



- **Module 9**
- **Factors contributing for a success of a HWM system, a summary**

- **Factors Contributing to the Success of Hazardous Waste Management in a Country**

Successful set-up and implementation of a hazardous waste management system requires concerted efforts and intervention in different strategic areas and at different levels (see Fig. 116). The strategic areas are partially interdependent and complementary to each other. Applying the tools of project planning, the strategic areas can be understood as elements of a project planning matrix: For each strategic area objectives, adequate action plans and indicators have to be defined. Achieving the objectives will eventually enable the successful implementation of a hazardous waste management system. An overall goal can be formulated which might be phrased:

“To eliminate the adverse effects of Hazardous Waste by ensuring safe, efficient and economical collection, treatment, recovery and disposal of wastes and to ensure that the system is reliable now and for the foreseeable future.”



Fig. 116: Successful implementation of a hazardous waste management plan requires simultaneous action of the stakeholders in different strategic areas

The strategic areas, relevant objectives and a few keywords are discussed below.

14.1 Strategic Area “Regulation and Planning”

Objective with regard to “Regulation”:

- ❖ ***Hazardous waste related legislation has been notified or supplemented where necessary and technical standards for sustainable HWM according to the International State-of-the Art have been developed and are being implemented.***

Legislation should include all required definitions and standards. It should also clarify responsibilities of the regulated community and of the government. Minimum requirements to be covered by regulation are:

Definition of hazardous waste and differentiation of hazardous waste from non-hazardous waste

Definition and differentiation of hazardous waste for recovery (commercial goods) and for disposal

Consistent, logical and user-friendly system of waste classification

Obligations of hazardous waste producers to report on hazardous waste generation and management

Definition of a hierarchy of hazardous waste management measures with regard to minimization of adverse impacts to the environment and human health and with regard to resource conservation

Mechanism enabling the competent authorities to approve hazardous waste disposal- or recovery operations intended by the waste owner

Mechanism for tracking transfer of hazardous waste

Definition of minimum standards for treatment and disposal of hazardous waste (e.g. landfill disposal, incineration)

Detailing licensing procedures for hazardous waste treatment, recovery and disposal facilities

Requirements for elaborating and implementing waste management plans

Regulators of emerging economies who are in the process of shaping HW related regulation in their countries might seek orientation from international HW regulation.

The European Union has developed a comprehensive package of latest legal provisions in HWM²⁴³ which might serve as guidance.

With regard to “Planning” the following objectives have to be fulfilled:

²⁴³ Source: http://ec.europa.eu/environment/waste/hazardous_index.htm

- ❖ ***An overall planning mechanism for HWM infrastructure is established that is instrumental in coordinating planning activities on a National-, State/Provincial, and City/District-level.***

The planning mechanism must consider the different planning levels: National/Central – State/Provincial – City/District. The planning process produces a National/Central plan and a plan for every State/Province which includes details from the Cities/Districts. The main planning work is usually done on a State/Provincial level. HWM planning is an interdisciplinary activity and requires cooperation of different government departments and experts from different areas.

- ❖ ***The competent authorities at the different levels and the relevant stakeholders have recognized the need for coordinated planning of a HWM infrastructure and have agreed to it.***

Planners should be aware that HWM infrastructure planning is not only a technical but also a political issue. Planning must win active support from the stakeholders for ensuring plan implementation. This may not always be easy. HWM infrastructure requires a certain ‘economy of scale’ for enabling economically viable operation of centralized facilities such as landfill sites and incinerators. Hence, planning might face stiff protest from neighborhoods, counties, districts and cities who object the erection of centralized facilities within their premises, particularly when waste also coming from outside of the own area is intended for disposal.²⁴⁴ To overcome this hurdle, public consultations have to be convened. Subject to the specific conditions planners may also ally themselves with high-level charismatic government bureaucrats who are in a position to reach out to the concerned municipalities for appealing to their consideration of the common welfare.

