this plan may have to be revised. If, on the other hand, the first waste management plan has yet to be worked out, it is very important that the political level should have accepted the need for a plan and allocated sufficient resources to its execution. **Hence, it is recommended to create a political starting point in order to carry out the foundation work for a waste management plan.**

A **political starting point** should include a decision on the following questions:

- Who will be involved in the preparation of the hazardous waste management plan?
- What is the time frame for the finalisation of the waste management plan?
- What is the relationship to other existing plans?

EU waste legislation, namely the Waste Framework Directive 2008/98/EC (Art 28), requires **competent authorities** to draw up waste management plans. The competent authorities comprise national administrations and environmental protection agencies as well as local and regional authorities. In addition, the planning process involves politicians, administrative staff and planners, contractors, various public organizations, NGOs and stakeholders.

Waste management planning is an important implementation and enforcement instrument of waste legislation and has become a permanent element of public planning efforts in all EU Member States. Waste management plans play a key role in achieving sustainable waste management.

The main purpose of WMPs is to provide an **inventory of current waste streams and treatment options and to outline needs for action and future developments.**

¹ Some elements and basic pieces of advice are taken from the Methodological guidance on preparing of waste management plans http://ec.europa.eu/environment/waste/plans/pdf/2012_guidance_note.pdf

For more detailed information on WMP, see Manual, Module 8.

Checklist before starting planning

It is recommended to check if the aspects listed in the box here below have been considered and clarified before starting the actual planning. This can be done with the help of the following checklist:

<p>Checklist</p> <p>It is recommended to <u>set up a task force with clear responsibilities for the work to be carried out.</u></p> <ol style="list-style-type: none">1. Are political understanding and support for the waste management planning process present?2. Have sufficient resources been allocated to the process?3. Scope of the waste management plan:<ul style="list-style-type: none">– What is the geographical coverage of the plan? National, regional or local level?– What is the time horizon of the plan? E.g. 3, 5 or 10 years?4. Have the participants in the planning process been identified? Do they include government departments, local authorities, waste experts, representatives of the waste management sector and the waste generating industry, and NGOs?5. Has the time frame for the preparation of the waste management plan been set? Time estimates for the project should be realistic.6. Have any relationships between the waste management plan and other plans (e.g. spatial planning, energy planning, etc.) been identified? Do they influence elements in the waste management plan?

Figure 1-1: Checklist for pre-operational tasks before starting the planning process

Involvement of third parties in the planning process

Participants in the waste planning process should include a wide range of stakeholders in order to cover all the important aspects. They may include:

- representatives from the political and the administrative level (government departments, regional authorities, municipalities)
- hazardous and other waste experts²
- representatives from the waste management sector (collection, recycling, incineration and landfill)
- industry, industrial and commercial organisations
- consumer councils/associations
- NGOs.

Other parties may be involved in the planning process as well.

² Waste management service providers (including collectors, transporters, plant operators and the corresponding associations), scientist, other competent stakeholders including representatives from specialized NGOs

Participation of stakeholders and the general public can be assured by means of working groups, round tables, public information, hearings, workshops, seminars, or other means to disseminate information and to compile and collect proposals, concerns and comments.

Geographical scope of the WMP

It should be ensured that **the whole national territory is covered by the planning**. According to EU legislation this objective can be achieved with **one national plan or with different regional/local plans which have to be coordinated**. Actually, a number of EU Member States, such as Germany and Austria, have established a system with regional waste management plans because of their specific administrative structure and size. Other countries combine various levels with the national plan as an overall structure and regional plans for further details. **For hazardous waste management it might be preferable to draft one plan on a national scale to ensure maximum clarity and efficiency.**

The establishment of WMPs requires the participation and coordination of several parties/authorities involved and therefore such decisions should be taken in the very beginning to ensure coherent planning and to avoid unnecessary duplication of work/efforts. Planning should take into consideration the country specific administrative system and other particularities. A national waste management plan will often be of a strategic nature highlighting certain objectives, whereas regional or local plans will be more action-oriented operational plans with detailed descriptions of current collection systems, treatment plants etc. In case several plans exist alongside each other it is important to coordinate and harmonise the different regions and levels.

In the case of very restricted resources or geographical particularities, regional/national authorities might start the planning with **priority regions with a high level of hazardous waste generation or major environmental pressures**. The adequate coverage of the whole territory of the country, however, should then be kept in mind already. Even if hazardous waste is generally concentrated in agglomerated industrial production areas, it also arises in smaller amounts in other regions and needs appropriate management.

Relationship to other plans and policies

Hazardous Waste Management Planning should be an integral part of the overall national planning system. This may include spatial planning, environmental planning, energy planning, planning for human and occupational health etc. A number of these different planning areas relate directly to waste management planning and should be carefully considered for the decisions e.g. on investments in future infrastructure.

Waste prevention measures via product and process design or closed-loop production could and should be integrated in hazardous waste management planning or established as a parallel and supporting approach.

Time horizon of the waste management plan

The establishment of an infrastructure and the implementation of measures need time to become effective and to produce visible effects, whereas on the other hand clear mile stones and review periods needs to be established to get things started.

To reflect this, WMPs should preferentially consist of two parts: part 1 for immediate action, and part 2 for a long-term perspective.

From a practical point of view, the time horizon of the plan should also be long enough to make it possible to evaluate whether targets in the plan have been reached. Therefore, it will not be practical to re-evaluate the plan after less than at least three years. The time horizon of the plan may also reflect other considerations of the political scene, e.g. the period between national elections.

Thus, a time horizon of **three to five years would be appropriate for the revision of the action part of the waste plan.**

Time schedule for the planning process

As one of the first steps, a time-schedule indicating the expected duration of the different planning stages and the expected finalisation date of the waste management plan should be made. The time-schedule should include provisions for the consultation period with the public, which may be time-consuming.

The whole planning process can be expected to take around **18 months**. However, this is only a vague indication due to experiences from European Member States and may vary according to the national and regional circumstances of a country.

In addition, the time-planning should include an indication of the decisions to be made at each stage and when, for example, workshops involving competent authorities and the industry are scheduled.

Content of a waste management plan

According to EU legislation, the following mandatory elements have to be included in a national or regional WMP are briefly presented in the box:

The **obligation for Member States to establish a waste management plan** is laid down in Waste Framework Directive 2008/98/EC.

