Chapter 6

Supportive and Relevant Information for Strategy and Plan

6. Supportive and Relevant Information for Strategy and Plan

6.1 Introduction

This chapter provides supportive and relevant information for the strategy and action plan presented in Volume 1, and comprises of the following sections:

6.2 Collection and transportation of hazardous waste

6.3 Treatment and disposal of hazardous waste

6.4 Management of soil-contaminated sites

6.5 Economic aspects

6.6 Information and data management

6.2 Collection and Transportation of Hazardous Waste

This section is similar in structure to that in Volume 1 Section 4, but with supportive and relevant practical information concerning especially the technical and operational issues (section 6.2.2) of transportation and interim storage pending collection for transfer to a waste management facility.

6.2.1 Current Conditions

(1) Technical and Operational

In Romania, there are very few and limited facilities dedicated for treatment and disposal of hazardous waste. Generally, generators of hazardous waste themselves `dispose' of their waste at their own premises – either within factory sites or on company-owned land near to their factories. In this event, they collect their own hazardous waste, and transport it to their own sites. As a consequence, no enterprises have developed a substantive specialist transport service for hazardous waste generators. The exception to the above and the principal types of hazardous waste currently collected and transported now are healthcare wastes, used oils and batteries.

In the Directory of Romanian Transport 2002 (www.transporturi.ro), there is an ADR (European Agreement for international transport of hazardous substances) transport sector for hazardous goods (eg petroleum products). Nearly 200 companies are listed; international companies and ~70% of the Judets are represented. However, from a sample of telephone contacts with these companies none are involved with transport of hazardous wastes.

(2) Political and Legislative

The legislative aspect of transportation of wastes is very recent and still developing. In respect of transport of wastes, Emergency Ordinance 78/2000 (amended by Law 426/2001) applies. In addition, vehicle requirements, packaging, labelling, placarding, driver training are all as prescribed under the `dangerous substances' legislation (GEO 200/2000 [on the Classification, Labeling and Packaging of Hazardous Chemical Substances and Compounds],

approved and modified by law 451/2001 and used in conjunction with the provisions of GD 490/2002 for the approval of the methodological norms for enforcing GEO 200/2000.

(3) Institutional and Organisational

The above requirements have not all been implemented. Currently, all transport operators are required to have a licence from the Ministry of Transport. An additional permit is required for transport of wastes. EPIs give such a permit for collection and transport activities' Applicants in the form of an Environmental Authorisation. In this document, the types of company activities are listed. This Authorisation document serves as permit for the companies to transport their own wastes. If an Applicant wants to do inter-city or international transport of hazardous waste, the applicant must obtain a transport licence for hazardous goods from Ministry of Transport as well. However, some EPIs require all Applicants of hazardous waste transport to submit photocopy of their licence for transport of hazardous goods obtained from Ministry of Transport, irrespective of whether in-city or inter-city transport. A further apparent requirement is that multi-county operators (e.g. Petrom) are required to obtain vehicle permits from each county EPI.

(4) Economic and Financial

A proposed objective of the national strategy is that all services for the collection and transport of hazardous waste to become efficient and cost-effective.

6.2.2 Issues

With relatively little wastes being transported for off-site disposal, Romania currently lacks the necessary skills and infrastructure for safe transport of hazardous wastes. Also, given the almost complete absence of large-scale hazardous waste transport in Romania, it is an area where the Environmental Protection Inspectorates understandably lack regulatory experience and capacity. The main issues for these activities in Romania are:

- How such a service to industry for waste transport to authorised treatment and disposal facilities should best be developed; and,
- How such collection and transport activities should be regulated and controlled to ensure that hazardous wastes in transit are safe and arrive at an authorised `recovery / treatment / disposal' facility.

Currently, there is minimal segregation of hazardous waste in Romania. Some liquid hazardous wastes are discharged with waste-waters, some may be stored in containers and much in so-called temporary storage in land basins. Solid wastes are often mixed with non-hazardous solid wastes and disposed of together with those wastes. Consequently, these wastes are rarely transported. When regulations and proper facilities are introduced, and enforced which require segregation and proper disposal, hazardous waste transportation becomes a significant issue. Some of these issues are further considered below

(1) Technical and Operational

An integrated and adequate network of disposal installations will eventually require, for example:

- A full range of different types of vehicles (eg tankers, flatbeds, container vehicles)

- Transfer / temporary storage stations appropriate for hazardous wastes
- Vehicle / tank maintenance and cleaning services

The technical and operational measures required for this component (ie vehicles and supporting infrastructure) will be driven by demand in accord with implementation of the National Strategy and Plan described in this Report. Used oils and acid batteries are two waste streams with specific legislation prescribed in Romania where these actions could be implemented practically and with immediate effect to validate the integrity of the regulation and control system.

1) Basic Vehicle Specifications

Vehicles are clearly one of the principal units in the transfer system. Skip vehicles, cargo tankers, flatbeds (open and curtain-sided) are generally readily available. However, there is a specialist unit which has a major role for collection and transport of waste liquids, and that is the vacuum tanker (see below under bulk liquid transportation). Vehicles used for the transportation of hazardous wastes must comply with the following requirements:

a) Packaged Waste Transportation

Only vehicles of the following types may be used to transport packaged hazardous waste :

- Box Van,
- Box truck,
- Flatbed truck,
- Container truck.

If flatbed trucks are used for transportation of packaged wastes the vehicles must be covered with waterproof sheet or tarpaulin after the vehicle is loaded, during transportation and when parked. Suitable equipment must be provided as and when necessary for handling and lifting hazardous waste containers in such a way as to prevent damage and spillage during loading and unloading.

b) Bulk Solid Waste Transportation

Only vehicles of the following types may be used to transport bulk solid hazardous waste :

- Container truck,
- Skip truck,
- Tipping truck.

If a container truck is utilised for transportation of bulk solid hazardous wastes then the containers must be designed and maintained so that waste is securely contained and cannot be spilt during lifting, transportation and off-loading of containers. Container, if open topped, must be covered with waterproof sheet or tarpaulin during transportation and when parked.

If a skip truck is utilised for transportation of bulk solid hazardous wastes then the skips must be designed and maintained so that waste is securely contained and cannot be spilt during lifting, transportation and off-loading of containers. Skips, if open topped, must be covered with waterproof sheet or tarpaulin during transportation and when parked.

If a tipping truck is utilised for transportation of bulk solid hazardous wastes then the truck body must be designed and maintained so that waste is securely contained and cannot be spilt during transportation. The truck body when loaded must be covered with waterproof sheet or tarpaulin during transportation and when parked.

c) Bulk Liquid Transportation

Only vehicles of the following types may be used to transport bulk liquid hazardous waste :

- Tanker truck,
- Container truck with demountable tank.

The tank body or demountable tank must be constructed of, or internally coated with, a material which is resistant to the waste to be transported. The tank body must not be open topped, all openings must be equipped with secure, leak-proof, hatches. Valves must be maintained in good condition so that leakage is prevented and must be equipped with a locking mechanism to prevent accidental opening or tampering. Valve couplings must be capped during transportation.

d) Vehicles for Transportation of Bulk Flammable Liquids

Any vehicles used for the transportation of flammable liquid hazardous wastes, and all associated equipment, must be designed, constructed and protected to ensure that it cannot create any ignition source or short-circuit under normal conditions of use and that these risks are minimised in the event of an accident.

e) Vacuum Tankers

Vacuum tankers are specialist vehicles and a major resource for the collection and transportation of liquid and `sludgy' wastes. They are available in a range of sizes from 1,000 litres up to 25,000 litres and can be mounted on rigid trucks, trailers or on sub-frames for local mounting on indigenous chassis'. A wide range of exhauster performances are available, up to 2000m3/hr depending upon the type of work to be carried out. The scope of available specification is extensive, eg:

- 1,000 to 25,000 litres total capacity
- Cylindrical shape constructed from 5.00mm carbon steel
- Anti surge baffles to suit capacity
- Torispherical dished & flanged ends to BS.5500
- Fully opening rear door with spun wheel clamps

- Whale pressure relief valves for added safety
- Sight glass contents indicator
- 75mm or 100mm inlet/outlet Saunders ball valves
- Mistral 360 exhauster/compressor delivering 360m3/hr driven by air operated PTO.
- Grit strainer and check valve protection

Principal Options:

- Stainless steel barrel & fittings
- Hydraulic opening rear door
- Hydraulic rear door clamps
- Choice of linings to suit individual applications
- Manhole - manual or pneumatic
- Ladders, catwalks, safety rails
- Choice of exhauster - vane type, air / water cooled or liquid ring
- Exhauster drive by PTO, hydraulic drive or auxiliary engine
- Tipping gear
- Hand wash units
- Reversing warning bleeper
- PTO disengagement linked to vehicle handbrake
- Worklights
- Flashing beacons
- Fire extinguishers
- Wash down or jetting pump

f) General Provisions for Transport of Hazardous Wastes

All vehicles used for the transportation of hazardous wastes must comply with the following provisions:

Vehicle Marking – placarding and hazard warning signs

Safety Equipment - enabling the vehicle driver / assistant to safely load and offload vehicle contents, dealing with minor spillages.

Documentation - waste manifest document, emergency procedures and instructions, copy of registration document for hazardous waste collection and transportation. Vehicle operators and drivers should note that it is illegal to collect waste from an unregistered source and without the proper documentation.

g) Vehicle Operation

En-route and parking - vehicles must not be left unattended when en-route and loaded with hazardous waste. Vehicles must not be parked overnight on the street or in public places when loaded with hazardous waste. If vehicles loaded with hazardous waste are parked overnight then they must be parked in a secure, supervised area.

Loading and Unloading - the vehicle driver is responsible for ensuring that the hazardous waste load is secure before departing the loading point. After loading the vehicle must be checked for contamination before departing the loading point and is contamination is found then it must be removed before transportation starts. After

unloading the vehicle the vehicle should again be checked for contamination and any such contamination removed before leaving the place of offloading.

Transportation - when planning the route for transportation of hazardous waste care should be taken to avoid built up areas as far as practicable and use the approved routes.

Accident & Emergency - in the event of accident or emergency the vehicle driver shall check that the load is secure and that there is no leakage. If leakage or spillage has occurred, he must:

- Remove documentation from vehicle and keep in his/her possession,
- Ensure that persons who could be effected by the leak or spillage are warned to keep clear, cordoning off area if possible,
- Contact the emergency services if necessary,
- Notify the Competent Environmental Authority as soon as possible,
- Take reasonable steps to minimise impact of spillage and stop and leaks if possible without risking his/her health or safety,
- Remain in vicinity of vehicle in order to assist and support emergency services dealing with incident.

Training - vehicle operators are responsible for providing adequate training for vehicle drivers and mates. The training, as a minimum must include:

- Operation of the vehicle,
- Vehicle loading and unloading,
- Vehicle handling when loaded,
- Vehicle safety features,
- Use of personal protective equipment (PPE),
- Procedures in event of emergency,
- Relevant chemical hazards.

2) Storage and Transfer Stations

In order to minimise the costs and risks of transporting relatively small quantities of hazardous waste over long distances, consideration should be given to the development and operation of strategically located transfer stations. These will provide secure storage of wastes prior to their collection and final disposal/treatment at a centralised facility. Such transfer stations may also incorporate simple pre-treatment processes in order to reduce the volume and/or hazard potential of the wastes prior to onward shipment. Most member states have such facilities. Operational requirements of `transfer stations' will be similar to

those described for the storage activity of regional waste treatment centres.

Storage of hazardous waste is frequently necessary in order to accumulate a sufficient, and economical, quantity for collection and transportation for treatment and/or disposal. Even if the waste is being treated and disposed of on site, it is advantageous to have a period of storage for the waste, for the following reasons:

- Storage of individual waste streams makes it possible to mix comparable wastes, and thus keep the composition of the waste to be treated reasonably constant.
- Some of the wastes can be used instead of treatment chemicals, such as acids and alkalis – which means acid waste may need to be stored until alkali waste has been generated (or received) and vice versa.
- Storage provides the equalisation of flow into the treatment plant, and thus maximum utilisation of available equipment in the plant.
- Sudden heavy loads of contaminants can be prevented from entering the treatment system.

a) Packaging and Containment

Prompt Containment - when waste is generated, it should be immediately taken care of. This means that the hazardous waste should be collected in containers suitable for the purpose, and stored at site, either for a short period until it is collected for treatment and disposal at a central treatment plant or treatment and disposal on site, or for a longer period until such a facility is available for final disposal.

Suitability of Containers - any container (package, drum or bulk container) used for storage of waste must be of the UN certified type, and should be suitable for the purpose and prevent accidental spillage or release. Containers must be resistant to attack by the constituents in the waste. For example, in the case of acid wastes, the containers should be lined with a substance such as polymeric material, epoxy or fibre glass. Similarly, cast iron, steel, or stainless steel may be used for pesticides, caustics, phenolics etc. A list of container types possible to be used for the different types of waste generated in the industries is given in ADR guidance notes. The containers for temporary storage should be designed to hold the waste for the periods between generation and treatment and to withstand stresses associated with normal handling during storage and transportation. If there are several different types of waste generated at the same industrial site, they should be stored in different containers, and properly labelled. The labelling should include information such as the source company's name and address, type of waste, their main hazard property, such as **explosive, flammable, corrosive, reactive, radioactive etc.**, and the destination address. Containers should be kept closed during storage and opened only as necessary to add or remove waste or to relieve any build up of pressure. Containers should be carefully inspected prior to use to ensure that they are fit for the purpose and that all seals, caps, closures etc are in good condition. If the containers are packaged in cushioning or absorbent material for storage or transportation, care must be taken to ensure that the cushioning or absorbent material is compatible with the waste contained. Care must be exercised to ensure that containers are not overfilled and sufficient ullage is allowed for expansion etc. Wherever necessary containers should be protected against extremes of temperature, which may adversely affect either the contents

or the containers. Where multiple small containers of waste are stored in larger containers care must be exercised to ensure that containers of seriously incompatible materials are not placed within the same outer container. In this context `seriously incompatible' means materials regarded as such within the ADR guidance, which if they came into mutual contact, may give rise to an exothermic reaction, liberate toxic gases, react explosively or be liable to spontaneous combustion.

Utilisation of Previously Used Containers - as a general principle is acceptable to store and transport wastes in previously used containers PROVIDING those containers are `fit for purpose' and comply with the requirements of these guidelines. In addition, special considerations apply as follows. Previously used containers must be thoroughly cleaned prior to use unless it is **known for certain** that the previous contents are wholly compatible with the waste. Particular care must be taken to inspect the container for any signs of damage, defective closures or seals and for signs of embrittlement or material degradation. The latter may be indicated by lack of flexibility and/or discolouration. All previous markings on a container not specifically relevant to the waste contents must be removed or permanently obliterated so as to prevent false identification. If it is deemed necessary to transport waste in a container that is unsuitable then this container must be placed inside a suitable sealed container and the outer container must meet all of the requirements of these guidelines. The outer container must be marked accordingly, including the information that the waste inside is itself within a damaged or defective container.

b) Storage Areas

General Provisions - both temporary and permanent storage areas should be designed properly, depending on the specific nature of the hazardous wastes. For example, if the waste is of flammable nature, the storage area should be designed with sufficient space for fire fighting, and prevention of fire spreading, and access for emergency vehicles. Incompatible materials should not be stored together, and must be separated by an appropriate barrier such as open space, dividing wall, fire-wall etc. dependant upon the nature of the adjacent "activities".

Containment - storage areas should be properly drained to avoid any runoff contaminated with hazardous materials to enter surface or ground water without proper treatment. The drainage water from fire fighting operations also may pollute the surface watercourses if allowed to drain directly. Therefore, the drainage water should be collected in a sump or interceptor pit, and subjected to proper treatment, depending on the hazardous nature of the substance, before discharge. It is essential that all storage areas holding packaged hazardous wastes should be bunded, to retain the fire-fighting water or any spillage. The capacity of the retention area depends on the nature and the quantity of materials stored, and is approximately 3 to 5 cubic metres per tonne of material stored for large storage areas, and higher for small storage areas. If the storage area is covered, it should be well ventilated and natural lighting is preferred to artificial lighting, if practicable.

Electrical Equipment - if electrical equipment needs to be installed care needs to be taken in equipment selection, particularly if the materials being stored are flammable and volatile. Electrical equipment should meet the required international standards. In addition, if flammable materials are being stored, protection against lightning should be considered.