- ❖ ***A HWM plan compliant with national and international requirements and standards, comprising National-, State/Provincial- as well as City/District-level planning, has been approved, is being implemented, monitored, evaluated and regularly updated.***

Plans and regulations on hazardous waste management have to

Contain all relevant objectives, activities, responsibilities to facilitate the further development and implementation of a fully integrated and cost-effective waste management system;

²⁴⁴ “NIMBY” phenomenon (Not In My Backyard)

Comply with National, State/Provincial, as well as international standards and requirements;

Be comprehensive and address all key areas/aspects of hazardous waste management performance on National, State/Provincial, city and institutional level;

To be based on the Cooperative Principle (Chapter 2), especially the inter-regional approach, which is indispensable for implementing an efficient hazardous waste management system;

Comprise “Priority Waste Lists” which define individual waste types occurring in the respective planning area with great (potential) environmental risk and to focus resources and activities on a) minimization of waste quantities, b) minimization of environmental impact, or c) improvement of treatment or disposal;

Provide provisions and specifications on the management of special hazardous waste streams such as waste oil, health care waste, waste electrical and electronic equipment, end of life vehicles, PCB containing wastes and high-volume low-toxicity wastes (e.g. fly ash)

Introduce “Extended Producer Responsibility” (Ref. chapter 2) for relevant categories and types of waste/spent products, or encourage a stronger involvement of stakeholders, particularly polluters, with the aim of improving pollution prevention and sustainable waste management performance by implementation and/or use of ‘Best Available Technology’ BAT, environmental management, voluntary agreements, etc.;

Define appropriate instruments to support sustainable waste management,

- Regulatory instruments, e. g. extended producer responsibility, disposal ban, facility standards,
- Economic instruments, e. g. fees, advance treatment/disposal fee, landfill tax,
- Persuasive instruments, e. g. voluntary agreements, waste prevention targets, eco-labeling, etc.

Establish and maintain waste management quality standards, criteria, benchmarks for a) preventing or minimizing waste amounts arising, b) minimizing the environmental impact related to waste generation, management, and disposal, c) promoting the efficient use of resources;

Set up or amend the monitoring/reporting system on generation and flow of hazardous waste;

Set up a communication system to improve public participation and to encourage stakeholders of all sectors of the society to become involved in partnerships, voluntary agreements, etc. for contributing to the overall goal of the plan.

14.2 Strategic Area “Effective Enforcement, Education and Training”

Objectives include:

❖ ***Enforcement of national and lower level legislation, regulations and standards related to hazardous waste management is effective***

Achieving a high compliance level with existing regulation is a key priority in HWM for minimizing adverse effects of hazardous waste on human health and environment. However the approach taken for enforcement may change over time. Whereas at the outset the competent authorities may have to adopt a “watchdog” role towards the regulated community, with increasing education success their role may gradually change into that of a partner who provides guidance, advice and smooth regulatory services.

Enforcement of legislation shall:

Be carried out by competent and trained personnel

Be supported by sufficient (financial, technical, personal) resources and procedures to fulfill the task appropriately,

Result in the establishment of integrated systems and procedures for licensing, monitoring and inspection (e.g. determination of “enforcement priority tasks”, elaboration of administrative inspection guidelines), taking stock of the HW inventory

❖ ***Self-regulatory initiatives of hazardous waste generating enterprises have improved hazardous waste management significantly***

Under the umbrella of ‘Corporate Social Responsibility’ (CSR) particularly multi-national enterprises have concluded voluntary agreements and developed their own strategies for environmental management including hazardous waste. These internal arrangements go usually beyond of what is required by legal standards. Such enterprises may educate their supply chain companies to do better in hazardous waste management by suggesting minimum standards for their environmental performance. Measures to be considered are e.g.:

Reducing waste generation, enhancing waste recycling and recovery

Improving hazardous waste segregation, collection, storage and transport

Taking responsibility for hazardous waste transferred to third parties for the purpose of recovery or disposal (“Duty of Care”)

❖ ***Data and information on waste management are sufficient to support planning, monitoring and enforcement***

Data and information have to

Be accurate and reliable to meet all requirements of waste monitoring, waste inspection, and adjustment of waste planning;
Cover the sources, type, quantities, recycling, recovery, treatment/disposal, facilities of waste management;
Be based on a comprehensive National system for classifying waste types, e.g. “Comprehensive Waste List”;
Be based on a National system for compilation, processing, analyzing, evaluation, and documentation of data and information, e. g. “Hazardous Waste Inventory”;
Be updated and analyzed periodically and documented, e. g. “Annual Waste Reports”;
Meet the requirements for planning, monitoring and reporting of waste management activities and performances;
Meet the requirements of law enforcement and control of both waste management activities and facilities;
Comply with national classification and reporting system.