According to Article 28, the competent authorities of the Member States are to establish a waste management plan that relates in particular to the following elements which must mandatorily be addressed in each waste management plan:

- (a) the **type, quantity and source of waste generated within the territory**, the waste likely to be shipped from or to the national territory, and an **evaluation of the development of waste streams in the future**
- (b) **existing waste collection schemes and major disposal and recovery installations**, including any special arrangements for waste oils, hazardous waste or waste streams addressed by specific community legislation
- (c) an **assessment of the need for new collection schemes**, the closure of existing waste installations, additional waste installation infrastructure in accordance with Article 16, and, if necessary, the investments related thereto
- (d) **sufficient information on the location criteria for site identification and on the capacity for future disposal or major recovery installations**, if necessary
- (e) **General waste management policies**, including planned waste management technologies and methods, or policies for waste posing specific management problems

Figure 1-2: Mandatory elements of a waste management plan according to EU legislation

Structure of a typical waste management plan

There is no rigid pattern for how to structure a waste management plan or strategy. However, considering the main contents to be included, a recommended simple structure may look as follows:

- Assessment of the status quo (inventory)
- Identification of deficits and needs
- Establishment of an appropriate infrastructure
- Financial aspects, calculation of investments and costs
- Allocation of wastes to appropriate treatment methods

In order to make the waste management plan easily readable and highly applicable for the different parties involved, it is recommended to keep its content as short and concise as possible.

The Waste Management Planning Process

The waste management planning process runs in cycles, i.e. in principle it is a continuous process, where the plan or strategy is revised at regular intervals. The process may be broken down in six phases: general considerations, status part, planning part, consultation process, implementation and plan revision.

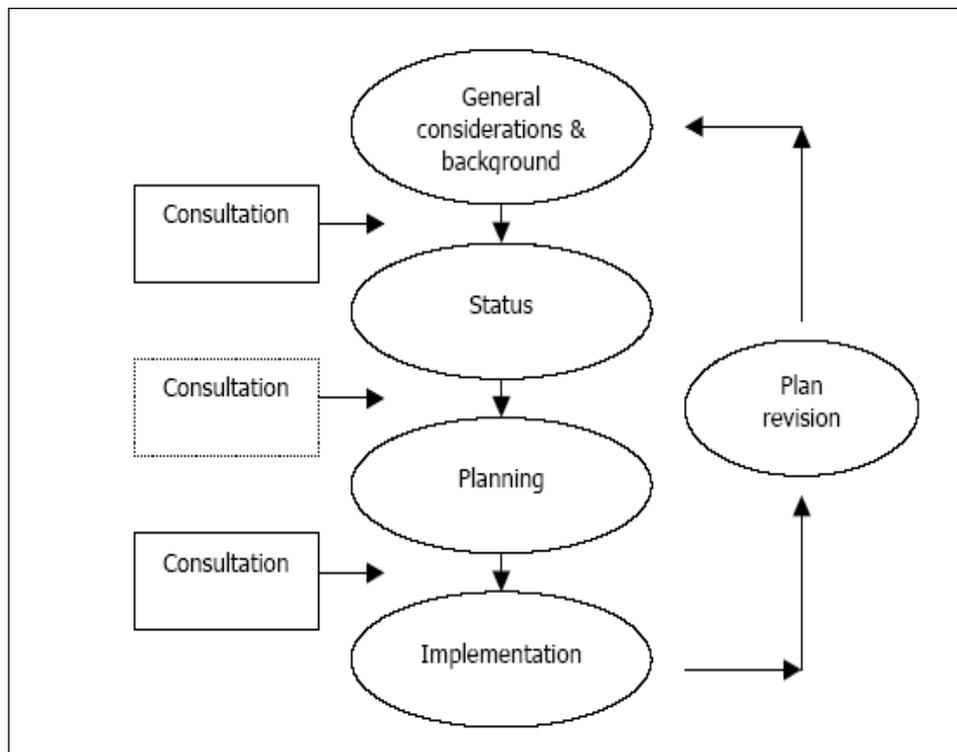


Figure 1-3: Cycles and processes during a WM planning process

(Source: Methodological Guidance Note on Preparing a Waste Management Plan, 2003; European Waste Topic Centre on Waste and Materials Flow)³

General considerations and background

The starting point of any Waste Management plan is the creation of a will to change. At first, there has to be an initiative and all relevant ideas have to be gathered. In this phase the planning period is determined, and any other boundaries of the planning scope are clarified. An important issue here is **public participation**, e.g. who should be involved in the planning process and how? Time schedules and work plans for preparing the HW plan have to be set up. Moreover, the relation to other plans, such as spatial and energy planning is considered. The background part of the Waste Management plan includes considerations regarding the national management principles (legal frame) as well as current and expected changes in the country's legislation (see also Manual, Module 2).

Status

This section corresponds to the "assessment of status quo" (inventory). In this phase, all data and information on the current situation in the waste management field are to be gathered and analyzed. Then the current waste management system is evaluated, i.e. problems relating to the current system have to be identified as well as possible solutions for these problems. Questions to be answered in this phase are: does the current system comply with

³ The Document is available at http://ec.europa.eu/environment/waste/plans/pdf/wasteguide_final.pdf

the objectives that are set and may be expected in the future, and if not, how can the system be improved?

Planning

The planning part represented in chapter 1.2.3 “Establishment of an appropriate infrastructure” should be prepared on the basis of

- international standards and national legislation,
- the status part and relevant assumptions for projecting future developments.

A central element is delineation of political objectives, e.g. for priority waste streams or waste treatment, and to develop indicators to monitor if the objectives are met. Another central element is to evaluate how these objectives may be met most effectively.

For this purpose, the choice of measures and instruments for the implementation of the plan or strategy is relevant.

Consultation

All parties involved in hazardous waste management should be involved in the determination of the future hazardous waste management system and a consultation phase must be included in the planning process before adopting the final waste management plan and its initiatives.

Public consultations may take place at various stages in the planning process. Thus, a public consultation may take place as a kick-off meeting before the status part, allowing the competent authority to collect ideas and input from selected stakeholders. Alternatively, consultations may be placed just before the planning part when the problems and possible solutions have been identified.

In practice however, in the preparation of a national waste management plan the industrial stakeholders are often involved in a consultation round when the first draft of the plan is available. The consultation round may be very limited – the draft plan is sent for written comments to selected stakeholders (political parties, industrial organizations in the waste management sector, consumer and environmental organizations, NGOs etc.).

The preparation of a regional/local waste management plan often includes a more extensive consultation phase, for example with public meetings, distribution of information brochures and information about the plan on the internet.

Implementation

After the adoption of the waste management plan, its orientations have to be put into practice either via legislation and regulation, negotiations with the industry, or information to the general public. The implementation and enforcement of the waste management plan/strategy requires joint efforts from all actors involved in the field of waste management and includes permitting and authorisation, education and training and other instruments as explained in more detail in Modules 3 and 5.

Revision

Well ahead of the end of the planning period, initiatives should be taken to revise the plan. At the start of a new planning period, the process set out in

Figure 1-3 is repeated.