Operational Issues - the storage area should also be managed properly, to minimise accidental spills, unauthorised activities and other problems. Storage areas must be secure to prevent unauthorised access. Employees working in hazardous waste storage areas should be adequately protected from contact with the materials. Protective clothing such as splash suits, helmets, goggles, rubber gloves etc. may need to be provided. Other emergency equipment such as respirators, breathing apparatus, first aid equipment, showers, eye rinses etc may also need to be provided. If waste is stored in barrels, the stacking of barrels of waste should be controlled within acceptable limits, and sufficient space should be allowed between rows of barrels for transport equipment and for regular visual inspection. Particular care must be taken to ensure adequate segregation of different, incompatible containers of waste. Proper sign posting will prevent unnecessary collisions within the storage area, leading to accidental spills and other damages. Documentation, detailing what is stored where, should be maintained and kept up to date. This documentation must be kept in such a place that it can be readily be made available to regulatory authorities and to emergency services as and when required. One of the main differences between storage of hazardous materials such as raw materials for production processes or hazardous products, and hazardous wastes is that in the former, the exact constituents, and therefore the nature of the hazardous material can be known, and in fact the material or product safety data sheets would be available, whereas in the latter case, often the constituents of the waste, and hence its hazardous nature will not be very clear. Therefore, the management of such substances is more difficult, and it will be necessary to take additional precautions, especially with respect to segregation of substances from different sources. Water reactive materials must be stored in secure dry areas.

Security - storage areas for hazardous wastes must be appropriately marked and signed. Most countries have signing requirements that must of course be complied with. Where relevant regulations do not exist it is recommended that caution signs be displayed at all entrances to hazardous waste storage areas and that graphical signs are displayed at these entrances indicating the potential hazards of the materials stored. Discrete storage bays or locations where wastes of individual hazards are stored should display the appropriate hazard sign in those locations. Access to hazardous waste stores should be effectively controlled by security measures to ensure unauthorised personnel do not gain access.

Documentation - adequate documentation must be kept remote from the storage area to enable personnel and emergency services to know exactly what wastes are stored in which locations.

c) Bulk Solid Storage

Containment - bulk solid hazardous wastes must be stored with effective containment preferably in an enclosed structure with roof to prevent ingress of rainwater. The storage area must be designed to contain and run-off from the waste and a collection system for run-off or leachate must be provided. If the material is light and dusty precautions must be taken to prevent it from being picked up and suspended in air during windy conditions.

Operational Issues - bulk containers should be regularly inspected for damage and integrity. They should be fitted with permanent or removable covers to prevent ingress of rainwater.

d) Bulk Liquid Storage Areas

Containment - bulk liquid hazardous wastes should be stored in enclosed vessels of suitable construction. Storage vessels should be bunded. Many countries have regulations, which specify the containment volume of storage bunds. Where this is not specified it is recommended that each storage bund should be sized to hold at least 110% of the volume of the largest tank in that bund or 10% of the combined volume of the tanks whichever is greater. When calculating these volumes it should be noted that the volume occupied by the intact tanks should be excluded. Bunds should be equipped with sumps for collection of liquids and spills and should be equipped with an appropriate pumping system. Bund internal surfaces should be coated with a material which is resistant to attack from the contents of the vessels contained in the bund. As far as practicable, control systems, cabling and other such items must be kept clear of the potentially wetted volume of each bund. If pipes and cabling etc. pass through the bund walls, the gaps must be effectively sealed with compounds resistant to the tank contents and capable of withstanding pressure generated if the bund were filled with waste.

Material Compatibility - storage tanks containing incompatible materials should be located in separately bunded areas.

Operational Issues - storage bunds and vessels must be inspected for security on a regular basis and results of inspections recorded. Storage bund should be kept clean and free from contamination to prevent contamination of rainwater falling in the bund. Rainwater must not be allowed to build up in storage bunds. If bunds are equipped with drainage valves then these should remain closed except when the bund is being deliberately drained and must be closed again after such a procedure.

e) Provision of Safety Equipment

Personal Protective Equipment (PPE) - adequate safety and personal protective equipment (PPE) must be provided, commensurate with potential hazards associated with the stored materials, to enable not only normal operational activities but also proper response to accidents, fire and spillages. Such equipment may include:-

- Protective clothing, for example, overalls, splash suits, visors, goggles, aprons protective footwear etc.
- Respirators and/or breathing apparatus as necessary.

Staff must be trained in the use of PPE, and PPE and safety equipment must be frequently inspected for serviceability and maintained in fully effective condition.

Emergency Equipment - safety equipment sufficient to deal with potential emergency situations must be provided and adequately cleaned, serviced and maintained. This may include:

- Fire fighting equipment, for example, extinguishers, fire tenders, foam monitors
- Decontamination equipment, for example, showers, eye-washes etc.
- Safety equipment for example, respirators, breathing apparatus (self contained or air-line) etc.

- Gas and/or leak detection systems.

f) Hazard Signs

Storage areas and containers including tanks should be adequately sign-posted and marked as to the contents therein and the relevant potential hazards. It is recommended that the same signs as for labelling are utilised.

g) Temporary Storage vs. INDEFINITE Storage on Site

Permanent storage on site as a method of final disposal would require large extents of land specially prepared for hazardous waste storage, to prevent pollution of the land and ground water aquifers even after long-term storage. This type of storage is generally practised only in places where site conditions such as salt domes or caverns are available.

In many countries, such geological features do not exist and it must be remembered that land is a valuable commodity. Whilst some form of secure, synthetic containment could be attempted this is not recommended as only one thing is certain about such containment systems, and that is they will fail at some time in the future.

As with any general rule there are exceptions. Specifically, asbestos wastes are generally disposed of by permanent storage, as these wastes, despite being very hazardous, are chemically and physically rather inert. Disposal can be on-site or off-site. The key issue with these types of inert yet hazardous wastes are that such sites should be:

- Clearly identified and marked;
- All operations must be subjected to very careful management and control;
- There should be very accurate documentation of types of waste, quantities and locations of deposit;
- The site should be designed with appropriate and secure containment provisions;
- The site should be designated as unsuitable for any after-use which would potentially affect the integrity of the containment.

It has to be recognised that, in some countries, some industries need to store their hazardous wastes in containers over a relatively long term, expecting to dispose of them at a suitable facility when such a facility is made available. Under these circumstances regular inspection by the industries themselves and by regulators is very strongly recommended.

(2) Political and Legislative

The primary legislation is in place. The secondary legislation now requires completing and implementing in order to ensure effective regulation and control. One of the components of the Phare 2001 German Twinning Programme is to assist with this and the transposition of the Internal Transport requirements of the Waste Shipment Regulation.

Waste producers and others in the waste handling chain should be made legally liable for any environmental or health damage caused by handling, treatment and disposal of hazardous wastes. Producers should not be able to discharge their liability merely by transferring the waste to another party. They must be able to show that they have carried out their **Duty of Care** by ensuring that the `other party' are able to, and will handle the waste in a safe manner and in accord with the relevant legal requirements.

It is normal in Europe to regulate and control the movement of hazardous wastes using a **consignment notification and/or manifest system**. Such a system may require enterprises to pre-notify, or at least report, the movement of consignments of hazardous wastes to the regulatory authority. The role of the regulatory authority is generally to ensure the `closed loop' i.e. to make sure that the notifications indicate that the waste (including the correct quantity), once it leaves the `source', arrives at the correct destination notification. This is intended to prevent illegal disposal of the waste. The system may also, in the case of a pre-notification system, allow the regulatory authority to veto the proposed movement or amend the instruction. Such a consignment or manifest system could in the future involve a significant number of notifications being received by EPIs. These notifications are also a potential source of accurate data on hazardous wastes. Such a system is ideal for incorporation into a computerised Waste Management Information System. A proposed hazardous waste information system is described in Volume 1 Section 7 of this report.

(3) Institutional and Organisational

There are many potential stakeholders in this activity at local, regional and national level. For example: drivers who own their own vehicles, waste producers as hauliers, specialist transport companies, waste management contractors, competent authorities etc. Developing and maintaining good communication links with ADR organisations will help these stakeholders.

The primary legislation must be supported by secondary legislation, standards and norms with guidance notes and training for all stakeholders, particularly those units with responsibility for regulation and control (eg EPIs and traffic police)

(4) Economic and Financial

Funding the infrastructure referred above is gong to be private sector and likely to evolve from those sectors with existing knowledge of the issues, eg treatment facility operators, oil sector, recycling (eg REMAT). In that event, full cost recovery will be required and such costs will of necessity be passed directly to the waste producer.

The types of costs associated with this activity are typically:

- Initial set-up costs
  - Establishment of Competent Authorities
  - Devising systems and procedures
  - Preparation of technical guidance notes
  - Training provision

- Capital investment
  - Transfer stations for the sorting and accumulation of small quantities of hazardous waste for further treatment
  - Collection and transfer systems for both liquid and solid hazardous wastes
  - Storage facilities at waste producers premises

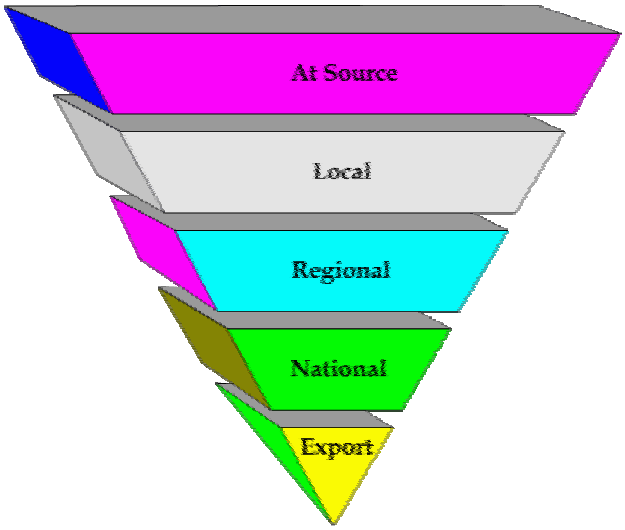
- On-going operational costs
  - Annual operating costs of facilities
  - Periodic inspection of waste producers and carriers
  - Processing of consignment notes
  - Information and data collection

6.3 Treatment and Disposal of Hazardous Waste

6.3.1 Hazardous Waste Management Overview

Treatment and disposal technologies are well established in Europe, most countries relying on a mixture of treatment and disposal at source (place of waste generation) and treatment at regional waste treatment and disposal facilities generally operated by waste management contractors. The proximity principle (Figure 6.3.1) states that, all other things being equal, wastes should be treated at the source or as close to the source as practicable.

Figure 6.3.1 Proximity Hierarchy



By and large, inorganic wastes are treated and disposed of by physical/chemical treatment processes followed by treatment of resultant wastewaters and landfill of treatment process residues. Predominantly organic wastes are generally treated by thermal processes followed by landfill of residues (and occasionally treatment of gas cleaning wastewaters).

Figure 6.3.2 illustrates the main treatment and disposal operations for hazardous waste management and their inter-relation to wastewater treatment and final disposal.

6.3.2 Treatment of Principally Organic Wastes

As indicated above these wastes are principally treated by thermal processes (e.g. incineration, pyrolysis, blending for utilisation as secondary fuel etc). Hazardous organic wastes generally contain toxic organic substances or other toxic substances like heavy metals. For this reason, thermal treatment systems generally require sophisticated combustion control systems and gas cleaning systems.

EU Directives specify requirements for hazardous waste incineration systems which must be incorporated into legislation / regulations of member states. Romania is in the process of preparing EU compliant country standards for incineration.

Table 6.3.1 shows total quantities of principally organic wastes by region and figures 6.3.3, 6.3.4 and 6.3.5 show the current geographical distribution of generation.

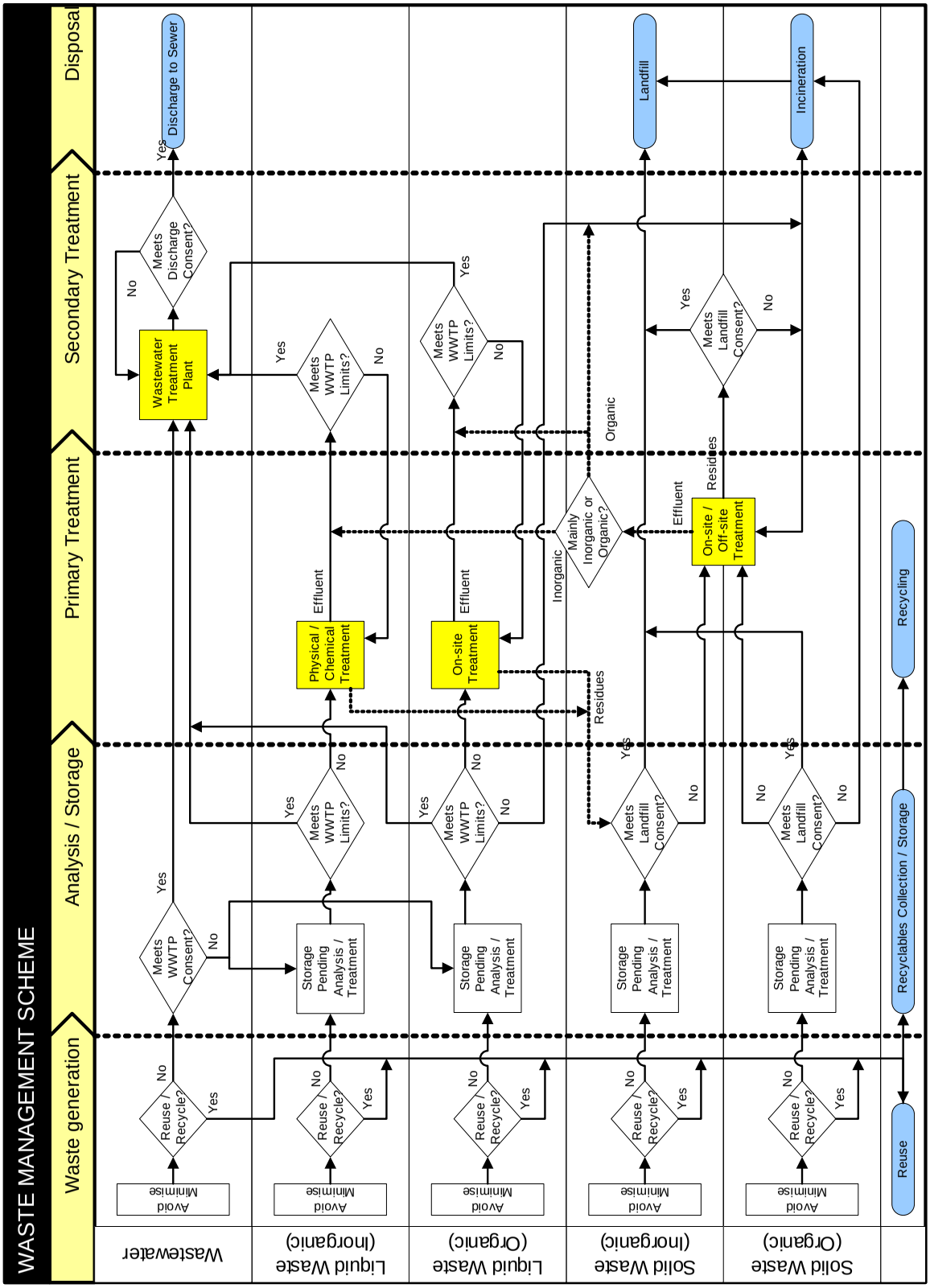


Figure 6.3.2 Schematic of Industrial Waste Management

Table 6.3.1 Prinicipally Organic Wastes by Region (2002)

Region	Quantity
North-East	127438
South-East	104457
South	133919
South-West	88552
West	101132
North-West	122026
Center	141869
Bucresti	10311
Municipality of Bucharest	107388
TOTAL	937091

The waste generation survey indicated that in excess of 922,600 tons of these wastes are oily wastes. It is believed that the quantities of solvent wastes are under-reported and in fact are much larger. Oily wastes are all suitable for cement kiln incineration; the following figures also show the locations of major cement kilns.

Options for management of oily wastes include:

- Regeneration / re-refining for original use (discussed in Chapter 6.1),
- Separation,
- Utilisation in other plant as secondary fuel,
- Dedicated hazardous waste incineration.