❖ ***Human resources and capacity for hazardous waste management are appropriate***

(See section 14.3)

14.3 Institutional and Organizational Set-up

This strategic area refers to the institutional and organizational set-up of the main stakeholders in HWM such as competent authorities, HWM service providers and HW generators. Objectives in this area are the following:

❖ ***Institutional and organizational arrangements for hazardous waste management are sufficiently developed and implemented***

Institutional and organizational arrangements have to suit the requirements on National, State/Provincial and City/District level with regard to regulation and planning, administration, enforcement and operational functions. The arrangements may need to be strengthened for gaining more efficiency and competency with regard to:

Clarifying responsibilities and scope of duties of stakeholders (public sector administrations, HW service providers) with regard to hazardous waste management, “Horizontal” co-operation of competent authorities and HW service providers with respect to planning, building and operating disposal facilities, and recovering and disposing HW

(Competent Authorities) Compiling, assessing and disseminating information related to HWM and advising the Government, lower level competent Authorities, Cities, industrial associations, chambers and HW generators accordingly
Improving licensing, HW transfer, on-site inspections, monitoring of organizations/enterprises and activities related to HWM.

Institutional and Organizational Set-up,

Waste Authorities: Formation of a Working Group on Waste

It was noticed that legislators at the National/Central/Federal level in low- and middle income countries are sometimes lacking practice related experience when framing waste regulation. As a result, legislative procedures emulate laws and regulation that are often falling short in practicability and of meeting real regulatory requirements. Moreover it was found that competent authorities at the State/Province level, without precise guidance how to implement National/Central/Federal regulation, may arrive at their own interpretation of the National laws. As a result, at the State/Province level inconsistent enforcement procedures may spread.

It is highly recommendable therefore to form a working group on waste, with equal representation from the competent authorities at the National/Central/Federal level and the State/Province levels in order to create a broader base for law making and to ensure uniform execution of waste related regulation in the entire administrative area of the country. This working group should fulfill the following tasks:

- Ensuring information and experience exchange between the States/Provinces and with the National/Central/Federal regulator
- Elaborating legislative proposals
- Clarifying legal issues related to waste law. This might require the formation of a sub-working group.
- Clarifying technical issues e.g. with respect to disposal technology, allocation of waste to recovery/disposal options, waste analysis etc. and elaborating proposals for solution. This might require the formation of a sub-working group.
- Reviewing the adequacy of the regulatory tools presently in use; modification and supplementation if necessary.
- Elaborating administrative instructions and practice related provisions for implementing waste regulation
- Interacting with industrial associations, NGO's and other relevant bodies

- Publishing guidelines, bulletins, standard procedures, codes of practice etc. for dissemination or sale among the stakeholders including the regulated community

In Germany the foundation of the [‘Working Group of the Federal States on Waste’ \(LAGA\)](#) in 1963 has proven to be highly successful in this regard.

❖ ***Human resources’ capacities with regard to HWM are appropriate***

The improvement of human resources and capacity shall

Be related to the institutional and organizational set-up

Consider all stakeholders at all levels

Be supported by sufficient budget allocation

Be based on training needs analysis and targeted programs/curricula in which the relevant topics and issues are sufficiently addressed, and

Convey the relevant subject matter to the training target groups by appropriate tools such as e. g. interactive workshops, lectures, talks, tests (Q&A), on-the-job training, internships

Compile and disseminate information on ‘Best Available Technology’ (BAT), (international) best practice standards and in-depth issues of HWM

Implement appropriate pilot projects.

Institutional and Organizational Set-up,

Hazardous Waste Generating Enterprises, HW treatment and disposal facilities:

Appointment of a ‘Waste Management Officer’

All enterprises in Germany generating hazardous waste in regular intervals are required by law to appoint a ‘Waste Management Officer’ (WMO) who takes care of waste related issues within the company. This has proven successful for improving internal waste management.