Initially, all assumptions are gathered and the results of the previous plan are analysed in detail during the conduct of a new status report. Special questions of interest include: which objectives have been met? Which activities were not implemented or did not have the desired effect? Did any of the initiatives have an unexpected impact on other sectors?

Against the background of the new status report and any new political objectives or other requirements, the next generation of waste management plan is prepared.

Revision of the plan is not dealt with in any detail in this manual.

1.2. Practical aspects: Plan preparation

1.2.1. Assessment of the status quo

The main **starting point of actual planning** for a successful management system related to hazardous waste is an **inventory of hazardous waste generation** in a country or region. Such an inventory of the current situation should provide a good overview of waste sources, amounts, properties, collection, transportation, treatment and disposal of waste, and the structure of the existing waste management system as it will serve as a basis for decision making for the following system development.

In the EU Member States, such an **inventory is mainly prepared by administrative authorities in close cooperation with the parties and stakeholders** involved in waste generation and management.

The inventory of the waste management system is supposed to give the parties involved in waste management planning an **overview of the current waste management system**.

The inventory should provide the basis for answering the following questions:

1. Does the current waste management system meet the **political objectives** for the following:
 - waste prevention/minimisation?
 - recycling/energy recovery?
 - safe disposal facilities?
2. Does the current waste management system address the **environmental, health and safety issues** in the relevant area of the hazardous waste management plan?
3. Does the current waste management system represent an **adequate administrative and organisational framework in terms of efficiency in the relevant area**?
4. What is the preliminary **list of possible changes** in order to:
 - meet political objectives?
 - improve the environmental, health and safety performance of the current system?
 - improve the capacity and the physical performance (collection equipment, trucks, access to waste management facilities) of the waste system as a whole and in terms of proximity and self-sufficiency?
 - improve the efficiency and the organisational framework of the system?

Figure 1-4: Checklist for the preparation of a national hazardous waste inventory

The inventory is most simply arranged by **waste source** (different waste generating activities in the relevant area), **waste streams** (materials of which the waste is composed) and the **waste management options** (e.g. collection, sorting, treatment and disposal).

The collection of data on hazardous waste generation is easily achieved with an **analysis of the national or regional industries**. As not all industrial activities generate hazardous waste, only the relevant industrial activities (e.g. galvanic industry, oil refineries, electronic industry, pulp and paper, textile, chlor-alkali, pesticides, iron and steel, dyes and pigments, paints and printing inks, cosmetics, metallurgical industry and hospitals) need to be identified and analysed (see Table 1-1).

Table 1-1: Examples of relevant industrial activities and processes generating hazardous wastes

(Source: Ministry of State for Environmental Affairs, Egyptian Environmental Affairs Agency and Egyptian Pollution Abatement Project: Hazardous Waste Management – Inspection Manual, 2002)

Industrial activity	Waste type	Production process
Pulp and paper	-sludges contaminated with chlorinated organic compounds, dioxins, furans chlorophenols, and peroxides	- bleaching processes
	Sludges containing organic solvents and heavy metals	Treatment of de-inking effluents from paper recycling
	Wastewater containing sodium hydroxide and sodium sulphide	Delignification process
Leather and fur	waste containing solvents such as ethers	Leather degreasing
	Pickling liquor containing chromium	Tanning process
	Sludges containing chromium	Wastewater treatment plant
	Tanned leather contaminated with chromium	Finishing process
Textile	Waste containing organic halogenated solvents and non-halogenated solvents	Finishing process
	Wastes containing peroxides, sodium hypochloride, chlorine	Bleaching process
	Highly alkaline effluents	Scouring process
	Waste dye stuff and pigments containing azodyes, heavy metals	Storage Dyeing and printing
Chlor-alkali	Sludges containing cadmium, arsenic, lead, hexavalent chromium, arsenic, mercury, halogenated organic solvents	Wastewater treatment plant
	Chlorinated hydrocarbon liquid waste	Electrolytic processes
	Flue gases, containing traces of chlorinated hydrocarbons	Incineration of the chlorinated hydrocarbon liquid waste
	Chlorine off-gases	Electrolytic processes of chlorine plants
	Liquid acidic waste (spents acids)	Drying of wet chlorine
	Alkaline effluents	Caustic soda processing
Iron and steel	Sludge containing heavy metals	Process of off-gases treatment, of electrical arc furnaces
	Skimmed oil Sludges containing oil	Spent cooling water (machinery cooling water) treatment
	Slags containing heavy metals	Melting process (furnace sludge)
Pesticide	Waste containing organophosphorous compounds	Manufacturing processes residues
	Halogenated organic solvents, washing solutions, and mother liquors	Equipment cleaning and washing (storage tanks, vessels)
	Sludges (halogenated filter cakes)	Filtration process
	Outdated pesticides and/or ones off-specifications	-
	Sludges from effluent treatment	Wastewater treatment plant
Dyes and pigments	Aqueous washing liquids and mother liquors	Equipment (tanks, vessels, mixers etc.) cleaning and washing
	Halogenated still bottoms	Still bottoms residues
	Sludges contaminated with heavy metals, waste pigment and dyes	Wastewater treatment
Paints, printing inks, alkyd resins,	Waste solvents containing paints/inks/varnishes/resins	Equipment (tanks, vessels, mixers etc.) cleaning and washing

Industrial activity	Waste type	Production process
and varnishes	Sludges containing pigments, oils, fatty acids, fillers, and solvents	Paints, resins, varnishes, and inks filtration process
	Sludge containing pigments, fillers, and other additives, containing heavy metals	Wastewater treatment
	Spent filter bags, containing pigments and chemicals	Filtration
Soap, fat, grease detergents, disinfectants and cosmetics	Sludges from effluent treatment	Wastewater treatment
	Halogenated filter cakes and spent absorbents	Bleaching
Metallurgic industry	Sludges, tars and other carbon-containing waste from metallurgy	From anodic process From secondary smelting
	Black drosses containing heavy metal from aluminium industry	From secondary smelting
	Slags/white drosses containing heavy metals	From secondary smelting
	Spent pot lining (cyanide compounds) from aluminium metallurgy	Maintenance of smelting furnaces
	Salt slags containing inorganic fluoride compounds from aluminium metallurgy	From secondary smelting
	Sludges	From off-gases treatment
	Slag from lead metallurgy	From secondary smelting
	Leaching residues, dust and sludges such as jarosite, hematite, etc from zinc metallurgy	From secondary smelting
Fabricated metal	Cyanide alkaline waste	Galvanization process
	Waste acidic pickling solutions	Pickling process
	Spent acids and alkalis solutions	Etching process
	Sludge from WWTP, containing heavy metals	Wastewater treatment
	Oil, emulsions and grease	Drilling and cutting machines Degreasing before painting
	Waste solvents	Painting processes
Electronic industry	Heavy metal solutions	Metal finishing processes
	Waste acids pickling solution	Pickling process Etching process
Petroleum refining	Sludges or solid waste containing heavy metals	Wastewater treatment
	Crude oil and products storage tanks bottom sludge	Storage tanks
	Sludges from wastewater treatment	Wastewater treatment
	Spent catalyst	Catalyst replacement
	Solid waste, catalyst fines	Catalyst regeneration
Coolants, foam/aerosol propellants	Desalter sludge, containing oil, heavy metal	Crude oil desalting process
	Spent halogenated solvents and solvents mixed	Manufacturing synthesis processes
	Sludges and solid waste containing halogenated solvents or other solvents	Process leaks or spills Wastewater treatment