Figure 6.3.3 Oily Waste Generation

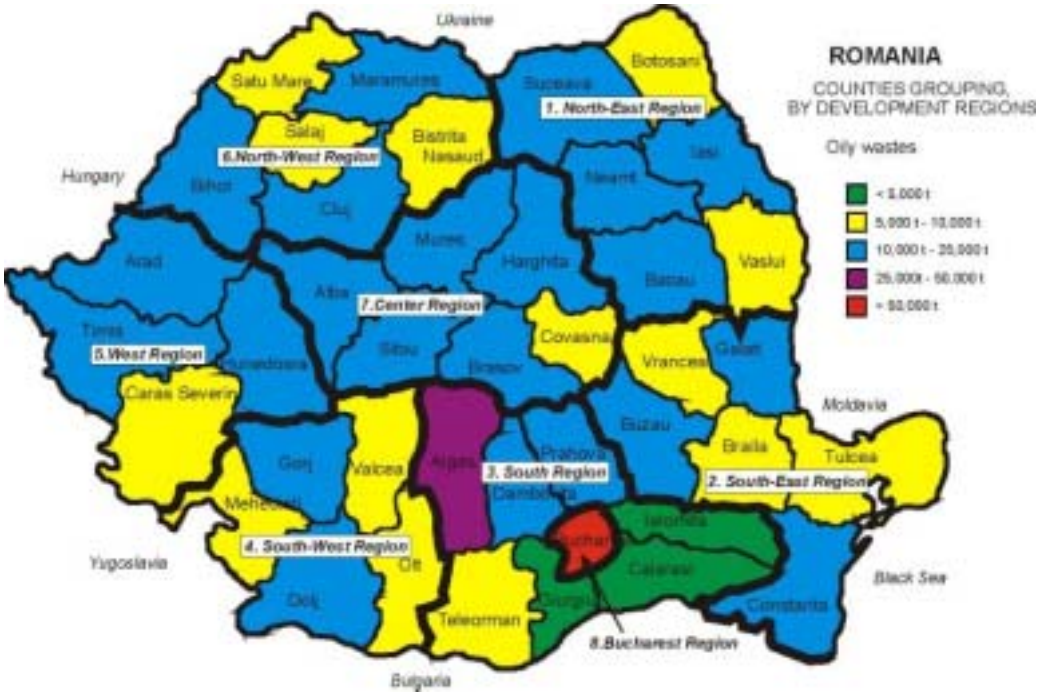


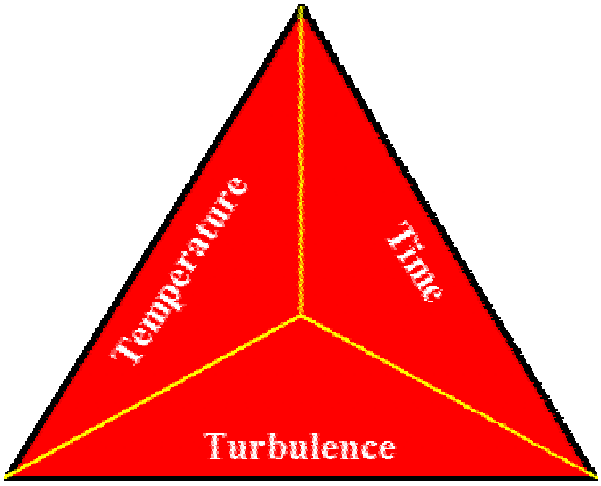
Figure 6.3.4 Non-Halogenated Waste Generation

Figure 6.3.5 Halogenated Waste Generation

For effective incineration, either in an industrial combustion process such as a cement kiln, or in a dedicated hazardous waste incinerator, there are five main requirements:

- Proper preparation of the waste prior to incineration.
- The 3 "Ts" (Figure 6.3.6) common to thermal treatment processes (“Time” - minimum of two seconds at required temperature, required “Temperature” –minimum of 850^{o}C or 1100^{o}C for wastes with more than 1% of halogen content and “Turbulence” (mixing).
- Presence of sufficient oxygen for complete oxidation of wastes.

Figure 6.3.6 The Three "Ts"



Cement kilns are generally the most appropriate plant for utilisation of waste oils as a secondary fuel as they operate at very high temperatures ensuring complete combustion, the kiln environment is alkaline absorbing acid gases produced during combustion and because ash and fly-ash is generally incorporated in the clinker product.

Cement kilns, particularly wet process kilns can tolerate wastes with halogen content, they are not as flexible in this regard as dedicated hazardous waste incinerators with gas cleaning systems. Having said that, gas cleaning systems can be fitted to cement kilns to enable processing of higher halogen content wastes.

Dedicated hazardous waste incinerators are very high capital cost. They offer more flexibility than a cement kiln in terms of the range of wastes which may be processed and the percentage of halogenated content tolerated in the waste feed. There are several kinds of combustion chambers used in hazardous waste incineration, the most common being fixed hearth, liquid injection, fluidised bed and rotary kiln. Mobile systems have been developed, suitable for contaminated soil processing, but these are generally less suitable for more concentrated wastes or as general purpose systems. The rotary kiln type of incinerator is the most robust and most flexible. Figure 6.3.7 shows a typical arrangement and components of a rotary kiln hazardous waste incinerator and gas cleaning system, figure 6.3.8 shows a rotary kiln combustion chamber.

Dedicated hazardous waste incinerators generally have sophisticated gas cleaning systems which include acid gas absorption, particulate control and may include activated carbon adsorption system for trace organics and dioxins / dibenzofurans. Gas cleaning systems and control / monitoring systems contribute a very sizeable portion of the capital cost.

Because of their very high capital cost, hazardous waste incinerators are generally only constructed and operated by generators of very large volumes of organic waste or by waste management companies offering a hazardous waste incineration service. In some countries, generators of very large quantities of organic wastes have supported the development of incinerators in partnership with waste management contractors.

Thermal processes are generally best operated as continuous processes; this is particularly true of hazardous waste incinerators. They should ideally be run at stable conditions for extended periods. Frequent start-up and shut-down leads to faster degradation of refractory materials and, consequently, higher maintenance costs. This is another reason why they are not-suitable for smaller enterprises not regularly generating large, consistent volumes of waste.

Figure 6.3.7 Rotary Kiln Incinerator (HK)

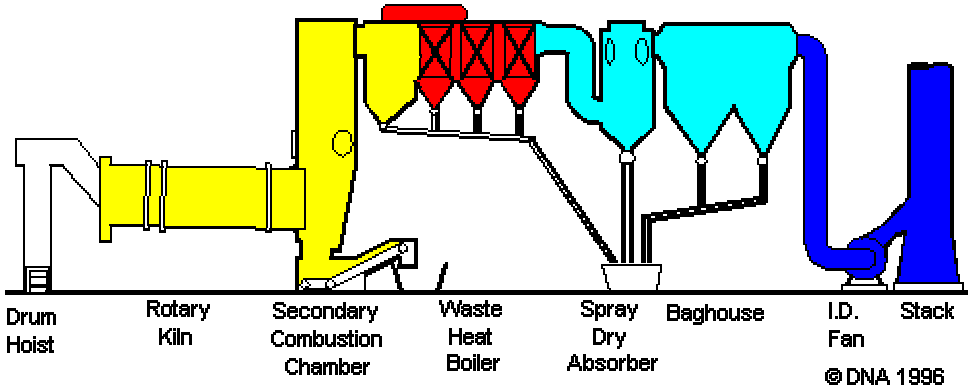


Figure 6.3.8 Rotary Kiln Combustion Chamber (UK)

Preparation and pre-processing of waste is the key to effective waste incineration, wastes are generally pre-processed using separation, blending and other physical / mechanical means. Gravity separation may be used to separate mixed oily waste into oily liquid, oily solid and water fractions. This may be done in a simple separation tank or using a centrifuge. Centrifuges are very applicable to many of the oily wastes generated by refineries. An example of a “three-phase” centrifuge which separates oil, water and solids is shown in figure 6.3.9.

Such equipment can be used very effectively to process waste from oil and acid tar lagoons to recover oil and separate residues requiring treatment and disposal. Several such installations are actually in use currently in Romania.

Figure 6.3.9 Three-Phase Scroll Conveyor Centrifuge

Blending of organic wastes prior to incineration is a key part of preparation; the objective is to prepare a high calorific value waste feed with appropriate viscosity, solids content, halogen content etc. to maintain temperature in the incinerator or to act as a supplementary fuel in the cement kiln. In the case of a hazardous waste incineration facility, the preliminary processes would normally be undertaken by the incinerator operator. In the case of cement kiln incineration, the collection, separation, blending processes may be operated by the cement kiln operator or a third party contractor at the cement kiln, or by a wste management contractor who would then supply the processed “waste derived fuel” to the cement kiln operator. Figure 6.3.10 shows such a third party organic waste blending facility (Thailand).

Figure 6.3.10 Organic Waste Blending Facility

6.3.4 Treatment of Principally Inorganic Wastes

Table 6.3.2 shows the indicative total quantities of inorganic hazardous wastes generated by Region. If Ilfov and Municipiul Bucharest are combined the generation is relatively uniform across Romania, ranging from 10,000 tons per annum (tpa) in the South West Region to 21,000 tpa in the Central Region.

Table 6.3.2 Prinicipally Inorganic Wastes by Region

Region	Quantity (t/y)
North-East	17891
South-East	13968
South	18005
South-West	9983
West	12577
North-West	17094
Center	21408
Bucresti	1544
Municipality of Bucharest	14057
Total	126525

Predominantly inorganic wastes are typically treated using physical / chemical treatment processes. These are generally low capital cost and easy to operate. Because of this, physical / chemical treatment systems are equally suitable for treatment at source and for operation at centralised treatment and disposal facilities.

The most common processes for treatment of predominantly inorganic wastes are:

- Oxidation / reduction,
- Neutralisation / precipitation,
- Dewatering,
- Stabilisation / solidification.

The most common applications are the oxidation of wastes containing cyanides and the reduction of wastes containing hexavalent chromium. Acidic and alkaline wastes are generally neutralised which also precipitates heavy metals as insoluble oxides / hydroxides. Occasionally heavy metals are precipitated as sulphides. Resultant sludges are generally dewatered.

Physical/chemical treatment facilities result in treatment products which require further processing / disposal. Effluents are generated which require appropriate wastewater treatment prior to discharge, and solid residues (principally insoluble metal oxides and hydroxides) which require disposal. These residues may be considered hazardous wastes themselves according to the European Waste Catalogue and the new Integrated Waste List, including:

19 02 04* - premixed wastes composed of at least one hazardous waste

19 02 05* - sludges from physico/chemical treatment containing dangerous substances

19 02 11* - other wastes containing dangerous substances

19 03 04* - wastes marked as hazardous, partly stabilised

19 03 06* -wastes marked as hazardous, solidified

In view of this, physical/chemical treatment plants need access to appropriate landfill capacity. If the solid residues are to be disposed of to landfill without further treatment then they would need to go to a landfill designated as a “hazardous waste landfill”.

Given the relatively low standard of current landfills and limited in-country experience in relation to sound hazardous waste management practices, and the lack of any hazardous waste landfills at present, it is logical to include stabilisation of solid residues prior to landfill. Following stabilisation, the wastes would, in accordance with the Landfill Directive, be acceptable for disposal at either a hazardous waste landfill or a non-hazardous waste landfill and generally classified according to the European Waste Catalogue and the new Integrated Waste List as:

19 03 05 - stabilised wastes other than those mentioned in 19 03 04

The terms "Stabilisation” and “Solidification" are often used as generic terms covering a wide range of physical / chemical processes, the most common process (typically involving mixing the waste with lime and cement) is widely used to process metal hydroxide / oxide / sulphide sludges and filtercakes (e.g. galvanic sludges) to give a waste which is regarded as non-hazardous for simple final disposal.

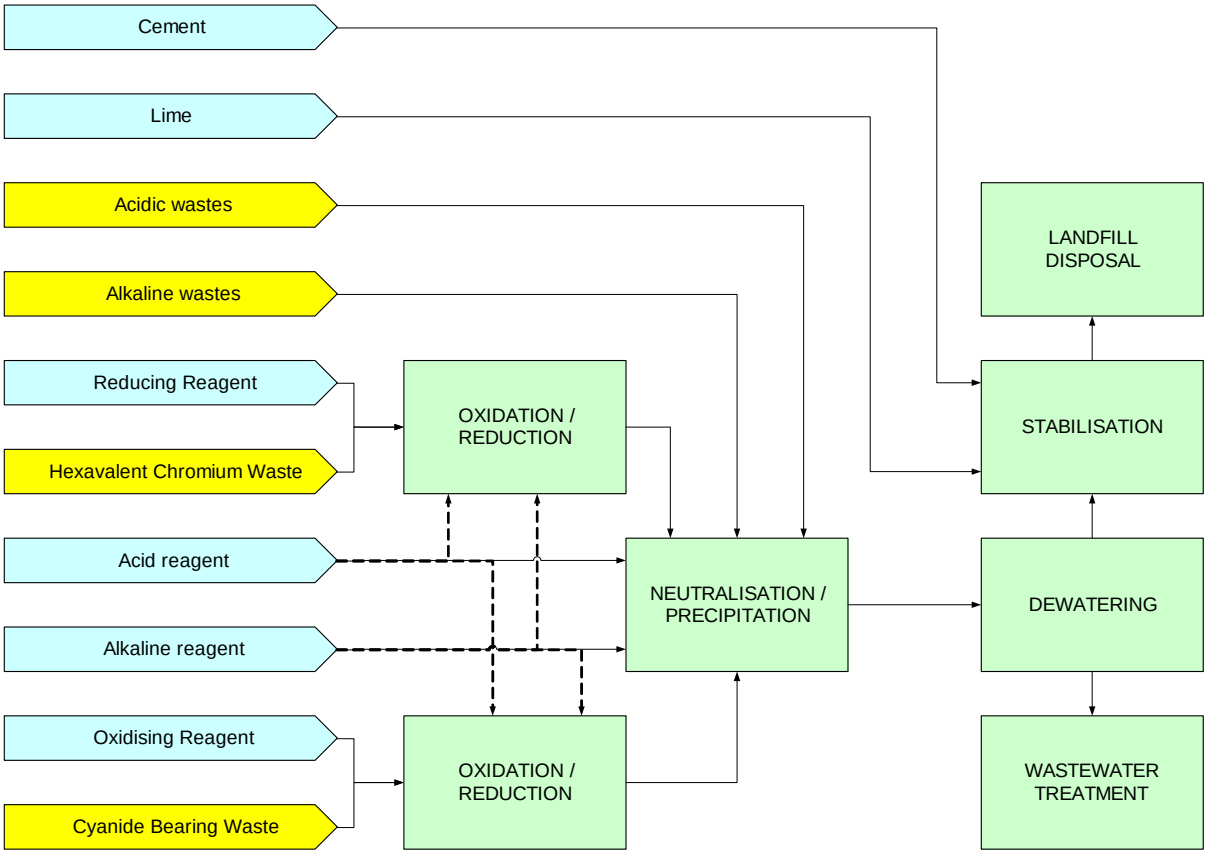
Figure 6.3.11 illustrates a typical process flow for a physical chemical treatment plant to process electroplating wastes. These processes are described in some more detail in Volume 1 Chapter 5.6 of this report.

Some enterprises visited have had such treatment systems (without stabilisation) in the past but many have been allowed to fall into disrepair or remain unused. Such facilities need to be refurbished or replaced. Alternatively, wastes could be sent to third parties for such treatment.

An option is to encourage the development of third party physical / chemical treatment services which at present do not exist in Romania. The processes would be the same but a centralised or regional facility serving many waste generators would be able to benefit more often by using one waste to treat another. For example steel picking waste has reducing properties and can be used to reduce hexavalent chromium waste, waste acids can be used to neutralise waste alkalis and vice versa.

Industrial waste landfills are beginning to appear in Romania but there is a need for accelerated development of these, organisations currently operating and developing industrial waste landfills could be encouraged to develop basic physical / chemical waste treatment facilities co-located on those landfills. Ideally one such facility would be located in each region. An example schematic diagram for such a physical / chemical treatment facility is included as Figure 6.3.12 and conceptual plant layout diagram included for an integrated facility comprising physical / chemical treatment, landfill and wastewater treatment in Figure 6.3.13.