The following are the responsibilities and functions of a WMO:

- 1) To advise the top management in all waste related issues and to inform about shortfalls in WM observed
- 2) To assess, organize & review internal waste management (e.g. establishing the waste inventory; setting up waste segregation, reduction, collection, storage, treatment, transport, utilization and disposal, elaborating ‘Standard Operation Procedures’ (SOP’s) and checklists)

- 3) To oversee all waste streams from “cradle to grave” (Duty of Care)
- 4) To oversee compliance with waste related and associated regulation, e.g.:
 - Record of proper waste management procedure and manifest
 - Occupational Health & Safety issues with regard to HW,
 - Road transport of HW according to dangerous goods regulation
- 5) To support the Admin. Dep’t. in tendering & signing contracts with disposal and utilization entities
- 6) To train staff with regard to the following:
 - Hazards from wastes arising in their respective working areas as well as adequate protective measures
 - Proper management procedures for hazardous wastes
- 7) To determine goals for waste avoidance, reduction, segregation, for enhancing/upgrading comprehensive utilization, for improving disposal and to monitor the implementation of those goals
- 8) To document & report all activities and to submit an annual report on No’s 1-7 to the top management

It is important to note that a ‘Waste Management Officer’ does not automatically become legally responsible for the company’s waste management. The WMO is responsible for providing all the information required to the top management which has to decide on the necessary action.

In Germany the competent authorities offer 4-day training programs for WMO candidates for acquiring the required qualification. Being a WMO is not a full time job. The staff who executes the WMO function will usually have also other tasks in the company. The company may also outsource the function of a WMO to an external expert.

❖ ***International cooperation is effectively developed***

Stakeholders such as:

Managers and staff of the competent authorities can get deputed from their organizations for taking part in international exchange programs hosted by authorities in countries with advanced HWM systems and accumulated experience. Also participation in international development projects pursuing HWM related themes provides opportunities for enhancing knowledge and experience.

Indigenous HWM service providers and HW generating enterprises may enter into joint ventures with investors from abroad. Such cooperation offers potentials for know-how and technology transfer in the area of HWM.

14.4 Strategic Area “Prevention, Recycling and Recovery”

Waste prevention and recycling activities have to be considered in the HWM Plan as top priority. Objectives to be formulated for this strategic area:

❖ ***The playing field is leveled with regard to hazardous waste prevention, recycling and recovery***

Planning has to consider the setting of framework conditions for hazardous waste prevention, recycling and recovery by:

Reviewing the legal differentiation between ‘waste’ and ‘commercial goods’ and regulation for sale and/or use of hazardous materials as commercial goods

Creating conditions in the entire planning area for establishing a transparent uniform tariff system for disposal costs so that disposal charges act as incentive to implement prevention, recycling and recovery

Supporting the set-up of an infrastructure and market place for exchange of secondary raw materials

Granting operational licenses for future installations in the manufacturing sector only when applicants consider ‘Best Available Technologies’ (BAT) with regard to emission control including hazardous waste minimization.²⁴⁵

Elaborating reference material for waste prevention, recycling and recovery

Selection of Best Practices in waste prevention, recycling and recovery

Preparation of waste prevention recycling, and recovery guidelines

Development of waste prevention, recycling and recovery indicators

Conducting advanced training and pilot projects

❖ ***The potential of waste prevention and reduction at the source is being exploited.***

Activities should focus on “Priority Waste Types”, which are characterized by hazardous potential, quantity and/or potential of prevention, (see strategic areas “Legal framework and enforcement”): Activities should consider the major aspects of prevention and reduction:

²⁴⁵ See Annex 7 for a list of all reference documents on BAT published by the European IPPC Bureau

Improvement of waste composition; i.e. avoiding unfavorable constituents by substituting them against less hazardous raw materials or additives during the production process. This facilitates later utilization.

Improvement of on-site segregation and pre-treatment of wastes

Improvement of operational/management measures (reference: ISO 14001:2004, material flow management, waste management concepts).

Moreover, activities should consider that waste prevention:

Requires sometimes complex modifications within the production process and is not directly within the purview of “classic” waste management;

Must be initiated within the production process early enough before products or materials become waste;

Is potentially diverse in its *effects* on materials and products: It may affect the quantity, hazard, and energy content of materials and products that are converted into waste.