A **checklist** according to the EWL (European Waste List) classification system which is arranged by source sectors can be used as a starting point for the inventory purpose. In a first step, the existing waste streams should be identified (see Figure 1-5).

After the identification of relevant industrial production activities, major arising waste streams and other sources of hazardous waste generation an **analysis of waste quantities and its basic properties/composition** should be carried out (see Figure 1-6). For this purpose specific and detailed knowledge of the production processes, technologies and use of materials within the manufacturing process is necessary. It should be recommended to collect the data in close cooperation with the relevant industries. Also the support of other regional, national or international expert institutions (e.g. UNIDO – National Cleaner Production Centres, Basel Convention Regional Centres, World Bank etc.) for estimations of the waste quantity and its properties might be of benefit, especially in case the industrial stakeholders are not likely to give detailed insight into their production processes and related data.

Waste sources, waste streams and waste quantities

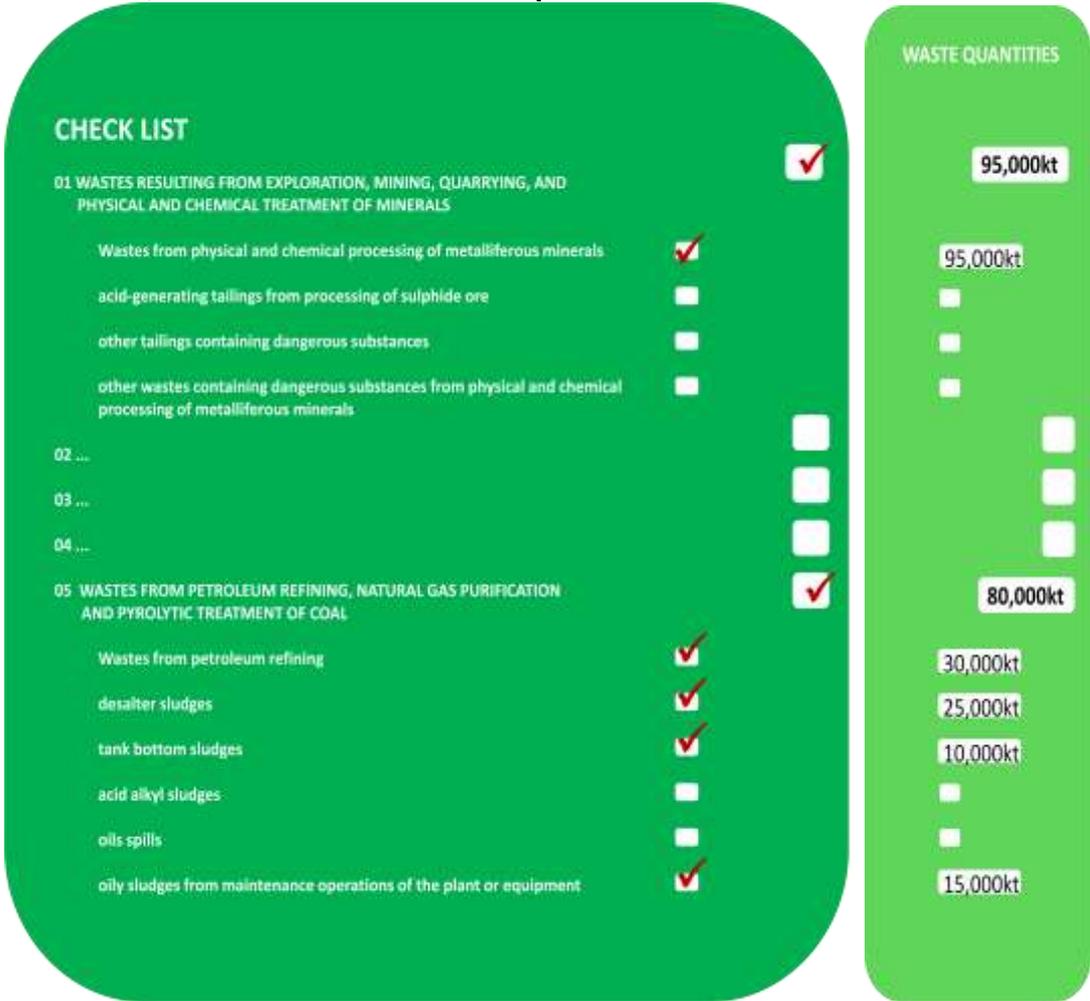


Figure 1-5: Example of a check list for identification of waste streams (based on the EWL) likely to arise from industrial activities in a country/region, and an indication of waste quantities

To render the inventory adequate and as precise as possible, it is important to use reliably and valid data and information. However, the estimation as shown in table 4-5 will be a very good starting point.

Methods of collecting data and information

The collection of waste management data can be approached by setting up a regular data collection and management system, preferably managed by an IT system, by an individual data survey in the preparation phase of the WMP or by making individual studies on specific waste streams or waste sources.

Collection of specific data and information for a waste management plan often means measurements carried out directly in the waste stream. Such measurements can have varying degrees of sophistication. Where it is possible to weigh the waste, this is of course the most precise way to register the exact amount. If direct measurements are impossible, calculations can be made based on data from equipment currently in use (number of bins emptied, number of trucks arriving at the plant etc.).

The competent local authorities, waste management enterprises, waste generating or waste recycling enterprises can provide some of the necessary data. These parties often have important information on quantities of waste collected, recycled or treated, as well as its composition. They also have information on treatment costs etc.

Allocation and specification of responsibilities

The documentation of responsibilities and the organization of the waste management in the WMP should preferably be organized in a generic chapter and -besides the description of involved bodies- might include a schematic overview of the treatment infrastructure currently in place.

Irrespective of the current system's distribution of responsibility, the responsibility for all waste streams should be described unambiguously in the waste management plan, and the responsible persons, institutions etc. should be clearly identified.