Figure 6.3.11 Example Process Flow for Electroplating Waste Treatment



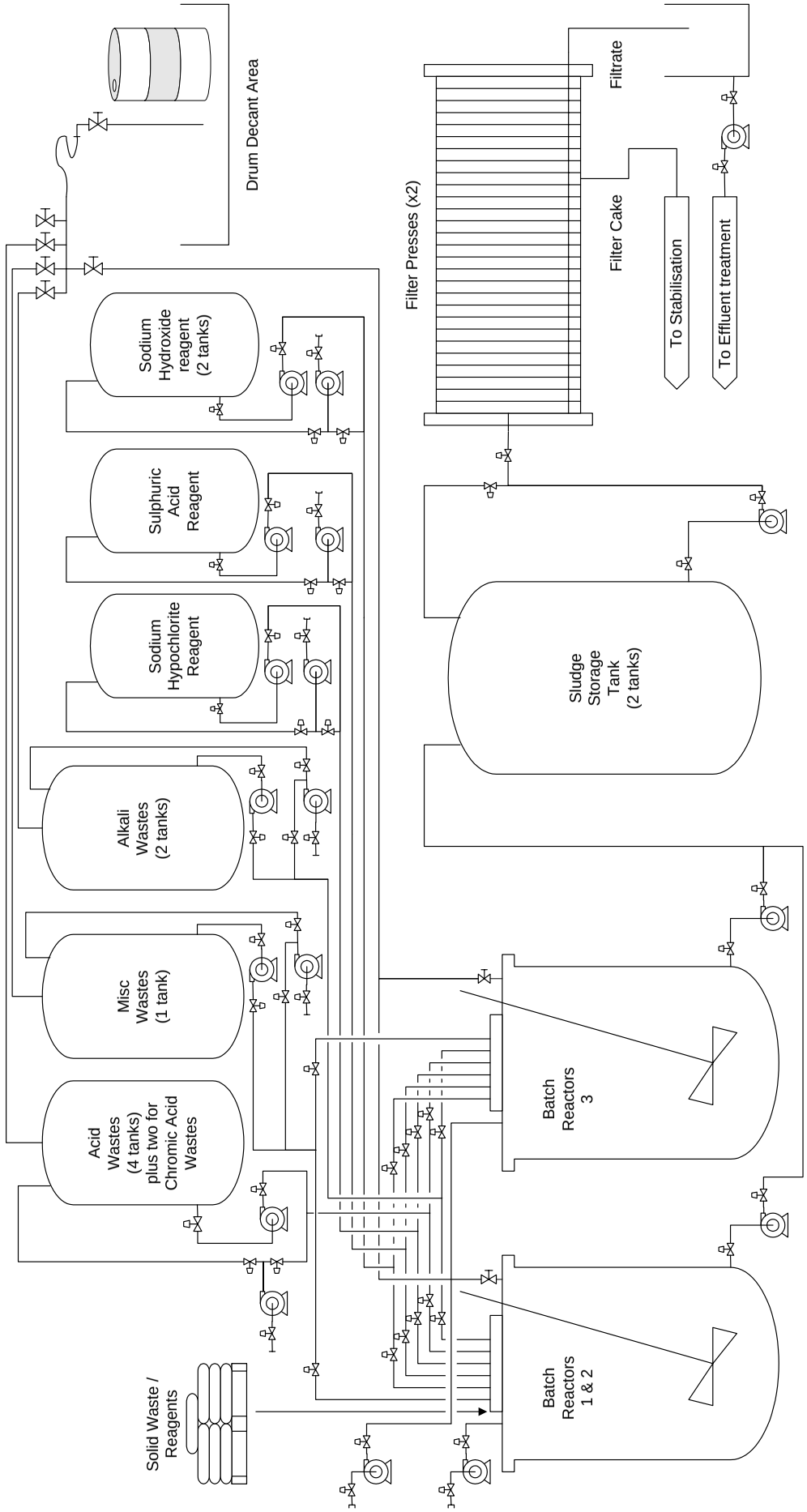


Figure 6.3.12 Schematic Diagram for Regional Waste Treatment Facility

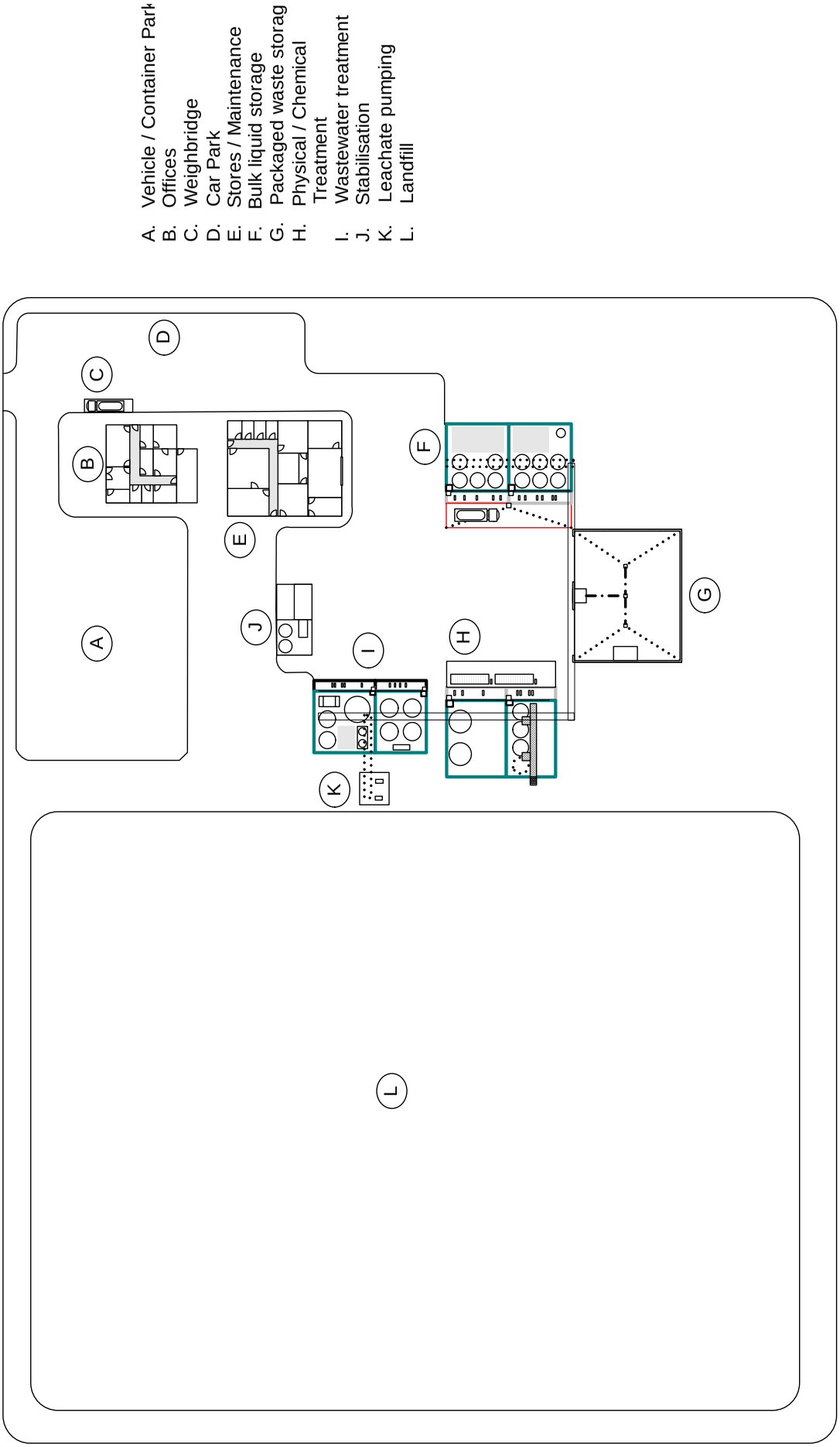


Figure 6.3.13 Example Layout for Waste Treatment

Figures 6.3.14 show reactors for physical / chemical treatment (oxidation / reduction) batch neutralisation / precipitation reactors having similar design. Figure 6.3.15 shows a continuous neutralisation / precipitation process.

Figure 6.3.14 Example of Oxidation / Reduction Reactor

Figure 6.3.15 Example of Continuous Neutralisation / Precipitation Reactor

Figure 6.3.16 shows a multi-plate filter press for dewatering treated sludges. Sludges may be partially dewatered (thickened) in a conical bottomed settling tank “thickener” or “clarifier” prior to filter-pressing. Figure 6.3.17 shows a stabilisation plant for processing physical / chemical treatment plant / incinerator residues, lime and cement reagents are stored in silos and the reagents transferred to the solids mixer by screw conveyor. A hoist is used to load residues into the mixer.

Figure 6.3.16 Multi-plate Filter Press

Figure 6.3.17 Stabilisation Plant

6.3.5 Management of Particularly Difficult Organic Wastes

There are some organic hazardous wastes which are particularly difficult to manage. These include:

- PCBs
- HCH
- Organic pesticides
- Persistent halogenated solvents

The options for the environmentally sound management of these wastes include:

- Treatment in specially equipped cement kilns
- Treatment in dedicated hazardous waste incinerators
- Physical/chemical treatment processes (e.g. dehydrochlorination of PCBs)
- Export for environmentally sound management in a country with the necessary facilities

PCB wastes by County and Region are shown in Figure 6.3.18. Currently, no facilities exist in Romania to take these wastes which are particularly difficult to handle and treat.

Figure 6.3.18 PCB Wastes

The most common method for treatment of PCB wastes is by incineration. The reason for this is that high temperature incineration is a technology which is well developed and readily available in many industrialised countries.

The existing Sotem facility could handle small quantities but it is current HolCim **policy** not to accept PCB wastes (organic wastes containing > 50 ppm PCBs). A suitably equipped cement kiln could handle these wastes if blended with other organic wastes to ensure that the halogen content is within acceptable limits (and PCB content remains below 50ppm – waste then not classed as PCB waste avoiding "policy issues"). Such blending processes are a normal pre-processing activity for all incinerators and cement kilns and should not be considered as contravening rules of not blending wastes with the objective of reducing hazard.

It should be noted here that some industrialised countries no longer permit such incinerators, the most prominent examples being Japan (PCBs) and Australia; these countries must of necessity find alternative destruction technologies for their PCB-containing materials.

A variety of other treatment processes have been developed for PCB wastes, most commonly dechlorination using metallic sodium. Fine dispersions of Sodium metals are typically used resembling emulsions, having high metal surface area to increase reaction rates. Other technologies are generally thermal (plasma arc dissociation, thermal hydrogenation and vitrification) none can be considered established, widely used technologies.

All the above technologies, with the exception of incineration are used on the PCB oils themselves, and solvents contaminated with PCBs. The problem of treatment and disposal of capacitor and transformer carcases remains. Indeed, the dismantling of transformers and the disposal of the carcases is one of the most difficult problems and why incineration is so commonly used for the solid residues even when solvent cleaning and sodium dechlorination is used for the resulting oils.

For a country without large volumes of PCB wastes, one option is export to a convenient country able to offer processing by one of the above technologies.

Pesticide wastes could also be processed in a cement kiln, either by blending liquid or solid pesticide wastes with other wastes to result in a liquid or sludge for injection as normal, or by equipping the kiln with a pneumatic canon to propel fibreboard kegs of solid pesticides into the hot zone of the kiln.

Barriers to the management of such wastes in cement kilns include:

- The reluctance of kiln operators to accept the more hazardous wastes
- Potential extreme public reaction
- Reasonableness of regulators

The development of a suitable dedicated hazardous waste incinerator, capable of processing these wastes would be an extremely expensive option (capital cost between 20m and 50m US$). Potentially a viable alternative, particularly for wastes which will not be generated in the future is export for destruction in dedicated hazardous waste incineration facilities.

6.3.6 Hazardous Waste Landfill

Whilst many hazardous wastes can be treated resulting in non-hazardous wastes which can be disposed of to normal industrial waste landfills there are some wastes for which treatment is not practicable. Some enterprises generate large volumes of hazardous waste requiring landfill and these enterprises will need to provide their own hazardous waste landfill capacity or send wastes to a third party contractor operating hazardous waste landfill.

The recently adopted Landfill Directive prohibits landfill of certain hazardous wastes, including:

- Explosive and oxidizing substances;
- Any flammable or highly flammable chemicals;
- Corrosive chemicals;
- Infectious clinical waste;
- Any waste in liquid form, except sludge;
- Any laboratory-produced chemicals which are new or not known for their effects on the environment or man ("precautionary principle").

The directive further stipulates that "hazardous wastes should where practicable be treated to reduce the hazard of the waste prior to disposal". As indicated earlier in this chapter, many residues from thermal and physical / chemical treatment would be regarded as hazardous wastes themselves unless subject to further treatment, for example by stabilisation. As stabilisation is a readily available and economical form of treatment the Directive implies that stabilisation should be undertaken.

Landfills for hazardous waste must meet certain design criteria, including:

- Minimum 5m thick "geological barrier" to the base and sides with permeability equal to or less than 1×10^{-9} m/s;
- If naturally available barrier does not meet these requirements an equivalent artificial barrier can be constructed, such a barrier must be at least 0.5 m thickness.
- Artificial sealing barrier must be provided.
- Drainage layer of at least 0.5 m thickness must be provided.
- Capping must be provided.
- Cap must have artificial sealing liner.
- Impermeable mineral cap must be provided.
- Cap must have drainage layer at least 0.5 m thichness.
- Cap must be covered with a minimum of 1 m thickness of topsoil.
- Collection systems for contaminated site water and leachate may be required and treatment systems may need to be provided.

There is likely to be a need for small regional hazardous waste landfills or dedicated hazardous waste cells on otherwise non-hazardous waste landfills.

6.3.7 Integrated Centralised Hazardous Waste Management Facilities

Many European countries have developed one or more large-scale centralised hazardous waste management facilities. All such facilities, except those in the UK, were developed with the aid of economic support from government. Indeed, many of these facilities were developed by public-private sector partnerships.

These facilities were often subsidised to reduce the impact of increased hazardous waste management costs. Similar approaches have also been adopted in some Asian countries. Development of such a large-scale national, strategic, hazardous waste management facility is one option for Romania but this would require considerable public-sector involvement and economic support to be viable. Figure 6.3.19 is an aerial picture of a large-scale strategic hazardous waste treatment plant (Hong Kong).

Figure 6.3.19 Aerial View of a National Hazardous Waste Treatment Plant

Given the transitional nature of Romania's economy, and the presence of several cement kilns belonging to companies that wish to provide a hazardous waste treatment and disposal service it is unlikely that such a strategic facility would be viable, or even desirable, in Romania.

6.4 Management of Soil-Contaminated Sites

6.4.1 Method of Overview

Presentation of the management conditions is made according to the 4 different management fields shown in Table 6.4.1. These 4 management fields are:

- Environmental protection of soil and groundwater;
- Prevention of effects of contamination on health and environment;
- Prevention of pollution;
- Management of post closure sites.

Table 6.4.1 Method of Overview of Management Conditions

	Present activity	Past activity
Contamination area SOIL / GROUNDWATER	A (see 6.4.2) Environmental protection of soil and Groundwater	C (see 6.4.4) Prevention of effects of contamination on health and environment Extent of contamination Risk assessment Prevention measures Restoration
Contamination source FACILITY	B (see 6.4.3) Environmental permitting and prevention of pollution Prevention of pollution	D (see 6.4.5) Contamination source from past activity: Management of post closure sites Identification and evaluation Confinement or eradication

6.4.2 Protection of Soil and Groundwater

(1) Groundwater

The protection of soil and groundwater is strongly associated with pollution control in a set of basic laws that have been explained in the progress report. The Water Law of 1996 has established the river basin concept for the integrated management of surface water and groundwater resources. Protection of water resources as well as river banks and beds or basins against pollution, and restoration of both surface and groundwater quality are among the main objectives of this law.

Enforcement of the law is made through a set of various important planning and

control measures that are very significant for the protection of groundwater: water management plans, land use control for the protection of water intake points, and surveillance through monitoring wells. Since no environmental quality criteria specific for groundwater has been set up, the drinking water criteria are the legal reference for groundwater quality.

Apele Romane manages the national network for the surveillance of groundwater quality. The most important network is a set of 1,225 monitoring wells with sampling and analysis twice a year. This data source is completed by the network of survey points in the vicinity of pollution sources and managed by industrial operators, and drillings and water wells for water supply in rural areas. The Ministry of Health and Family performs well water quality analysis for hygiene and safety of drinking water.

This system of groundwater surveillance provides little information on groundwater contamination from hazardous substances. Only areas around the industrial plants and waste landfills in operation, where groundwater monitoring of hazardous substances is compulsory, can provide such information. Shallow groundwater appears to be particularly sensitive because of its vulnerability, the quasi absence of protection status (nobody responsible for its management), its use for individual water supply, and the absence of water quality check for hazardous substances.

(2) Soil

The most important legislative measure for the protection of soil and groundwater in Romania is the ministerial order n°756/1997 about regulation of evaluation of environmental pollution. This document establishes soil quality values for a set of soil contaminants as summarised in Table 6.4.2 and Table 6.4.3. These values must be considered as trigger concentration values for soil and groundwater, with alert and action levels.

Soil quality values are established in the Order for 97 contaminants, according to 4 groups which are: heavy metals, hydrocarbons, chlorinated organic compounds and pesticides. Admissible contaminant concentration values are established in mg/kg of dried matter according to alert levels and intervention levels, with sensitive and less sensitive end uses. Alert level means the concentration level which must warn authorities about potential environmental impacts and require them to carry out an assessment of concentrations to identify extension and levels of contamination. Intervention level means the concentration level which requires the authorities to carry out risk evaluation studies and reduction of pollutant emissions. Sampling must be done according to Order n°184/1997 about procedures for environmental audits. Romanian tests methods are applied for analysis.

Table 6.4.3 summarizes management alternatives according to the stipulations found in the ministerial order n°756/1996 for soil contamination. These alternatives are defined according to soil contaminant concentration levels and end land use categories. Problems and gaps raised by Order 756 for the management of contaminated sites are explained in section 6.6.