❖ ***The potential of environmental sound waste recycling and recovery is realized.***

Activities should focus on “Priority Waste Types”, which are characterized by hazardous potential, quantity and/or potential of prevention, (see strategic area “Legal framework and enforcement”): Activities should consider the major aspects of recycling and recovery:

Improvement of waste composition; i.e. avoiding unfavorable constituents by substituting them against less hazardous raw materials or additives during the production process. This facilitates later utilization.

Improvement of on-site segregation and pre-treatment of wastes

Improvement of operational/management measures (reference: ISO 14001:2004, material flow management, waste management concepts).

Activities have moreover to consider that waste recycling and recovery:

Should make use of ‘Best Available Technologies’ as far as possible in order to minimize risks to the environment and to human health.²⁴⁶

May generate waste water, emissions to air and secondary hazardous wastes that require proper treatment and disposal

²⁴⁶ See ‘Reference Document on Best Available Technologies for the Waste Treatment Industries’, published by the European IPPC Bureau)

Is frequently considered as profitable business by operators because the competent authorities do not require them to ensure proper management of secondary pollutants generated

High recycling- and recovery rates do not automatically indicate a State-of-the-Art circular economy; recycling and recovery may be based on low-technologies which cause uncontrolled dissipation of dangerous substances (emission to air, water, and soil, but also products) and leads to high environmental and health risks; such problems need to be identified and resolved.

14.5 Strategic Area “Treatment and Disposal”

- ❖ ***Consistent minimum acceptance criteria, licensing procedures and operation conditions for treatment and disposal facilities are developed and implemented.***

With respect to landfill sites, the following has to be regulated:

Licensing procedures

Acceptance criteria

Design criteria of construction elements essential for pollutant retention

Quality control measures during construction

Emission control and monitoring

Requirements during the operational and post-operational phase

Disposal of secondary pollutants generated (leachate)

With respect to CPT plants, the following has to be regulated:

Licensing procedures

Acceptance criteria

Emission control and monitoring

Operation conditions

Disposal of secondary pollutants generated (e.g. waste water, filter cakes and oil)

With respect to incinerators, the following has to be regulated:

Licensing procedures

Acceptance criteria

Incineration conditions (temperature, subject to presence of halogenated organic pollutants, retentions time etc.)

Emission control and monitoring

Disposal of secondary pollutants generated (e.g. slag, fly ash, waste water, filter cakes)

❖ ***Feasibility studies for HW treatment & disposal facilities for the individual facilities specified in the HWM plan have been completed.***

Feasibility studies for the envisaged treatment and disposal facilities have to be conducted on a City/District level. This requires a more detailed re-examination of hazardous waste generation data which may lead to modifications of the initial planning concept. Quality standards and acceptance criteria for the design, construction and operation of chemical/physical treatment plants, landfill sites and incinerators have to be defined. Planners, regulators, contractors and operators need to be trained accordingly.

Feasibility studies should provide information with regard to the following:

Catchment area, types and quantities of hazardous waste to be treated / disposed

A shortlist of maximum 5 options for the potential site location

Rapid Environmental Impact Assessments of the installations under consideration (at each of the shortlisted respective locations) and suggested measures for minimizing and compensating such impacts

Detailed design specifications for the installation under consideration, as far as possible according to 'Best Available Technology' (BAT), including measures for emission monitoring and pollution control

Specification of ancillary facilities such as laboratory, water & electricity supply, weigh bridge, fence, access road, storage area, workshops, trucks, compactor, garages etc.

Requirements for quality control during the construction period (important e.g. for landfill sites);

Specification of the required staff and capabilities;

Treatment and disposal of secondary pollutants generated

Post-closure measures after the active lifetime of the facility (important e.g. for landfill sites);

Options for the operator model;

Financial requirements, including costs for site development, quality control, access road, fixed capital costs for main- and ancillary facilities, operation costs, salaries for staff, etc.;

Options for structuring and calculating the fees to be charged to waste producers, particularly with regard to additional transport costs

- ❖ ***Suitable State of the Art facilities including physical chemical treatment plants, incinerators and landfills for the effective treatment and disposal of organic and inorganic hazardous waste are available and provide sufficient capacities.***

Detailed planning and construction of the hazardous waste treatment and disposal facilities resulting from the feasibility studies must be initiated. Based on the feasibility studies, design standards should be elaborated. Subsequently tender documents have to be developed and tendering undertaken. The contractor finally identified may yet require training.