Additional parameters

The inventory should comprise **additional parameters** such as the consideration of **geographical dispersion or spatial agglomeration of industries and related locations of hazardous waste generation.**

Contaminated sites in terms of historical or ongoing production and disposal on-site, uncontrolled landfills and illegal dumpsites are other issues which should, swiftly be addressed and documented in the status quo part.

Furthermore, it is important to be aware of and to collect data on the **general infrastructure** and the existing **(hazardous) waste management infrastructure.**

General infrastructure

Information on national transport axes, roads and its capacity is essential for the establishment of a waste management infrastructure. This section should also comprise envisaged investments and planned projects.

Waste management infrastructure

Existing recovery and disposal facilities (e.g. metal and solvent reclamation facilities, incineration plants, landfills, physico-chemical treatment plants) should be listed. If possible the registered current usage, the capacity of each plant as well as the financial aspects of the treatment should be included in the description of the system. The description should contain the amount of each waste stream treated annually, the maximum capacity of the plants, the

expected lifetime of the plants, the costs of treatment for each waste stream etc. Plans for extensions or renovations should also be described. Collection and waste transport schemes could be taken into account, even if the responsibility for collection, transport and treatment is allocated to the industrial producer of hazardous waste.

This section should also comprise envisaged public and private investments and planned projects.

Facilities in which waste is treated may also be production plants and not only dedicated waste treatment facilities (e.g. co-incineration plant see also Manual Module 6). **Data on waste treatment facilities can be obtained either from operators of the facilities themselves (via visits or questionnaires) or from the competent authorities in charge of permits and controlling.**

Information about waste treatment facilities is valuable for a number of purposes:

- The planning authority needs detailed information about **number and capacity of all types of facilities** in order to make the capacity planning for all the specific waste streams.
- Waste producers are interested in the recovery and disposal of their waste.
- The general public is interested to be informed about existing and planned waste treatment installations in their vicinity

Documentation and illustration of collected data

In order to better understand the complex situation of waste generation, waste composition, waste quantities and its geography, it is recommendable that the data and information should not only be elaborated in text and tables, but also visualised with graphs, diagrams and maps.

It is useful to develop a cartographic plan to achieve a better understanding of the geography of industrial production and related hazardous waste generation, allocation of existing (hazardous) waste management infrastructure and the general infrastructure.

Therefore, first the total amount and geography of hazardous waste generation should be cartographically illustrated, afterwards, priority wastes according to their quantity and hazardous properties should be indicated separately. Another map should contain all existing waste treatment and disposal facilities (see an example from Germany in Figure 1-6). It is most useful to apply a geo-information system where different layers can be defined and combined.

At a later stage, these maps will be an important tool for planning/allocation criteria for establishment of new facilities and related infrastructural investments (for detailed explanations, see Manual Module 8) taking into account future industrial development and its geographical pattern. Some additional examples of possible illustrations are given in Figures 1-7 and 1-8. Please note that it is of crucial importance to include the facility capacities into such cartography as essential information and a basis for planning (see Figure 1-6).

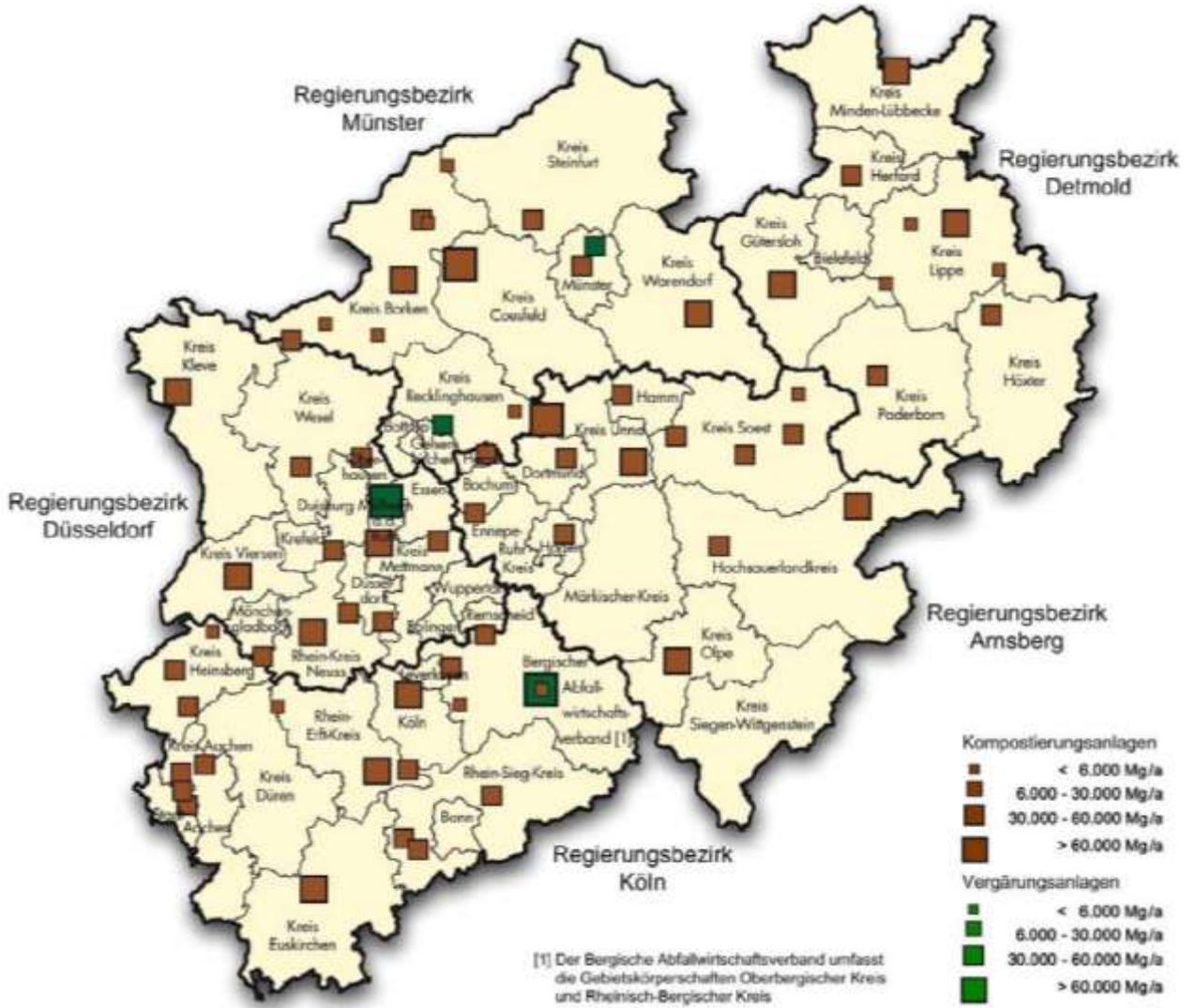


Figure 1-6: Waste treatment facilities for biowaste in an administrative region of North-Rhine Westphalia (Source: Oberdörfer LANUV NRW)