Table 6.4.2 Trigger Concentration Values of the Ministerial Order n°756/1997

	Alert values	Action values
Soil	Concentration levels in annex of the Order for sensitive and less sensitive land uses	Concentration levels in annex of the Order for sensitive and less sensitive land uses
Groundwater	70% of the action values	Equivalent to the legal threshold standards, which is assumed to be drinking water quality standards

Table 6.4.3 Management Alternatives in Case of Soil Contamination, According to Ministerial Order n°756/1997

	Concentration lower than alert level	Concentration higher than alert level and lower than action level	Concentration higher than action level	Observations
High sensitivity of land uses	A. Special measures	B. Soil impact is assumed; contamination prevention measures and monitoring	C. Land use is forbidden but shift to low sensitivity land uses possible in case E conditions	High sensitivity uses are present or future residential / recreational areas, agriculture, protected areas
Low sensitivity of land uses	D. No action	E. Soil impact is assumed; contamination prevention measures and monitoring	F. Land use is forbidden but Possible in case E conditions	Low sensitivity uses are present or future industrial and commercial uses

The Research Institute for Soil Science and Agrochemistry manages a national soil quality monitoring program. This monitoring program started in 1977 and basically concerns agricultural and forest soils. Sampling has been performed on a fixed grid of 16x16km totalling 942 plots. Results of the program have been summarised in section 10.2.2. The Ordinance n°38 of 21st March 2002 has officially established the task of a national programme ofr soil monitoring for agriculture and forestry soil, as part of the National Integrated Environmental Monitoring System of MWEP. Beside this monitoring program, which focuses on agriculture and forest soil, analyses of soils and sediments in sensitive places are occasionally performed by the local laboratories of Apele Romane.

(3) Monitoring System

Monitoring of soil and groundwater quality around industrial pollution sources is a general practice made according to the compliance document agreed between the site operator and the EPI office. The number of groundwater monitoring wells is in general limited to 1 or 2 points. The regulation for landfilling of waste has required a minimum of 3 points for waste landfill sites.

The MWEP is responsible for the development of general environmental policy and legislation and for monitoring. Every EPI has responsibility to monitor environmental conditions, such as ambient air, surface water, ground water, soil and noise, in public areas. Control of monitoring data and surveillance of monitoring practice is done by EPI based on its inspection and police (environmental guards) duties. Direct sampling and analysis of soil and groundwater is also performed.

In 2000, the MWEP started to compile environmental data from all institutional sources through the recently created "National Integrated Monitoring System," placed within its Ecological Control and Monitoring Division. However, at present, no appropriate monitoring for hazardous waste facilities is organized in Romania. The Governmental Decision on Waste Landfilling (162/ 2002) obliges landfill operators to enforce continuous monitoring programs. The regulation for landfilling of waste has required a minimum of 3 points for waste landfill sites. According to this regulation, the operator is responsible for the post-closure monitoring for a duration established at 30 years at least.

6.4.3 Prevention of Pollution

(1) Outline

The basic pieces of legislation for prevention of pollution have been described and analysed in the section about institutional aspects. Measures taken in order to prevent contamination of soil and groundwater from potential sources of contamination are based on the legislation of control of emissions and discharge of factories and economic units. The transposition and future implementation of the IPPC directive in the Romanian system of prevention of industrial pollution is under way and should be definitively important for the objectives of prevention of contamination of soil and groundwater and constitution of soil-contaminated sites in the future. The waste management plans and the regulation on landfilling of waste are of course important components of the pollution prevention system for waste landfills contaminated sites.

(2) Environmental Audit and Inspection System

Environmental audits are required for operating industrial units or activities in conformity with the list of activities in an annex of the law on permitting procedure n°125/1996. Monitoring for controlling emissions of contaminants is compulsory and executed according to environmental audit permits. This law and the order on environmental audits procedures have been described in the Progress Report. The EPI inspection system is limited due to the lack of human resources and operating budget, as well as insufficient laboratory capacities for analyses. The MWEP is aware of the need to strengthen the role of EPIs in environmental protection. Policy trends in this field have been presented in the section on institutions.

(3) Waste Landfills

The Law for the approval of Emergency Ordinance 78/2000, approved in July 2002 by GD 426/2001, requires the elaboration of county level waste management plans to be submitted to MWEP. These plans are important tools for organising the prevention of pollution of soil and groundwater.

The Decision n°162 on landfilling of waste is an important regulatory instrument for the protection of groundwater and soil quality in waste landfill contaminated sites. It

provides key measures about responsibilities, financial guaranties, closure and post-closure plans, and environmental permits for operation. Waste landfills without operation permits will be soil-contaminated sites needing post closure management plans.

6.4.4 Prevention of Environmental Impacts

(1) Outline

The measures that can be undertaken in order to protect the environment and population against the impacts of contaminated areas are basically oriented to the prevention of exposure to contaminants, the capacity to control emergency conditions, and the evaluation of risks. More radical are the actions of confinement or eradication of the contamination sources, which are considered more appropriately in the next section on post closure management. Main measures for the prevention of environmental impacts might be:

- Inspection of health and control of well water quality
- Evaluation of extension of contaminated area and risk assessment
- Land use constraints and urban planning
- Emergency plans
- Transfer of the water source
- Confinement of the pollution source
- Restoration of the contaminated area
- Eradication of the pollution source and clean-up

An important government decision has been recently taken which deals particularly with the problem of identifying and mitigating potential impacts of soil-contaminated sites. This is the Decision n°118 of 7 February 2002 regarding the approval of the action program for mitigation of surface water and underground water contamination, caused by the discharge of the hazardous substances. This action program is described.

(2) Action Program

The objective of the action program of concern is a high level of water system protection all over the country. It specifically deals with the legal and institutional framework necessary to prevent pollution and limit the effects of pollution of surface and underground water due to hazardous substances.

The list of hazardous substances considered as priority substances for the monitoring program is provided in appendix 1 of the Decision. It consists of 35 basic substances with planned review of the list by December 2003.

The Decision establishes a working committee for the promotion, coordination and implementation of the action program. The first step of implementation of the action program is stipulated in Art. 4, which provides that the MWEP will carry out the initial inventory of contamination sources for surface water and groundwater which result in water pollution within 1 year after enforcement. The second step is stipulated in Art. 5, requiring an initial inventory of waters contaminated by priority substances and waters that are potentially exposed to contamination. Contamination is defined as concentration values

higher than quality objectives targeted for groundwater, which is interpreted here as drinking water quality objectives. Updating of the action program will be done every 5 years.

(3) Emergency Plans

Waste generators and holders are required to prepare action plans for emergency conditions under stipulations of GEO 78/2000, and to establish conditions for the good implementation of these actions. Such plans are particularly crucial for the management of hazardous waste storage sites, and should be given high priority in case of acute toxicity products.

The order 278/1997 provides guidelines for the elaboration of emergency plans against accidental pollution. Emergency plans in case of water pollution are submitted to Apele Romane. The emergency plans include the list of critical areas and risks to downstream water users, the list of equipment, operators and emergency teams, the list of measures, training programs for emergency teams, and distribution of responsibilities. Emergency plans are prepared each year by Apele Romane for each water basin to cope with accidental contamination of water and its possible impacts on population and the natural environment. The plans include the list of potential polluters, water users, teams and responsible persons of the warning system and list of measurement stations.

At the level of the Danube water basin and within the framework of the Danube convention, the International commission for the protection of the Danube river is working on preparing guidelines for management of installations handling substances endangering water.

(4) Assessment Studies

Assessment studies are the first basic step of prevention of impacts from soil contamination. Assessment studies include investigation of contamination levels and area extent, and at least a preliminary risk assessment. It is often necessary to establish a surveillance or monitoring system before taking a decision about remediation alternatives. Its objective is to understand the patterns of propagation of contamination. Surveillance is then considered here as a part of the assessment study process.

The present system of assessment studies in Romania is mainly based on the environmental audits performed by operators of soil contamination sources. Conditions of assessment are not appropriate for reliable information about the geographical extent of contamination levels and about the patterns of propagation of contaminants in groundwater. Risk assessment is investigated for all environmental and health risks induced by the present operation of industrial units subject to inspection in the surrounding area. It does not focus on soil and groundwater contamination sources and contaminated areas.

A more integrated approach of assessment of soil and groundwater contamination and its impacts in a whole area is required, but there are already some examples. . The study for ecological rehabilitation of a site contaminated by oil and petroleum products in Targoviste is an example of assessment study which is however managed under the Ministry of Agriculture and Sylviculture. The EPI of Prahova has presented in the annual report of state of environment sections and maps dedicated to groundwater and soil contamination conditions in Ploiesti.

(5) Land Use Constraints and Urban Planning

Land use constraints and urban planning are the basic measures that can help to prevent exposure through direct contact with contaminated soil and land.

The Law on the authorisation of the construction of buildings and some measures for housing construction (n°50/1991) is the legal framework for arranging urban and regional planning processes. Ministerial order 91/1991 sets out the procedures and contents of planning documents. Annex II of the law on environment protection 137/1995 obliges planners to submit an EIA as part of planning procedure. Order 125/1996 has made compulsory an environmental permit to the planning process, which was later replaced in 1999 by the obligation to have an environmental chapter in territorial plans. Urban plans are subject to environmental permits issued by the Division of permitting and certification of the MWEP.

Public agencies in charge of spatial planning are the directorates for territorial planning under the ministry in charge of public works, transport and housing, the Institute for statistics on construction and information on territorial planning (INSEROM), and the National institute for urban and regional planning, which provides quality certification of urban and regional spatial plans. The MWEP has responsibility for authorising territorial plans with respect to environmental protection, and coordinating EPIs' authorisation of territorial plans.

6.4.5 Management of Post Closure Sites

(1) Outline

Management of post closure sites raises serious specific legal and practical difficulties in the field of responsibilities, and financial and technical resources. There are also difficult decisions about the level of clean-up which must be considered appropriate, or more basically the kind of remediation solution that would be sufficient to adequately protect the population and environment against risks. All these problems are more crucial in the case of old, past activity sites. Waste landfill sites in operation in 2002 are now regulated to propose post-closure plans and financial sources for implementation, which is in principle the guarantee that no future soil-contaminated sites will be created.

Sites or facilities that have induced contamination of soil and groundwater from past activity are the core of the problem of soil-contaminated sites. Management of contamination sources from past activity meets difficult considerations like identification of such sites, finding of polluters, finding of financial sources to take actions, and setting of appropriate environmental objectives to solve the problem when health and environmental risks have been found.

(2) Identification and Inventory

The identification of soil-contaminated sites is established as a priority in the Stockholm convention on POPs. In Romania, Decision n°118 of 7 February 2002 has required the identification of surface and underground water pollution caused by hazardous contaminants (section 6.4.4). This action program should in principle initiate a planning process based on a systematic inventory of soil-contaminated sites. It is not clear however if non active hazardous sites are planned or not, and if groundwater and soil protection is a priority objective or not, in this plan.

The existing tools for the identification of soil-contaminated sites from past

activities are however non-existent, with the exception of the regulation for landfilling of waste which requires such identification, and waste management plans which should in principle contain a statement of old contaminated sites. Clear definition of soil-contaminated sites and supporting technical guidelines for identification and inventory, as well as a registration or database system will be necessary.

(3) Remediation

The requirement for remediation of contaminated sites is not clearly stated except in the case of waste landfills according to the new regulations for landfilling of waste. The idea that contaminated sites should receive remediation action is mentioned in law 78/2000 as one of the objectives of the waste management plans (Art. 8). Ministerial order n°756/1997provides that the authorities must decide if remediation is necessary or not, and if necessary, must establish remediation objectives.

Remediation action is then a decision to be made at the local level, which presents the advantage of possible adjustment to local conditions of risks. However, there is no clear statement of the intention of local EPIs about the kind of action that should be undertaken and conditions that would justify such action. The soil quality criteria approach (section 6.4.2) shows that action, which can be remediation, is based on parameters like land use sensitivity and toxicity level. Potential risk to groundwater resources should however be considered as the basic decision criteria for remediation alternative.

Nothing is said about the specific cleanup level required in case of remediation. It can be assumed that the quality objective required from cleanup action would be the soil and groundwater (drinking water) quality criteria. For soil quality, such an objective would however be inconsistent with the principle of remediation decision at the discretion of local authorities.

Probably in consequence of such unclear conditions of remediation needs and within a context of lack of financial resources, to the knowledge of the JICA study team, there is almost no significant example of remediation project in Romania. A project of ecological rehabilitation of contaminated soil under requirement of the Ministry of Agriculture and Sylviculture is under way in Targoviste. There is also a PHARE project starting activity in Ploeisti but it focuses on assessment of contamination conditions and clean-up is not yet planned.

(4) Responsibilities

According to the PPP principle which is adopted in the Romanian legal system, the polluter is responsible for the damages occurred and should take appropriate measures. In the regulation for landfilling of waste, the responsibility of the operator of landfills is clearly stipulated. However, the conditions of responsibility in the case of past activity related non active hazardous waste site is unclear.

Emergency Ordinance 78/2000 provides few indications about responsibilities and financial resources for contaminated sites when waste holder is not found. The land owner who is damaged can require financial support to local authorities, and in case of hazardous substances contamination, benefit from the environmental fund (project). Basically, the waste owner is responsible for restoration of site. If not identified, current waste holders, who are operators of the site, are held responsible until the original holders are found.

The Law No.426 from July 18, 2001 on wastes management stipulates that in the case where the producer of waste is not known, it is the person identified as the present

wastes holder that should bear the expenses for environmental cleaning and rehabilitation until identification of the producer of waste. If the producer of wastes cannot be identified, the legal or natural persons whose properties are affected may get financial support from the local authorities, and when the impact is caused by hazardous wastes, from the Fund for Environment.

(5) Financial Resources

The issue of financing remediation works is strongly related to the clarification of responsibilities. Financial resources for managing the post closure phase of sites under operation have been clarified in the regulation for landfilling of waste. The operator must present a bank guarantee of good execution in order to obtain the environmental permit for the waste landfill operation. The operator must establish a closure and post-closure monitoring fund. The local government authority is responsible for supervising the use of the fund.

In case of absence of the responsible party for the contaminated site, it is assumed that requirement of funding from the environmental fund by the local EPI will be the only possible solution for remediation of the site. Soil pollution monitoring and mitigation can be supported by funding. The environmental fund has been established by Law n°73/2000 approved and modified by Law n°293/2002, and Law n°72/1996 in order to support priority environmental objectives of the national action plan for environmental protection. The conditions of application and attribution of this fund are not yet clarified.

6.4.6 Main Issues

(1) Environmental Conditions

The main aspects coming from the review of current physical conditions of soil-contaminated sites can be simply summarised as follows:

- There is no legal definition of soil-contaminated sites;
- A large number of industrial waste deposit sites are without pollution prevention measures, which means a serious potential of impacts on soil and groundwater;
- The major pollution sources with potential impacts on surface water are well recorded in several inventories;
- Waste deposits under present operation are inspected and regulated. Most historical dumping sites of hazardous waste and equivalent places having potential impacts on the environment are outside the system of pollution management;
- Soil and groundwater contamination has not received the same attention as surface water related pollution.

The study and survey of soil-contaminated sites has shown that only major pollution sources with critical conditions for environmental quality are generally declared as soil-contaminated sites by the EPI offices. These sites are often national or international priority issues for the management of the water environment. Smaller pollution sources and contaminated zones generated by old activities are not known.

These sites may be critical because of the toxicity level of the waste substances involved (PCB, chromium) or because of the extension and level of contamination (oil

products) as well as potential risk for chronic or acute pollution of surface water (risk of landslide of landfill materials in surface water, bacterial leaching of mining waste and increased acidity of surface water). The quality of the natural environment and potential water resources are directly affected by these contaminated sites. Potential international conflict resulting from surface water contamination is one of the possible issues raised by contaminated sites.

The sanitary effects of contaminated sites are not known. Risk assessment studies performed by site owners as a result of environmental audits focus on present activities on a whole rather than contamination from past activities. The method and results of these studies have not been communicated to the JICA study team. There is no knowledge of the whole extent of sanitary effects from major and minor contaminating sources that exist in the country.

Several sites were identified with sensitive environmental conditions during the JICA field survey (Volume 3 of the report). Sensitivity comes from the proximity of a major or minor river course and shallow groundwater. Land use and groundwater resources remain the highest priority criteria.

(2) Data

1) Soil and Groundwater Quality Data

Groundwater quality data are provided from the national network of groundwater surveillance and point specific monitoring wells of units subject to EPI inspection. This system provides very few data on hazardous substances parameters. There are almost no data in this field regarding shallow groundwater. The main sources of data are the EPI inspection reports and the environmental audit reports that are required by site operators in case of modification of activity or privatisation.

2) Database

Based on the concept of surface water pollution sources, the Romanian authorities have established several listings or inventories under different jurisdictions. Data are however very poor in the field of soil and groundwater contamination. There is a need to have a reliable, unique, comprehensive and central system of recording such sites. This will need consensus about the objectives and needs of such database and a better coordination of the data management between jurisdictions involved under the MWEP. The database of obsolete pesticide storage sites under the Ministry of Agriculture seems to be well constituted, but coordination with the MWEP, which is in charge of waste management tasks is not clear.