- ❖ ***Adverse effects on the environment from the treatment and disposal of hazardous waste are minimized as far as possible.***

Emissions resulting from operation are controlled and secondary pollutants are properly collected and treated.

- ❖ ***The scale of the facilities as well as the operator model ensures cost effective operation and cost recovery.***

(See chapter 13.5.3)

14.6 Strategic Area “Segregation, Collection, Storage and On-site Treatment”

The following objectives have to be achieved in this area:

- ❖ ***Waste is effectively segregated and managed at the source***
- ❖ ***Enterprises perform environmentally sound on-site recycling and -treatment of HW in a transparent manner***
- ❖ ***The requirements of temporary storage have been investigated and environmentally safe (centralized) facilities are realized***

Related activities have

To be detailed in the “HWM Action Plan”, in connection with waste prevention, recycling, recovery and disposal, proposing a step-by-step approach, e. g.

- 1) Consider legal restrictions on waste segregation (e.g. ban of mixing hazardous with non-hazardous waste)
- 2) Improve compilation and dissemination of know-how
- 3) Conduct demonstration- and pilot projects
- 4) Conduct advanced training

To consider hazardous as well as non-industrial hazardous waste

To focus on methods and systems for segregation, temporary storage, collection, and transport; the arrangements have to be sufficient to comply with national requirements
To give priority to source oriented segregation measures, with the aim:
To segregate hazardous waste at the earliest possible point
To gain “clean” fractions of recyclable material
To minimize waste fractions for disposal,
To consider that services for the collection and transport should be efficient and cost-effective.

Enforcement in this area should rely on on-site waste investigation campaigns that focus on temporary on-site storage of hazardous waste within waste producer's premises, separation of hazardous waste streams, collection and particularly on-site treatment, recycling and disposal of hazardous waste (see chapter 5.2.). After evaluation of these campaigns measures must be taken to ensure that hazardous waste segregation, on-site storage, on-site treatment and –recycling is in compliance with the respective regulation. Experience has shown that conduction even of a limited number of on-site waste investigations has a positive educative impact on the regulated community.

14.7 Strategic Area “Financial Instruments”

The objectives of this Strategic Area reflect the Polluter Pays Principle and the Producer Responsibility.

- ❖ ***Financial sources for funding the implementation of the HWM infrastructure plan have been identified and are available.***

The options and projects of the HWM Plan finally selected for implementation have to be subjected to a detailed financial analysis. Subsequently, a financial plan has to be drawn up with a detailed specification of funding requirements and allocation of financial resources.

- ❖ ***Charges/fees for waste management services reflect the true costs of the services***

It is the aim to ensure that full costs are encompassed in prices for waste management services. Within this strategic area also a price formation scheme for providing waste management services has to be developed, reflecting the true costs of the services according to the ‘Polluter Pays Principle’ (e.g. including costs for the aftercare of landfills after site closure).

❖ ***Economic and financial instruments support effectively the implementation of Sustainable Waste Management***

The introduced economic and financial measures shall

Reflect the 'Long Run Marginal Costs' (LRMC) of waste management services and facilities provided by public or private operators – collection, transport, pre-treatment, disposal

Be incentive to support waste prevention and recycling through innovative and resource efficient production technologies (e.g. providing loans with discounted interest rates for equipment procurement that meets 'Cleaner Production' criteria defined by the regulator)

Be incentive to support the development and implementation of innovative and environmental friendly waste recycling and treatment technologies

Introduce deposit refund systems for selected hazardous and/or recyclable spent products or waste materials (e.g. batteries, oil)

Give preference to recycled as well as recyclable products and materials in public sector procurement policies

Be incentive to support the set-up of Public Private Partnerships (PPP).

The seven strategic areas listed above may serve as orientation for conducting a gap analysis of the HWM situation in your country.

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