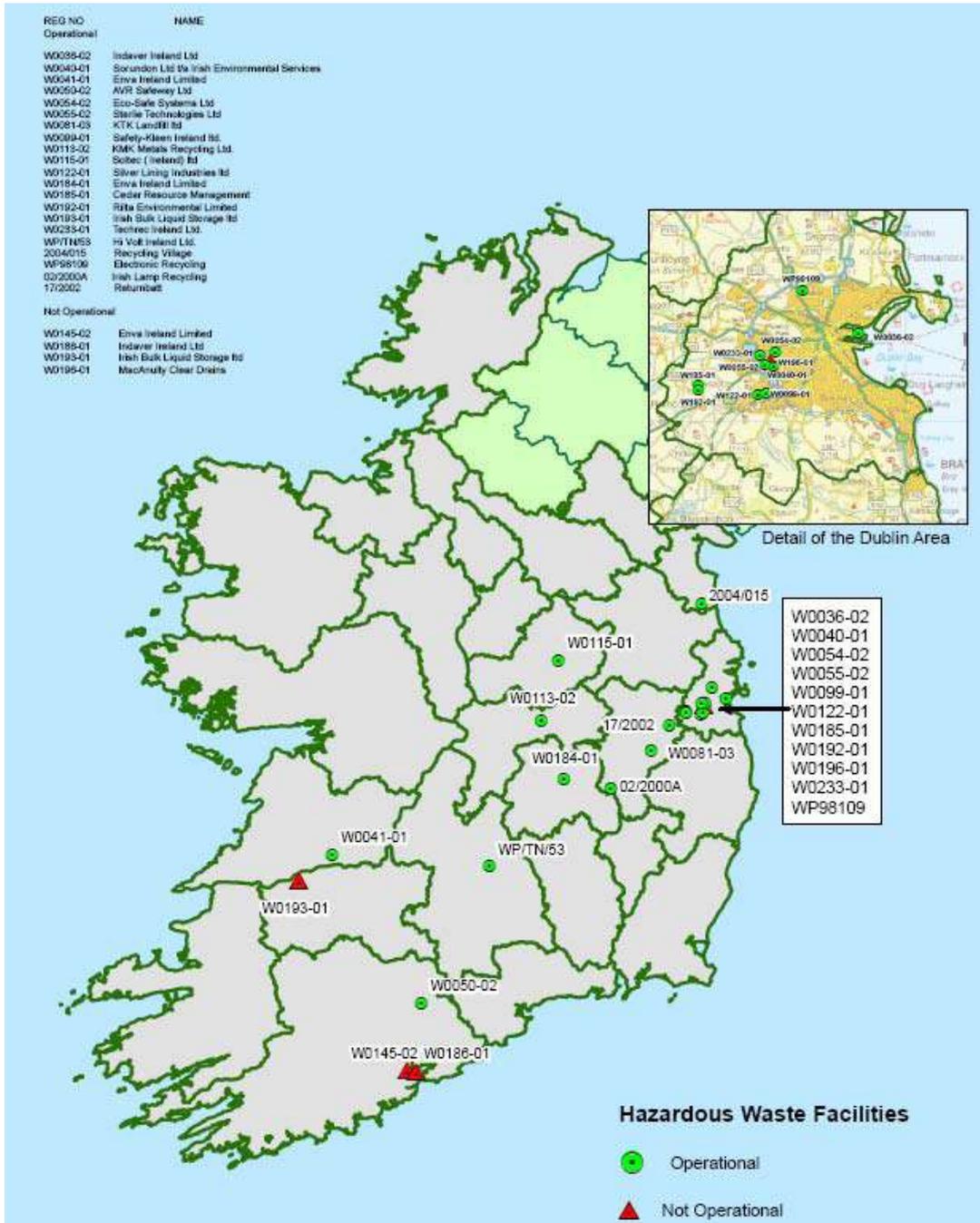


Figure 1-7: Hazardous waste facilities in Ireland

(Source: National Hazardous Waste Management Plan 2008-2012 ; <http://www.epa.ie/downloads/pubs/waste/haz/NHWMP2008.pdf>)



Figure 1-8: Commercial hazardous waste landfills in the USA

(Source: <http://www.ehso.com/cssepa/tsdflandfills.php>)

Definition of priority waste

According to EU legislation, the hazardous waste itself is defined as a priority waste stream. However, it can be further differentiated -which is important to set up actions accordingly. After data collection, further actions and investments need to be prioritised by identification of priority waste types according to

- **Highest quantities of hazardous waste**
- **Most hazardous waste types** (main composition/physical and chemical properties/hazardousness)

Priority wastes need to be addressed first in the establishment of environmentally sound management in a country/region as they impose the highest negative effect on the environment and human health. Also, the physical geography and the geographical pattern of waste generation has an influence on the determination of priority actions. Regions with industrial agglomerations and resulting in high levels of hazardous waste generation need to be addressed first in the planning as well as areas where specific conservation of natural resources needs to be safeguarded.

Forecast of future generation of hazardous waste

Once the basic information is compiled, estimations (forecast) of future hazardous waste generation on the basis of current waste quantities generated and due to expected overall economic and industrial development of a region or country can be made. A forecast of waste generation is an asset to be achieved at a later stage after the finalization of the first inventory when detailed and reliable data is available.

1.2.2. Identification of deficits and needs

The status of the current waste management system and its description allow for an identification of deficits and needs in terms of collection and treatment capacity. Basically, the country's capacity needs to assure the management of all waste generated can be identified -wastes generated at present and as estimated for a period for at least 10 years ahead- without endangering the environment and human health and in line with the principles of sustainable production and resource efficiency.

In this context the following aspects should be answered and quantified:

- The changes needed in order to improve the environmental, health and safety performance of the current system addressing priority waste first
- The changes needed in relation to the capacity and the physical performance of the waste system
- The changes needed in order to improve the efficiency and the organisational framework of the system
- The measures needed to eliminate and/or remediate contaminated sites (illegal dumps)

Being an asset, the **future waste generation forecast** should also be included, as well as political objectives, including targets and indicators.

Significant parameters influencing the planning are:

- Amounts and types of waste
- the geographical origin of the waste
- the availability of sufficient waste collection and treatment capacities

In addition, it is recommended to already include some future projections, even if they are only rough estimates, as such development might heavily influence the planning and related investments.