3) Information Sources

The identification of soil-contaminated sites and the evaluation of potential contamination as well as more detailed studies will require a large number of data in the fields of land use, water resources, hydrogeology, hydrology, pedology and geology, and others. The availability of these data and their access are the preliminary requirements for the study of soil-contaminated sites.

The constitution of a database on soil-contaminated sites will strongly depend on the easy access to information sources, for example municipal archives and scientific data, and the strong coordination between the various authorities that must be involved in such process. Easy access to information sources will be one of the key

aspects for the good progress of such a database. The direct exchange of information between local EPIs would be helpful as well.

4) Data reporting and Inventory

It is now a common practice in Europe to establish a database or national inventory of contaminated sites. The existing approach of inventories in Romania has been mostly determined by the purpose of surface water management and has been dealing with sites in present operation. Several important inventories of pollution sources have been performed in Romania since 1995, as shown in section 4.4. There is however none that has been dedicated to soil or groundwater areas possibly contaminated by hazardous substances from past activities. The standard approach of inventorying soil-contaminated sites gives however importance to soil and groundwater quality conditions resulting from present and past contamination sources.

We can assume that this gap is partly the result of the Romanian specificity, namely the international commitments as regards to the Danube river water quality and the modest role of groundwater resources in water supply. This could have resulted in a highest priority for surface water compared with groundwater. There are however new trends to increase the consideration of groundwater quality in environmental management.

The inventories of waste landfills and deposits on the one hand, and those about storage of waste pesticides and PCBs waste materials, on the other hand, are of course a relevant part of future inventory of contaminated sites. Historical sites should be reported and included, and health risks through drinking water and land use should be assessed.

(3) Site Management

1) General

Site management covers several aspects of prevention of pollution generated by hazardous waste treatment facilities: control of equipment and facilities, impact prevention, monitoring, communication with local authorities and possibly with the public. Very often, management measures are limited to the minimum required measures, like restricting access and showing signboards. Waste landfill sites are managed under the requirements of the regulation for landfilling of waste.

2) Monitoring

Monitoring is an essential part of site management, regulated by law and controlled by EPI inspectors. Monitoring is done as a day-to-day standard measure with a limited number of samples and items which are in most cases insufficient to evaluate soil and groundwater contamination.

3) Site Investigation Procedure

There are very few examples of site investigation for soil and groundwater contamination in Romania. The decision criteria for starting investigation are not clearly established. When a site is found as having potential contamination, what are the criteria that should be considered in deciding if investigation is needed? We can assume that simple risk evaluation like the type of hazardous substances, pathways, and category of risk should be such criteria. For a more complete risk assessment, that could be decided as a result of preliminary assessment, we can assume that the decision

criteria are the concentration levels found to be higher than those permitted for existing or planned land uses, as established by the order n° 756/1996.

Given the lack of risk assessment studies, there is no knowledge of potential impacts on soil and groundwater and the consequent risks. There is no knowledge of the extent of sanitary effects from major and minor soil or groundwater contaminating sources existing in the country. Risk assessment studies performed by site owners as a result of environmental audits focus on the present operation of industrial units. Risk assessment studies of soil and groundwater contamination sources and contaminated areas are needed. When contamination of groundwater spreads quickly, cost of remedial action increases if untreated, which makes assessment an important step in the good timing of remediation.

In practice, the lack of laboratory capacities and budget to cover the needs of sampling and analysis in case of assessment needs are however obstacles to action.

4) Site Remediation Procedure

Remediation may be the solution retained for preventing exposure of people to contaminants. Remediation can be ecological rehabilitation, clean-up, confinement or any other final solution to eradicate the contamination source and prevent contamination risk.

The study has shown that there are several major sites with high risk of surface water, and sometimes groundwater contamination. These sites have been known for a long time and already registered as hot spots. However, in most cases, no action has been taken in spite of the environmental risks found. This situation seems to result from the lack of clarification about jurisdictions and responsibilities, the lack of financial resources, and the absence of technical guidelines. It is expected that stronger environmental requirements, development of an environmental fund, and technical guidelines will improve the situation. Certain of these sites that have been known for years will need to be considered as priority contaminated sites and as such, should be investigated for formulating a plan of remediation.

In conclusion, there is no clear procedure of remediation in Romania. There is no specific agency responsible to develop and control remediation works, and there is no clear legal statement of decision criteria for remediation and selection of the appropriate remediation alternatives. This situation leads to no action or, in case of action, can put high prejudice on the environment due to uncontrolled remediation works. Remediation works are not explicitly submitted to EIA and inspection. According to the waste regulation for landfilling of waste, the local EPI authorities decide on the required remediation measures needed for waste landfill sites that are no longer authorised to operate.

6.4.7 Management Strategy Objectives and Targets

(1) Objectives

The basic objective of the strategy for management of soil-contaminated sites is to prevent the possible health and environmental effects of past and present contamination sources of hazardous waste substances. This objective is stipulated in the environmental laws of Romania. Legal and international requirements regarding the protection of soil and groundwater quality have been overviewed in section 6.4.2. Main objectives are

summarised in Table 6.4.4 below.

These objectives can be applied to the whole issue of contaminated sites or only to the limited scope of hazardous waste disposal sites. In the establishment of targets and recommendations for the strategy of management of contaminated sites, focus is given to hazardous waste deposits and storage sites, whether historical or present.

Table 6.4.4 Main Objectives of the Strategy for Management of Soil-Contaminated Sites

	Main objectives
1.	Achievement of legislative requirements regarding the appropriate treatment and elimination of hazardous waste materials and substances for EU accession
2.	Application of the precaution and sustainability principles in the management of hazardous waste
3.	Avoidance of new soil-contaminated sites for the preservation of soil and groundwater resources for the future generations
4.	Achievement of the quality objectives of surface water, which quality is more or less determined by the quality of groundwater
5.	Protection of public health, through preventing unacceptable exposure levels to hazardous contaminants in soil and drinking water
6.	Achievement of international obligations of the Romanian government in the field of biodiversity preservation and prevention of ecological accidents in the Danube river (Danube river protection convention framework);

2) Targets

Main targets are established from the finding of key issues (6.4.6) and background objectives mentioned above. Targets are summarised in Table 6.4.5 below. Recommendations in section 6.4.8 are designed to achieve these targets after discussion of options when relevant.

Table 6.4.5 Main Targets

	Main targets
1.	Prevention of soil / water contamination for operating hazardous waste treatment facilities (deposits, landfills, lagoons, storage sites) through implementation of existing laws
2.	Prevention of the spreading of soil and water contaminants and associated health and environmental risks from historical hazardous waste deposit sites (deposits, landfills, dumps, lagoons) through implementation of existing laws and revision or setting of new legal requirements
3.	Understanding of present conditions of environmental management practices and existing potential impacts on health and ecosystems of contaminated sites in Romania
4.	Development of remediation measures and cleanup of contaminated sites that present potential high risk or damage to the population and the natural environment
5.	Development of a policy of management of contaminated sites (objectives, procedures, jurisdictions) through new ministerial orders and techical guidelines

6.4.8 Evaluation of Strategy Recommendations

(1) Overview

The strategy proposed for the management of soil contaminated sites consists in the application of 10 main recommendations. These recommendations aim at managing non active sites and contaminated areas in order to eliminate or reduce environmental risk. These recommendations are listed in Table 6.4.6 and reviewed in this section below. They are classified according to 4 groups of activities:

- Institutional improvement for prevention of soil contamination, which deals with institutional and legislative needs to fill in existing gaps;
- Data management for the understanding of soil contamination risk and environmental impacts, which basically means the establishment of a national inventory and reporting procedure of contaminated sites
- Decision making and policy needs in terms of development of basic procedures like decision criteria and technical guidelines for remediation planning; These include aspects of an institutional nature which have not been included in the first group of recommendations.
- Development of remediation and cleanup projects, which focuses however on the planning step only.

Table 6.4.6 List of Strategic Recommendations

Categories of recommendations	Recommendations
1. Institutional Improvement for prevention of soil contamination	1. Improving the management of hazardous waste deposit / storage sites in order to avoid future soil contaminated sites
	2. Clarification of the legal status of contaminated sites, focusing on historical sites, through ministerial order
	3. Clarification of the administrative responsibilities and liabilities for management of contaminated sites
	4. Clarification of the status of soil cleanup projects in the EIA system
2. Data management: Understand soil contamination risk and environmental impacts	5. Establishment of a database system and inventory of soil contaminated sites
	6. Development of compulsory reporting and registration of contaminated sites
	7. Set up of technical guidelines for inventory and surveying activities

Categories of recommendations	Recommendations
3. Decision making and policy: Development of procedures	8. Clarification of soil quality trigger values through revision of order 756 or new order provision
	9. Set up of technical guidelines for decision making procedure about remediation
4. Development of remediation	10. Development of remediation measures and cleanup projects

Table 6.4.7 is a checklist of the coverage of recommendations according to the 4 fields of management established in section 6.4.1 for the review of management conditions and issues (see Table 6.4.1). This checklist is intended to show how the recommendations can contribute to the global improvement of the present system of management of contaminated sites.

(2) Improving the Management of Hazardous Waste Deposit/Storage Sites

Improving the management of hazardous waste deposit/storage sites means a better control of contamination sources for the prevention of soil and water pollution. This recommendation is a basic requirement in order to avoid the emergence of future contaminated sites and prevention of risk to future generations. It deals with the general conditions of prevention of pollution in industrial companies, with special attention to the generation and handling of hazardous waste and substances. The good implementation of environmental laws for authorised operating industries and waste treatment facilities should be enough to ensure such purpose. The ongoing process of strengthening the capacity of EPIs contributes to the same objective. Besides the task of compliance with the law requirements, which is already well performed by the EPI agents, there are 2 points needing attention for global improvement in the field of contaminated sites management.

1) Revision of the Procedure of Environmental Authorisation

The procedure of EIA and environmental audit for approving a given number of activities in Romania is in principle the best way to prevent future soil contamination accidents from operating plants and facilities. Field visits have shown however that there are endless procedures engaged by proponents for submitting studies and demand of authorisation, taking benefit of the lack of legal deadlines to be respected. In the case of historical sites with liable and accountable parties, and within a context of low awareness of environmental damages, the deficiencies of the authorisation procedure system leads to inaction. In case of high mobility of contaminants in groundwater and soil, this may be very damaging for environment and public health. The procedure should be revised with introduction of clear and strict deadlines for submission of demand of authorisation, evaluation studies (EIA, audits), and delivery of permits.

2) More Systematic Control of Deposit and Storage Conditions

A more systematic control of deposit and storage conditions of hazardous waste should be operated through the use of a formalised checklist.. This point is important because environmental authorisation is generally attributed to the company for its whole activity, which induces an insufficient attention given to waste deposits and storage sites. This is particularly obvious in the case of historical deposits which are

located in the industrial plant, and sometimes outside, but under the management responsibility of the company. A formalised format sheet document for use by the company in charge of waste deposit management and another one for use by the EPI could help create awareness of inspection and control key points in view of contaminated sites management. Examples of format documents and key items useful for format documents are provided below in Appendix 3.1 and 3.2 of Volume 2. The format sheet of management key data in Appendix 3.1 can be used as a reference model for establishing a sheet maintained by the operator of the facility handling hazardous waste. The list of key items of a formatting sheet for preliminary evaluation of contaminated sites by EPIs (Appendix 3.2) can help for a systematic control of site management conditions but is designed for the preliminary survey of contaminated sites (recommendation n°7 in Table 6.4.6).

Table 6.4.7 Checklist of Recommendations and Effects on the Management Fields Defined in Section 6.4.1

	Recommendations	A	B	C	D
1.	Improving the management of hazardous waste deposit / storage sites in order to avoid future soil contaminated sites		x		
2.	Clarification of the legal status of contaminated sites, focusing on historical sites, through ministerial order			x	
3.	Clarification of the administrative responsibilities and liabilities for management of contaminated sites				x
4.	Clarification of the status of soil cleanup projects in the EIA system	x			x
5.	Establishment of a database system and inventory of soil contaminated sites			x	x
6.	Development of compulsory reporting and registration of contaminated sites	x	x	x	x
7.	Set up of technical guidelines for inventory and surveying activities	x		x	
8.	Clarification of soil quality trigger values through revision of order 756 or new order provision	x		x	
9.	Set up of technical guidelines for decision making procedure about remediation				x
10.	Development of remediation measures and cleanup projects		x	x	x

A,B,C,D: See Table 6.4.1 for definition

(3) Clarification of the Legal Status of Contaminated Sites

1) Legal Definition

Making a legal definition of soil-contaminated sites is a sensitive point because of the need to consider the specific conditions of the country and the possible

undesirable consequences of the definition such as the high cost of covering an inventory of sites. For example, including or not including municipal landfills in such a definition has consequences for the potential number of contaminated sites. The heterogeneity of conditions of soil contamination, the diversity of factors to take into consideration, and the possible priority objectives and management principles to be retained are all aspects making the consensus for an appropriate definition difficult.

First, the time frame to be considered for management of soil-contaminated sites is large. Although it is clear that past activities with present contamination and possible impacts are the core of the problem, it is also necessary to take into consideration present activities which have the potential of future soil and groundwater contamination.

Second, the selection of basic categories of sites that can be considered as soil-contaminated sites is also large: waste storage, waste dumps, waste landfill sites, liquid waste lagoons, factories, and sites of accidental spillage of hazardous substances. Since contamination is firstly caused by past activities, it is more practical to consider that soil-contaminated sites may be contamination sources, like those mentioned here, or contaminated areas, of which the actual contamination sources are sometimes unknown.

Third, the hazardous waste substances that can be retained as contaminants of soil and groundwater may be subject to discussion. It should be in principle focusing on the legal definition of hazardous substances. Hazardous wastes are the main but not the only possible sources of hazardous substances for contamination of soil and groundwater.

There are factors that increase confusion about the subject of soil-contaminated sites, as this was found during the study. It seems that one difficult point of understanding comes from the methodological purpose of the definition that is generally given to soil-contaminated sites and from the objectives.

As regards the methodology, the standard pattern is to consider that all sites having some potential of soil contamination should be considered as soil-contaminated sites. This is practical for an exhaustive identification and registration of sites. It however means that only few of the soil-contaminated sites will prove to have effective contamination.

Within the scope of this study, hazardous waste deposit and storage sites constitute the core of the definition of contaminated sites. A legal definition should however include contamination sources like hazardous substances spillage, as defined in 4.4.

2) Legal Status of Contaminated Sites

When contaminated sites are waste deposit and storage facilities under present operation, the existence of these sites is made legal through the system of environmental authorisation and inspection. It is expected that there are a lot of historical in-site facilities with low or no control but are not illegal because they are not dissociated from other facilities of the plant in the authorisation document. In the case of landfill sites, the landfilling law provides a definition of illegal and legal landfills.

However, when contaminated sites are historical hazardous waste dumps, it is

not clear if they are considered to be illegal. According to the waste laws, dumping of waste by economic units and individuals is illegal but nothing is said about old dumping sites. It would be important to state through ministerial order that such sites must be considered as illegal.

(4) Clarification of Administrative Responsibilities and Liabilities

This recommendation on clarification of administrative responsibilities and liabilities can be divided into key aspects which are:

- Clear allocation of jurisdiction for soil and groundwater quality management;
- Clear statement of liability conditions for the potential damage caused by contaminated sites and remediation, and consequently for financing investigation programmes and remediation works;
- Institutional coordination especially in the process of inventory making and remediation decision and planning.

1) Allocation of Jurisdictions for Soil and Groundwater Quality Management

The task of contaminated sites management is not clearly allocated, or allocated on a piecemeal basis between several agencies, which leads to confusion and lack of action. A clear allocation of responsibilities is recommended for reporting data, making inventories and managing databases of contaminated sites, and deciding and controlling remediation works. EPI should have the main control and police responsibility in this field, and provide and manage the data for county level inventory of sites. ICIM is in good position to manage the data countrywide. Apele Romane should have a financial contribution through grants or low interest loans for sites investigation and remediation. The Institute of Pedology could contribute in the preparation of technical guidelines for the field surveys.

The JICA study team understands that the action program established by Decision 118 for the inventory of contamination sources for surface water and groundwater has been undertaken under the jurisdiction of Apele Romane. However, no information has been provided about the progress of this action program. Apele Romane should improve its communication on this action program and make clear the present conditions of implementation and relevance for the contaminated sites issue.

Of course, more basic institutional arrangements should be established for soil and groundwater. Jurisdictions for groundwater are fragmented, while shallow groundwater is mostly outside this system. The recent centralisation of monitoring data at the MWEP could help to improve this situation through better coordination. Soil quality has been regarded as a responsibility of the Ministry of Agriculture (Institute of Pedology), and it is not clear who is in charge of soil contamination and contaminated sites in the MWEP. There should be at least one person working on the problem in the waste department of MWEP.

The role of EPI is expected to be fundamental at various stages in the management of soil contaminated sites, particularly for the approval system and control of remediation. In case of non liability and non accountability sites, EPI should have to cover several tasks like setting objectives and priorities of remediation, and financing investigation and remediation works with use of the environmental fund. The possibility of using the environmental fund for remediation will be evaluated after

completion of the inventory of contaminated sites. The EPI tasks could be summarised as follows:

- Establishment of inventory and data base
- Approval of remediation plans;
- Setting up the clean-up level objectives in these plans;
- Controlling the achievement of these objectives;
- Licensing and controlling the clean-up works.

2) Statement of Liability Conditions

The question of liability for damages is critical in the present double context of privatisation and land restitution to former land-owners (Land restitution law). Potential new operators and new land owners must be informed about their responsibilities in case of soil contamination. The implementation of the land restitution policy, in particular the procedure of registration of land ownership, land use and land value has not progressed as expected. These conditions may contribute to the lack of the environmental enforcement instruments that are based on the PPP.

It is clear that operators of plants and facilities, based on application of PPP principle, are held responsible for pollution prevention. The landfilling law clearly stipulates responsibility of the operator for post-closure monitoring for a duration of 30 years at least. Then, the problem of clarification of liability and responsibility is almost related to the cases of historical sites. There are 2 basic situations:

- Polluter is accountable, and will be required to take measures but does not want to commit with requirements. Authorities could enter into case by case contracts with these polluters with voluntary contribution of industrial enterprises to remediate or clean-up.
- Polluter is not accountable or not identified as responsible for past pollution. Authorities must take decisions and actions about investigation and remediation measures. Remedial action programmes must be prepared by county EPIs in coordination with local agencies involved.

As regards the liability or accountability of the polluter, the following cases can be found:

- Polluter is identified and liable
- Polluter is past operator/owner and fulfils its obligation through a protocol on environment management agreed with new operator/owner for remediation of soil contamination, within the procedure of land privatisation
- Polluter is past operator/owner but the new operator/owner was not aware of the soil contamination problem; The new operator/owner is held responsible and has in principle an obligation to remediate land as one possible requirement of the environmental authorisation (5 years validity)
- Polluter is a state company of past activity; the new state operator/owner of the site has obligation for remediation.

Liability of the land owner is not clearly established. Liability of the landowner is a common practice in EU countries. Basically it seems that a limited liability of the landowner is considered in Romania. This should however be clarified through ministerial order about remediation requirements. The share of responsibility between operator and land owner is not sufficiently clear. For example, when contaminated land is the ownership of a private individual without present economic use, while pollution has been caused by past operator who is no more liable or accountable, who should be held responsible for remediation?

Responsibility of the government for undertaking and financing investigations should be clearly stated in the following cases:

- State is the polluter;
- State is the landowner while polluter is not liable or not accountable
- Neither the polluter nor the landowner cannot be found or are not accountable
- State has supported responsibility of damages in the process of land privatisation

3) Institutional Coordination

Carrying out the inventory of contaminated sites and taking decisions about investigation and remediation needs coordination of parties involved at local level. Coordination needs the establishment of working technical committees. Coordination should be improved between EPI agencies and water basin agencies for the purpose of contaminated site management.

At the national level, coordination between MWEP and Ministry of Agriculture, or between ICIM and Apele Romane seem important for improving knowledge and management of contaminated sites. The existing action program established by Decision 118 and described in 6.4.4 provides an opportunity for such coordination.

(5) Clarification of the Status of Soil Cleanup Projects in the EIA System

Remediation projects will need licensing because they have a high potential of pollution. It is expected that the potential environmental impact from remediation and site cleanup will be high with trends to closure and restoration of old sites. Contaminated soil should be considered as a potential hazardous waste and any operation involving excavation of contaminated soil raises potential risk of environmental contamination. Developing protection and prevention measures specific to remediation and clean up is thus essential for fulfilling the environmental objectives of remediation programmes.

It is recommended that major remediation programmes should be included in the list of projects subject to EIA and environmental authorisation. Since the EIA regulation is in the process of revision, there is a good opportunity for integrating remediation activity in the environmental authorisation and EIA system. Remediation measures that should be considered for environmental authorisation are those that involve excavation works. More simple temporary remediation measures with no soil excavation can be regulated directly under EPI inspection.

(6) Establishment of A Database System and Inventory of Soil Contaminated Sites

The establishment of a database system and compulsory inventory of soil contaminated sites is the most urgent and necessary action to be taken for starting the process of management of contaminated sites. Its purpose is to understand the present conditions of soil contamination risk and related environmental impacts in Romania. Such database is also very useful in the identification of stored hazardous waste quantities, which are not accounted for in the data system of waste flows. This recommendation is strongly related to reporting and registering of sites.

1) Inventory of Contaminated Sites

Identification and inventory of soil-contaminated sites is the first priority. This requires development of several basic steps like identification of sites, identification of vulnerable areas, inventory, registration and preliminary assessment. It is a long-term process to complete but could be started in each county by EPI. The identification process should be planned for up to 2005 at county level, and up to 2010 for full countrywide coverage.

Inventory of contaminated sites can be defined from the point of view of hazardous waste deposit and storage sites, which is the point of focus in this study, but could also include industrial sites as this is currently done in most cases in EU countries. The existing database of operating waste deposits under ICIM responsibility is very useful inj establishing the inventory of new sites. Contaminated sites and soil or groundwater areas that have been or could have been contaminated by hazardous substances from past activities in Romania are not mentioned in such inventories. It is however important that historical sites are part of the inventory because soil and groundwater contamination are often caused by hazardous substances from old waste deposits. The inventory activity must be compulsory and initiated by a ministerial order and supported by technical guidelines.

Inventories of pollution sources that have been performed in Romania since 1995 are very useful but are not adequate for the purpose of the contaminated sites inventory, which is to identify sites with health or environmental risk potential through contamination of soil and groundwater. The international commitments for the Danube river water quality and the modest role of groundwater resources in water supply can partly explain this deficiency. This could have resulted in a higher priority for surface water compared with groundwater. There is however a growing trend to increase the consideration of groundwater quality in environmental management.

Table 6.4.8 below shows the existing gap between the existing approach of inventory of pollution sources and the expected approach of inventory of contaminated sites. As explained in recommendation n°8, it is essential to consider the importance that should be attributed to surface water in this field.

Table 6.4.8 Approach for Inventory of Contaminated Sites

Existing approach	- Selection of sites with contamination risk on surface water; - Selection of sites with important risks for the Danube river basin; - Selection of sites with present activity.
Expected standard approach	- Selection of sites with contamination risk on soil and groundwater; - Selection of sites with contamination risk on drinking water resources; - Selection of sites with contamination risk related to sensitive land uses; - Selection of sites with potential of contamination from past activity.

2) Database

The waste data base managed by ICIM, which includes industrial hazardous waste, provides information on the flow of waste materials generated and treated. Existing quantities out of this waste flow are not well known. The ICIM data show however that there are many hazardous waste deposit sites in Romania related to past operating activity. This means that the quantity of hazardous waste deposited without environmental measures is certainly very significant and represents a potential threat to the environment. The establishment of a database will provide a better information on these quantities and give the possibility of estimating the impacts and risks for health and the environment.

The database should be constituted at the level of each county before national processing at ICIM and MWEP. The establishment of a database for contaminated sites implies the need to solve several preliminary or related conditions, which are:

- Upgrading awareness of the problem at EPI level and other administrative units;
- Establishing a list of typical sources of data;
- Setting a list of basic criteria for ranking and selection of sites for the inventory;
- Setting a list of basic information for description of each site
- Data base computer system and information management (maps, GIS)
- Opening the reliable information and access to such information to the public.
- Internet access to the consolidated data base should be considered.

The following categories of data must be handled:

- Data for identification of sites
- Data for site-by-site evaluation (preliminary checklist of data items in recommendation n°7)

- Data for scoring and ranking of sites (partly common with precedent)
- The reporting of basic data on contaminated sites by EPI to ICIM has 2 components:
- Data about management conditions of operating sites which are a potential source of soil and groundwater contamination
- Data about contaminated sites with past contamination and present potential effects on health and the environment

The checking items and data which are necessary for these two components are similar but may involve more or less additional research or information by the EPI officers. Reporting by site managers under the control and verification of EPI inspectors is the most easy case and is already partly done. When however no operator can provide information for past contamination sources, other information sources should be used by the EPI officers.

3) Data Processing

Mapping appears to be the most reasonable method for recording contaminated sites. Given the problem of availability of appropriate scale maps (1/50.000 at least for contamination sources and contaminated areas), mapping may be a difficult problem to resolve. It is however necessary to develop mapping in this field, and approximate scale sketches of sites will be done first in case of the absence of maps. The final purpose for the recording method of soil contaminated sites could be a GIS system development.

The linking of data to maps or drawings provides an effective tool for increased visibility and insight into the extent of contamination in soils and groundwater. GIS for site modelling could be a particular application of the technology. A hazardous waste site where characterization and remediation are being conducted can be described by cartographic or map layers called planimetrics (e.g., roads, property lines, buildings) and by data sets (e.g., sampling location, topographic elevation, chemical concentrations).

The technical data that are used to characterize the site can be stored in a database that is accessible through conventional database management system functions. Computer-aided drafting functions provide a means of editing and modifying the display to make it more attractive or easier to understand.

4) Reporting and Registration of Contaminated Sites

(a) Reporting Procedure

Reporting procedure pertains to several key aspects, such as identification of information sources, collection of useful pertinent data, institutional arrangements for data collection and analysis, and procedures for access to these data. The reporting output is the inventory/register document and the related data base for each contaminated site necessary for the statement of soil contamination conditions in relation to hazardous waste (and substances). Present statements about soil contamination conditions in Romania are very general. There is no national statement of levels of contamination in soil and groundwater, geographical extent, environmental impacts, remediation actions under way, and establishment of priorities.

Since reporting is concerned with waste stocks instead of waste flows, reporting means here the follow-up of progress in the identification and inventory of contaminated sites, of assessment of impacts and achievement of remediation objectives. The overall objectives of reporting are:

- To establish an inventory list
- To establish environmental impacts of contaminated sites in Romania
- To clarify and to improve management conditions of operating sites when necessary

The reporting system should be operated at three different levels covering data collection, data processing, and diffusion of data. This is explained in Table 6.4.9

Table 6.4.9 Overview of Reporting System to Be Set Up

Reporting levels	Contents
1st level data check by operators about operating conditions (new sites)	Reporting of site (facilities) management conditions by operators, which is already done in the waste data management system but need adjustments and improvement for the soil / groundwater contamination issue;
1st level data collection by EPI about historical sites	Reporting of historical sites conditions by EPIs, which is a completely new task. Knowledge of these historical sites is however required in waste management plans by law and national strategy;
2nd level data processing from local to national management units	National reporting procedure of contaminated sites data from EPIs to ICIM and MWEP;
3rd level diffusion of data in local / national documents:	Reporting of results in decision making documents and public access documents like county waste management plans, county environmental reports, and the national annual environmental report.

(b) Reporting Items

The data items that should be considered as particularly important in the reporting of EPI to ICIM about 1st level data collection (new and old sites) are listed in Table 6.4.10. The 3rd level reporting data items that could be expected for diffusion in environmental statement documents are for example:

- Present / past sites
- Liable / unliable sites
- Surface area, waste quantity, main contaminants
- Conditions of mobility and spreading of contaminants
- Existing impacts and potential impacts

- Potential risk levels ranking in the inventory
- Decision taken or to be taken for management of the site
- The presentation of contaminated sites conditions in the waste management plans is made compulsory by law and the national waste strategy. The state of environment reports of local EPIs should include a chapter or section about soil contaminated sites, with information on the level and extension of soil and groundwater contamination, and induced risk, as well as measures undertaken to mitigate these risks.

Table 6.4.10 Proposed Reporting Data Items from EPI to ICIM

	Reporting data items
1.	General information: GPS location, site designation, surface area, name of operator who deposited waste if known, location in/outside the factory plant, authorised/non authorised site, etc.
2.	Type of hazardous waste and quantity deposited (waste coding), if known
3.	Category of site (municipal landfill, dump, deposit, storage, lagoon)
4.	Land ownership and land owner name
5.	Statement of liability (polluter is / is not known, polluter is / is not present operator, no polluter and no operator known)
6.	Disposal activity (permanent, occasional, no activity)
7.	Years of activity (starting, finishing)
8.	Land use (in case of past site)
9.	Statement of remediation measures (Closure plan done, cleanup plan done, cleanup done, simple remediation measures done, etc)
10.	Site management conditions (lining, drainage, limited access, monitoring of groundwater, monitoring of soil)
11.	Availability of data on soil contamination (monitoring data, investigation data, no data)
12.	Availability of data on groundwater contamination (monitoring data, investigation data, no data)
13.	Soil is contaminated under or at proximity of the site (yes, no, unknown)
14.	Groundwater is contaminated under or at proximity of the site (yes, no, unknown)

(c) Registration Procedure

Final reporting in statement and policy documents can be considered as a first step in the registration process. Registration requiresa policy document with commitments like remediation and land use. It consists of a specific document with an inventory of contaminated sites (register), and integrating risk contaminated sites data in the spatial planning documents.

Registration of soil-contaminated sites creates the possibility of establishing a management policy and a record of site locations. There is not any official registration of sites referring to past activities or past accidents aiming at protectingthe population against health effects of soil and groundwater contamination. There are jurisdictions'

based registers of surface water pollution sources and these can be used in the registration of soil-contaminated sites.

Local EPIs, which will be fully in charge of initiating and managing inventory registers, should also be in charge of initiating registration of the soil-contaminated sites in urban plans and certificates. The registration work could start with small additional resources under the responsibility of the waste departments and in coordination with other local authorities through a county level committee organisation. Progress in the registration will make it necessary to develop new resources for full identification of sites, database constitution, mapping, field observation and assessment of contamination conditions. Registration must be considered as a long term activity with permanent updating.

The best output of registration is integration of the soil-contaminated site data into urban planning documents. The regulation for landfilling of waste has started to require the inclusion of landfills after closure in the cadastre document. This is a very positive decision and the same kind of system with systematic registration should absolutely be performed for non-active hazardous waste sites. This system will however present some limits related to the definition of contaminated sites, the scale of areas concerned, and the present urban land use of contaminated areas. The EIA of urban plans should take into full consideration the environmental impacts of registered soil-contaminated sites. EIA might also be a tool to identify new sites.

(7) Development of Technical Guidelines for Inventory and Surveying

1) Inventory Activity

Technical guidelines will be required for inventory and surveying activities. Such guidelines will provide methodological support to the EPI staff and all technical agents concerned with the activity of data analysis and studies for scoring and ranking of sites. Studies consist of field studies (preliminary surveys) and desk preliminary evaluation using checklists. Risk assessment studies can be required but are more related to remediation policy as developed in recommendation n°11. Technical guidelines for inventorying and surveying can be first established at the county level and then, based on exchange of experience, established and diffused by the MWEP countrywide.

2) Scoring and Ranking

Scoring and ranking of contaminated sites is the main methodological aspect of inventory activity after identification. Several factors can be considered for scoring and relative ranking of sources of contamination. The choice of pertinent factors is linked with the policy objectives of contaminated site management, which should be reflected in the setting of soil quality trigger values (recommendation n°8).

Health protection should certainly be the point of focus in soil contaminated site management, and then risk exposure through land use and water consumption considered as the main factor for the good evaluation of scoring items and trigger concentration values in view of selection of remediation alternatives. The first priority objective of management of soil-contaminated sites is to prevent exposure of people to hazardous contaminants likely to endanger health..

Land use related factors are clearly important for scoring and setting of trigger concentration values. The Order 756 with reference on soil contamination (section 6.4)

does not provide pertinent tools for decision making in the field of contaminated sites but shows the idea that cleanup objectives should be established in accordance with land use. Land use restriction should be considered as the basic practical measure of remediation when appropriate. This approach is reasonable and adopted in several EU countries.

Water use related factors are not clearly established from the Romanian system for use in managing contaminated sites. Factors related to groundwater use and resources are in principle strongly interdependent with soil contamination management. Components of soil contamination are subsurface soil and shallow groundwater. However, the study has shown that Romanian authorities have been more preoccupied with the safeguarding of surface water quality than groundwater, which could have consequences for the definition of soil-contaminated sites and objectives, with some focus on surface water contamination risk. In the present context, the main objective of protection of groundwater quality seems to be more or less oriented toward the achievement of surface water quality objectives rather than the objective of protection of groundwater resources. Furthermore, land use sensitivity would be more significant for defining the objectives of soil cleanup than groundwater resources protection.

Table 6.4.11 below provides a statement of conditions in Romania for the identification of objectives of remediation and cleanup as regards contaminated water related risk. The choice of such objectives determines the choice of items for a scoring system during the inventory. It shows several reasons why the importance of groundwater management could have been minimised in Romania. It also shows reasons why consideration of groundwater resources protection in defining the objectives of contaminated sites management would be appropriate.