Other parameters may also influence waste generation in the planning period, and, in order to estimate the future needs for waste management services etc., it is necessary to estimate the influence of:

- Population growth
- Changes in the economic situation (growth/recession)
- Changes in demand for, and nature of, consumer goods
- Changes in manufacturing methods
- New waste treatment methods
- Effects of policy changes (prevention, minimisation, re-use, recycling)

In the table 1-2, possible elements for inclusion in the planning part are presented. At the stage of assessment of needs and deficits in the current system, it is crucial to take into

consideration the current collection scheme, available waste management facilities and relevant distribution of responsibilities between (local/regional/national) authorities and the industry. The actual situation has to be assessed in regard to the equipment and capacity of the available infrastructure and the need for establishment and improvement to be derived from these data.

Table 1-2: Possible elements for inclusion in the planning part

Working step	Scope
Identification and analysis of the parameters expected to be of significance for waste generation – and identification of options for waste management	<p>Hazardous waste generation and the composition of waste adjusted in relation to:</p> <ul style="list-style-type: none"> – changes in the economic situation (growth/recession) – changes in demand for and nature of consumer goods – changes in manufacturing methods and new production technologies – effects of policy changes
Determination of objectives for WM	<ul style="list-style-type: none"> – waste prevention, recycling, recovery and safe disposal of waste – hazardous waste streams, e.g. priority waste streams – sources of waste, e.g. industry and other
The future waste management system – action plan	<ul style="list-style-type: none"> – collection (curbside, bring schemes, recycling sites) – waste management facilities (recycling, incineration with energy recovery, landfilling) – Distribution of responsibilities between local authorities and industry (industrial waste, producer responsibility, etc.) – economic consequences and financing: <ul style="list-style-type: none"> total cost of management system use of charges, fees and taxes, producer responsibility - measures to implement the waste management plan
Long-term development	<ul style="list-style-type: none"> – future investments in new waste management facilities - additional research and studies to be performed

The identification of needs and deficits should also take into account ‘proper treatment and disposal options’, therefore addressing the allocation of the hazardous waste generated to a best environmentally treatment operation. Hence, the establishment of an appropriate infrastructure needs to be derived from such assumptions.

On the basis of the potential and capacity of the country, including the economy, the adopted policies and the existing mandatory targets such as targets fixed in EU directives, the most realistic scenario should be selected as a starting point for the planning.

When the analyses of the current situation and the expected future developments in waste quantities have been made and the objectives agreed upon, it should be decided how these objectives can be met. This may be considered as the core of the planning process.

Preparation of an action plan

The action plan should include:

- Selection of collection systems
- Identification of the waste management facilities still needed
- Assignment of responsibilities to the various parties
- Considerations of economic consequences and financing
- Considerations on the use of measures to implement the waste management plan

Waste management facilities

The action plan should include decisions on the type and capacity of waste management facilities. Decisions on this issue should be thoroughly studied, as the establishment of such facilities is rather costly.

The regional/local plans should contain a detailed assessment of the need for different types of plants and of the existing capacity. The action plan should contain estimates on whether the national strategies on waste are complied with, such as the principles of proximity and self-sufficiency. Furthermore, the action plan should assess whether the various types of plants have been adapted to the overall objectives of the waste strategy/plan in terms of capacity and treatment methods, taking the waste hierarchy into account. Each treatment plant should be described and assessed with regard to the amounts of waste expected to be generated within the planning period.

Facilities may have an operational lifespan of several decades, so the location must be carefully selected.

The planning horizon for different methods of collection and treatment basically depends on economies of scale of the facility/equipment involved. This sets minimum capacity sizes for the plant if it is to be operated economically and with minimum planning horizons in order to guarantee the pay-back time.

In the planning it should also be estimated whether plants comply with present and future standard requirements (e.g. according to EU legislation or other national legislation), and plans for extension, upgrading etc. should be considered in the plan.

See also section 1.2.5. on economic consequences and financing.

1.2.3. Establishment of an appropriate infrastructure

Basically, appropriate infrastructure needs to ensure appropriate management of all waste generated (at present and as estimated for a period for at least 10 years ahead) without endangering the environment and human health and in line with the principles of sustainable production and resource efficiency. Apart from sufficient and geographically well-situated capacity and a balanced mix of treatment facilities, this requires the establishment of adequate technical standards and operational practices.

The following aspects should be taken into account in order to establish an adequate collection infrastructure and a network of appropriate recovery and disposal installations:

- Identify suitable sites for waste disposal
- Incorporate the most recent scientific and technical knowledge
- Determine specific technical processes for disposal
- Ensure the protection of human health and the environment
- Consider that the waste should be disposed of in one of the nearest installations

Technical standards

In order to be considered appropriate, recovery and especially disposal installations should be designed and managed according to high standards of quality. If possible, competent authorities (CAs) should apply Best Available Techniques (BAT).

The OECD defines BAT as follows: “the use of technology, processes, equipment and operations that are based on scientific knowledge, whose functional value has been successfully tested in operative comparable plants“, and explain that „BAT can be briefly described as the use of the most efficient and proven technologies and methods of operation

to prevent and minimize harmful impacts on the environment at reasonable costs. Alternatively, BAT may be viewed as improving environmental performance through a variety of initiatives involving the selection or promotion of techniques, incentives, innovation, operating practices, programs, or performance standards without necessarily prescribing specific technologies⁴. Furthermore the OECD states that „BAT is a dynamic tool. It evolves at the same time as technology and methods of operation are making progress, so it implies regular updating of information related to “cutting edge” waste technologies and techniques“.

Note that the use of “cutting-edge technology” may not be the most appropriate technique in certain waste management circumstances. For example, for the management of certain wastes, such as obsolete equipment, it may be that manual dismantling may yield higher reuse and recycling value of the materials, as opposed to the use of high-end technology. (see OECD Guidance Manual on Waste Management) at www.oecd.org/dataoecd/23/31/39559085.pdf

Further details on BAT as applied in the European Union can be found on these websites:^{4 5}
⁶ and an exemplary documents and the latest reference documents (BREF) for waste management can be downloaded here ⁷.

Detailed information on technical standards for the construction and operation of the different treatment facilities is available in the Manual for:

- **Thermal treatment:** In Module 6 of the Manual information on hazardous waste incineration is given, and chapter 9.2 presents information on co-processing.
- **Physico-chemical treatment** of hazardous waste is comprehensively highlighted in Module 4 providing general explanations, economy of scale calculations to be considered for the establishment of such facilities as well as some clarifications regarding to definitions.
- **Above-ground landfill sites** for hazardous waste disposal are covered in the Manual Module 7 comprising information on technical conditions such as the multibarrier concept (11.1), geological (11.4) and technical barrier (11.5) and the required quality of hazardous waste to be disposed of in landfills (11.2). Further, technical information is given in chapter 11.6 on leachate drainage and collection, chapter 11.7 on landfill gas drainage. A reference design for sealing and leachate collection system is provided in chapter 11.8. Additional information for construction and operation of landfills is presented in Manual chapters 11.9-11.12. Economic aspects are discussed in chapter 11.13. A case study from China is provided in chapter 11.14.
- **Underground disposal** is briefly covered in Module 7 of the Manual.

Criteria for the location of waste treatment facilities

⁴ The conceptual approach of Best Available Techniques (BAT) was introduced as a key principle in the IPPC Directive 96/61/EC (Directive 2008/1/EC codified version).

⁵ A Draft BAT Guidance on Best Available Techniques for the Waste Sector: Transfer Activities published by the Environmental Protection Agency of Ireland is available at <http://www.epa.ie/downloads/consultation/bat%20waste%20transfer%20jan%2009%20-%20v10.pdf>

⁶ A Draft BAT Guidance on Best Available Techniques for the Waste Sector: Landfill Activities published by the Environmental Protection Agency of Ireland is available at <http://www.epa.ie/downloads/advice/bat/BAT%20Landfill%20final%20April%202003.pdf>

⁷ The European Commission, Joint Research Centre, Institute for Prospective Technological Studies published BREF documents on Waste Incineration (<http://eippcb.jrc.es/reference/wi.html>) and Waste Treatments Industries (<http://eippcb.jrc.es/reference/wt.html>).

Sites or areas which are suitable as a location of waste treatment facilities can be presented either by geographical maps as shown above (Figure 1-6) and/or by a specifying list. Furthermore, a set of siting criteria for selecting a site for the construction of treatment facilities can be listed.

In practice, siting criteria should be defined in a first step for areas to be absolutely excluded from construction purposes. According to the revised methodological guidance 'Note on *Preparing a Waste Management Plan*⁸ of the European Commission, DG Environment', the criteria may comprise amongst others the following criteria:

- Areas protected for ecological, landscape or cultural value
- Location susceptible to earthquakes, subsidence, landslides, erosion, flooding, extreme or adverse climatic conditions (e.g. temperature inversions, fogs, severe winds)
- Densely populated, built-up area
- Hospitals, schools, places for worship, community facilities
- Residential areas, recreation areas
- Public open space, community facilities, areas used for commerce
- Areas highly visible to many people

In a second step, remaining areas should be specified and ranked in a list of potentially suitable areas in relation to geological and hydro-geological criteria e.g. as set in the EC Landfill Directive, and in relation to climatic and infrastructural aspects.

1.2.4. Financial aspects, calculation of investments and costs

Financing of the waste management system depends on national legislation and the extent to which there is a tradition for making users pay for the service. Charges are rather commonly used for collection and treatment of waste although other financing systems, such as producer responsibility, are used for some waste streams.

Costs of treatment and disposal facilities

Cost calculations for different treatment and disposal facilities are available in Modules 4,6,7 of the Manual. They are based on estimated local costs for China in 2007.

The calculations are made for physico-chemical treatment plants of different capacities, and for incineration facilities. Cost items for landfill development are also listed in the Manual (chapter 11) as well as estimations of "Economy of Scale" effects on hazardous waste landfill disposal (based on actual local costs, in China in 2007).

Because of comparatively high investments, incinerators should preferably be planned and developed as centralized facilities that are adequately scaled and located (for details, see Annex 13 of the Manual on Details of Calculations of Specific Costs) in Modules 4, 6 and 7.

Other costs

- Price of treatment of one tonne of waste at the various treatment plants (landfill, incineration, separation etc.)
- Costs in connection with collection of one tonne of waste split up between collection methods and waste streams

⁸ As the revised guidance document on WMP/WPP will be published in 2011, currently only the old version is available at http://ec.europa.eu/environment/waste/plans/pdf/wasteguide_final.pdf

- Costs in connection with transportation of one tonne of waste distributed on waste streams

1.2.5. Economic consequences and financing

Achieving the preferred mix of treatment methods for each waste stream in the future system is the real challenge of waste management planning. The final result may consist of a number of measures and instruments (legal and economic) to be activated, awareness campaigns, new waste collection schemes and access to new treatment facilities.

In addition to estimating the effectiveness of initiatives in terms of volumes of waste to be directed and redirected in the overall waste stream, the future waste management system will typically imply significant investment and additional operation costs.

A major component in making the final decisions and approving the new waste management system will be to decide based on the economic consequences of both the initial investments and operating costs, and the future level of user fees and charges. Again, each initiative should be evaluated in terms of economic consequences, and finally included in one aggregated overview.

The aim is to estimate the total costs in terms of capital costs and operating costs. However, as collection equipment, landfills and other facilities needed in the overall waste management system have various life spans and depreciation periods, calculations should be made in order to compare and sum up the costs of numerous operations. One way is to calculate the total annual costs, i.e. operating cost plus the annual cost of investments.

If possible, the costs should be divided into:

- costs of general administrative initiatives such as costs of waste planning, permitting, legislation etc.
- cost of general initiatives for waste prevention
- costs related to the treatment of various waste streams including investment costs

In this way, it should be possible to keep track of the economic costs of achieving the objectives. It should also be possible to compare the costs of the current waste management system with the costs of the new waste management plan.

Calculations of the costs per ton of waste may help to get an idea of the average costs, and may be used to compare the costs with the costs of alternative measures.

Financial and expert support of international organisations

In the European Union, there is substantial money involved in ensuring continuous development of a waste management system, and throughout Europe there are many methods of financing. Collection and transportation, treatment facilities and landfills are financed and operated by private enterprises, public enterprises, semi-public entities or inter-municipal partnerships.

For low- and medium-income countries, the European Union offers the possibility of support through external experts and financial support within external cooperation and aid programmes to achieve the realisation of diverse projects in the field of environmental protection. Countries can apply with tenders and specific projects to obtain this support from the European Commission. For more details, visit http://ec.europa.eu/europeaid/what/environment/index_en.htm.

Further financial funds might be available e.g. in the international context (World Bank, regional banks, national cooperation agencies, etc.).

Allocation of wastes to appropriate treatment methods

Certain types of waste are particularly suitable for only one specific treatment method, such as landfill, incineration or physico-chemical treatment. Decisive parameters are often the



physical and chemical composition and the caloric value. Physico-chemical treatment can be used as pre-treatment in order to limit the hazards of land filling. For detailed information on appropriate treatment allocation, see Manual, Module 4.



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