It is recommended that the scoring system as well as quality trigger concentration values should be based on both shallow groundwater and surface water which are sensitive exposure routes in case of soil contamination. Since surface water is already a well known issue in Romania, it is proposed that more focus on groundwater and specially safeguarding of quality of the groundwater resources would be justified for decision making in contaminated sites management.

3) Format Sheet

Land use (exposure to soil) and water resource (groundwater) are the most important factors to be considered for risk from soil contamination. In a scoring system, land and water uses related sensitivities can be linked with other factors like toxicity and quantity of contaminants, site management conditions, mobility of contaminants in groundwater and others. Theistance between the site and sensitive receptors like residential land uses, rivers, vulnerable groundwater resources, as well as specific facilities increasing the risk of accident are all environmental factors to be considered for scoring sites for potential risk level ranking.

In the case of groundwater, scoring items should include vulnerability conditions, such as use for drinking water and other uses, and potential as a future resource. Groundwater vulnerability conditions are well studied by the water department of ICIM, and coordination with this department is necessary for getting pertinent data in the process of scoring of contaminated sites.

In the case of land use, scoring items are categories like residential, amenity (park), industrial, commercial, agriculture, gardens, and future potential land use.

Order 756 has proposed land use sensitivity categories which are however insufficient for scoring performance.

Scoring of sites can be done according to high/medium/low vulnerability and sensitivity, and associated with scoring of exposure and potential risk levels in order to find out a ranking classification of contaminated sites.

Ranking methods should be established at the county level before transposition at national level if necessary. Most critical sites with specific remediation actions will be defined after investigation and should be given the highest priority.

The scoring and ranking process is based on data pertaining to contaminated site management conditions (in the case of operating plants and facilities) and environmental conditions (vulnerability, exposure routes, mobility and toxicity of contaminants). Such data should be collected by EPIs. The MWEP has adopted a system of evaluation of priorities for planning the closure of municipal landfill sites. It can be used as a methodological reference for inventory of contaminated sites.

An example of formatting data according to key items for use by the local EPIs is provided in Appendix 3.2 of Volume 2. It provides the basic information requirements for the preliminary evaluation of contaminated sites. Site management aspects are integrated in this list.

Table 6.4.11 Surface and Groundwater Factors in Management of Contaminated Sites

Evaluation items	Argumentation
Current conditions stressing the importance of surface water in Romania	- Surface water is the main water resource; - Romania is an upstream area for major tributaries of the Danube river; - It has a major role to safeguard surface water quality for these tributaries downstream states according to the Danube river protection convention.
Possible factors contributing to minimize the importance of groundwater in Romania	- Water resources development has concentrated on surface water; - Quality conditions of groundwater and health impacts are not known, and in some cases surface water resources have been developed as a substitute to contaminated groundwater, with a progressive shift from underground to surface water as a solution to prevent exposure to contaminants; there are examples that could confirm such view. - International obligations of Romania in order to achieve objectives of the Danube convention have determined research priority activities for surface water quality issues instead of groundwater quality issues.

Evaluation items	Argumentation
Conditions that however stress the importance of groundwater in risk evaluation and prevention of soil contamination	- Application of the precaution principle; - Legislative background and integration to EU environmental protection system; - Safeguarding of the water resources of the rural population which is not supplied by central supply systems; - Safeguarding of the water resources potential for future generations; - Absence of data about shallow groundwater quality for hazardous substances items

4) Field Preliminary Surveys

There are two situations needing surveying, in case of soil/groundwater contamination already observed:

- Case of contamination source known, need to investigate the extent and level of soil and groundwater contamination.
- Case of contamination source unknown, need to investigate the extent and level of contamination and the contamination source.

As shown by the EPI questionnaire survey (see Volume 3), the first case is presently the most important in Romania, specially as regards the hazardous waste deposits and storage sites. This case must be considered as the first priority in Romania for taking action to manage contaminated sites generated by hazardous waste deposits. The second case is presently almost non-existent in Romania, probably because of the lack of data. This case is also more difficult to implement and should not be given priority in this strategy.

Site surveys can be done for general evaluation or detailed evaluation according to needs. In principle, a general survey can be sufficient for the evaluation of extent and level of contamination, based on sampling of soil and groundwater. Drilling can be necessary for the groundwater survey if the number of existing wells is insufficient to understand the site conditions. Then, guidelines should focus on:

- Methods of investigation of general conditions and assessment plan
- Methods of investigation of the extent and level of soil and groundwater contamination.
- Methods of evaluation of risk levels and measures

Evaluation of contamination levels should be possible according to a set of limited number of contaminant items to make it practical, and following standard methods of sampling and analysis. The soil sampling method should be established considering the following items:

- Number of soil sampling points in the area suspected of soil contamination

- Soil sampling conditions (depth, quantity, preparation of samples)
- Soil sampling conditions for groundwater, in case of sampling in existing wells and sampling according to the drilling investigation

Reinforcing laboratory capacities such technical capacities are a practical condition for risk assessment of soil-contaminated sites. Preliminary assessment is however possible with limited technical resources and priority should be given to this type of assessment, after identification of sites.

Order 756/1997 already provides indications about sampling and analysis of soil samples. It requires that provisions of the Order of MWEP No. 184/1997 regarding the Procedure for Environmental audits should be followed. International tests methods can be applied in certain cases.

Decision 118 provides that methods for risk and environmental impact assessment will be established by the MWEP, the Ministry of Industries and Resources and the Ministry of Health and Family, as part of implementation of the action program for prevention of water contamination. Implementing this requirement of the Decision is a good opportunity for the MWEP to establish guidelines in the field of assessment of groundwater and soil contamination.

(8) Clarification of Soil Quality Trigger Concentration Values Through Revision of Order 756 Or New Order Provision

Order 756 provides soil quality threshold values for decision making such as the need of assessment or remediation. These values have been explained in section 6.4.2 and can be found in Appendix 3.3 of Volume 2. These values can be considered as trigger concentration values. Trigger concentration values are generally established as tentative standards for triggering further investigation to check the concentration of hazardous substances. In the Order 756, values are however also in principle action values since remediation action is considered above certain levels of concentration.

Clarification of the soil quality trigger concentration values of Order 756 is necessary. They are not useful because of several gaps and problems as summarised in Table 6.4.12 below. This order raises several basic problems that make application of requirement almost unfeasible.

The existing concentration trigger concentration values of Order 756 for the management of soil and groundwater in the context of contaminated sites are not appropriate. This order should certainly be used for the different purpose of diffuse soil contamination for example. It is necessary to establish new values in order to fit with reasonable risk exposure conditions that could arise from contaminated sites, and to make it in a practical and feasible way. The first question to answer is what is the purpose of soil contamination management in Romania? Is it protection of soil as a valuable natural resource with future potential and for future generation? Is it protection of land development potential, protection of groundwater, surface water, natural ecosystems, or prevention of health risk?

Table 6.4.12 Gaps of Order 756 and Needs to Fulfill These Gaps

Items	Gaps and problems	Needs
Soil contaminants values	There is a too large a number of soil contaminans reference values, and all these values are set at very strict concentration levels which are not justified.	Reasonable and representative set of reference values
Risk level (groundwater)	The Order requires that groundwater should be kept at drinking water quality level or at least 70% of this level everywhere in Romania without consideration of risk related to groundwater consumption! This view is very unrealistic and not justified when considering the contaminated sites management issue. Application of the Order would raise unmanageable cases like need to eliminate contamination source (contaminated site) through site remediation in places where groundwater is not consumed and health risk exposure is inexistent.	Focus on risk levels from contamination of groundwater resources
Risk level (land use)	End land uses which are classified as sensitive and less sensitive uses are not clearly defined and relationship with risk exposure levels is not clear. This approach leads to inconsistency. For example, if action value is exceeded in rural areas (agricultural use is classified as sensitive), then remediation will be in principle necessary even in quasi absence of risk!	Establish risk levels for clear end land uses categories
Scale	No consideration of the scale of contaminated land (area, volume) is done, which is however an important factor for the good evaluation of potential risk.	Establish minimum scale requirements. In the Netherlands, 25m3 of contaminated soil is a minimum.
Cleanup objectives	Trigger concentration values of the Order are also considered as cleanup quality objectives, which is not consistent with the variety of local conditions to take into consideration for feasible and appropriate remediation. Uniform trigger concentration values defined at national level are useful to take decision. Cleanup quality objectives should be established according to local risk conditions among other factors.	If trigger concentration values are clear and detailed, it can be used as general cleanup objectives. Cleanup objectives can however been defined on a case by case basis in the remediation plans.

(9) Development of Technical Guidelines for Remediation Decision Making

Economic and social cost of contaminated sites is potentially high and justifies remediation actions. Key points for remediation are:

- Remediation plan subject to approval;
- Clear statement of objectives of remediation;
- Control of achievement of objectives;
- Obligation of financing the implementation of plan;
- Obligation of environmental approval for clean-up works.

1) Decision Criteria

Technical guidelines are necessary to support the work of EPIs in decision making about actions needed to manage contaminated sites. The proper selection of best alternatives for assessment and remediation actions is the key point of this recommendation. As shown earlier, Order 756 cannot be properly used in the field of decision making for contaminated sites.

After the preliminary identification of contaminated sites according to potential risk levels, the authority in charge must take a decision about the most appropriate action: What to do? Which level of assessment, which level of remediation? It will be necessary to develop action criteria (factors), like:

- Sites with polluter known and accountable/not known or not accountable (liable): Action required will be completely different in each case. Priority is law enforcement against known polluters. Trigger concentration values and cleanup objectives can be useful, but a site by site approach with agreement between facility operator and authority is desirable.
- Sites with insufficient information/good information: First level of action can be considered as fulfillment of the checklist, for example, with subsequent decision about future action. If good information is available, the problem will be to decide remediation measures: Firstly, if urgent temporary measures are needed or not (access to site, control of water supply, etc). Inventory of measures needed according to the case.

2) Remediation Measures

There are temporary and permanent remediation measures that should be considered according to the situation and risk level. Temporary measures are often a priority because of their potential efficiency to prevent impact of contaminants, quick implementation and low cost. When investigation and risk assessment studies have shown the presence of very high risk in a site, more radical permanent measures must be planned. Planning and implementing permanent measures should be considered on a case by case basis. The county waste management plans should include a remediation plan for risk priority contaminated sites, with temporary or permanent remediation.

As mentioned in recommendation n°1, permanent remediation measures, that often involve excavation or removal of contaminated soil, must be subject to EIA and environmental authorisation. The implementation of temporary measures should not be subject to such heavy procedures but EPI will monitor these measures to ensure that

they do not become a source of environmental damage.

Temporary measures are measures to prevent exposure to/absorption of contaminated soil and groundwater, and measures to prevent the spreading of contamination. Monitoring should also be considered as a priority measure. No action can be considered as a kind of remediation measure in cases when there is no risk or an acceptable exposure to risk. Table 6.4.13 below provides a description of the main temporary measures.

Table 6.4.13 Types of Temporary Remediation Measures

Remediation objectives	Measures
Prevent exposure to / absorption of contaminated soil	Control of accesses and fencing of the site
Prevent exposure to / absorption of contaminated groundwater	Information of people consuming groundwater Prohibition on groundwater drinking and substitute water source
Prevent the spreading of contaminants through ground water	Collector sewers around the site Making surface impermeable to avoid infiltration of rainwater Pumping of groundwater Extraction well Establishment of containment liner walls: Vertical and/or horizontal barrier
Prevent the spreading of contaminants through soil particulates dispersion	Covering of soil in case of risk of dust spreading by wind
Monitoring of the impact of temporary measures on the environment	Monitor the effect of measures on environment

(10) Development of Remediation Measures and Cleanup Projects

Only limited reference is made to contaminated sites and soil cleanup in the national policy for waste management. There is however an urgency to consider this problem, and several actions should be undertaken:

- To intensify soil cleanup operations. Existing experience in Romania should be established. EPI offices can make such a statement and establish the results.
- To encourage industry to cooperate in soil cleanup programmes
- To set priorities for high priority remedial action plans
- To integrate plans in the waste management plans

Recommendations for the development of remediation measures and cleanup

projects are to:

- Start remediation planning in waste management plans
- Develop voluntary agreements with industries for management of contaminated sites
- Identify national high priority contaminated sites
- Develop voluntary agreements with industries for establishing remediation measures should be planned for the most important industrial plants having medium or high risk priority sites.

After county based evaluation of contaminated sites and identification of high risk sites in the county waste management plans, the MOE should determine several sites that will retain attention for planning cleanup. There are 3 types of situations:

- Sites with known and accountable private operator/owner
- Sites with known and accountable state operator/owner
- Sites with unknown / unaccountable private operator/owner, needing
- Pilot projects should be planned for each case. The first situation needs enforcing based on current laws. The second situation should serve as an example for the private sector. The third case needs state action and funding.

The economic and social cost of contaminated sites is potentially high and justifies remediation actions. State owned contaminated sites should provide a good example in terms of technical and financial aspects. Then, remediation should be established based on a very clear system of clean-up requirements and control of achievement of objectives, with strict application of PPP principle.

6.5 Economic Aspects

6.5.1 General Principles

Assessment of the appropriate role of economic instruments for hazardous waste involves consideration of a pollution control program in general, of which hazardous waste is but a part. Hazardous waste policy instruments should be therefore designed in recognition of the need for an integrated approach, in which interrelationships with non-hazardous waste management actions are made explicit.

For example, policies designed to facilitate clean production in general are highly relevant for the specific topic of hazardous waste generation and disposal. General air and water pollution taxes and regulations, and solid waste management economic and other policies are also of direct relevance for the topic of hazardous waste.

Following are the criteria by which policy instruments (economic or regulatory) may be judged:

- Environmental Effectiveness
- Economic Efficiency (in terms of cost-benefit, or cost-effectiveness tests)

- Revenue Raising
- Equity, Fairness, Acceptability
- Administrative Feasibility and Cost

In light of these criteria, this chapter reviews the kinds of economic instrument that may be used for pollution control, with some international examples, and with special reference to their relevance for hazardous waste management.

Recognizing that many factors of critical significance for hazardous waste management lie outside the jurisdiction of environmental managers, this is followed by reference to some of the necessary "enabling factors" that play a crucial role in determining the success or failure of environmental policy in general, and as a consequence, of hazardous waste management in particular. This section concludes by considering the potential role that economic instruments may play in the Romanian context, and a proposal for utilizing external funds to facilitate needed investment in this area.

6.5.2 Economic Instruments for Pollution Control: Relevant International Experience

(1) General Use of Economic Instruments

To date the use of market-based instruments for pollution control has been fairly limited in the industrial world. An OECD survey in 1987 of the range of market-based instruments used for pollution control in industrial countries concluded that while user charges (e.g. charges for water supply, landfilling waste, etc.) were widespread, specific environmental taxes were comparatively rare. In general, the levels of these charges were rarely adequate to have any incentive effect. Indeed, rather than influencing environmental behavior, recovery of the administrative costs of regulation appears to have been the primary objective. Moreover, of the 150 instruments identified, about 40 were in the form of subsidies, which in general run counter to the arguments in favor of market-based instruments. Overall, primary reliance for pollution management was on command-and-control, or regulatory methods rather than economic instruments.

Recognition of the important role that economic incentives can play in environmental management has become more apparent in recent years. Appropriate pricing and taxation structures are gradually emerging, although actual levels still generally fall well below those necessary to effect major behavioral change. In January 1991, guidelines for the application of market-based instruments (in conjunction with regulation) in environmental policy were presented at the ministerial meetings of the Environment Committee of the OECD. The announcement was partly motivated by the experience of OECD countries, indicating the feasibility of such instruments. It was also partly due to recognition of increased costs of meeting environmental standards as those standards continue to be raised; in principle, market based instruments may be the cost-effective means of achieving emission and ambient standards.

Recent developments in the OECD countries indicate a substantial increase in the use of economic instruments since the 1987 survey, it being estimated that the number has increased by perhaps as much as 50 percent. Almost all the countries make use of some type of pollution charge, and many use deposit refund systems or subsidies for environmental protection. Non-compliance fees and liability payments are also used, while tradable permit systems and performance bonds are less common. On average in 1995, revenues from environmental taxes overall were 2.5% of GDP, or 7% of total tax revenues. (Economic

Instruments for Pollution Control and natural Resources management in OECD Countries: A Survey, OECD 1999). It is estimated that these proportions have increased in the succeeding years.

An important development is that the instruments that have been introduced most frequently to address pollution are product charges (otherwise known as presumptive charges), and deposit-refund systems. In the countries for which data are available, the increase in the use of these approaches has been 35 and 100 percent, respectively. However, their practical impact is somewhat difficult to assess.

On the other hand, emissions charges (including non-compliance penalties based on emission quality), such as those for air quality management based on emissions of SO2, Nox, or particulates, or for water quality based upon BOD or COD, do not appear to be used more frequently now than they were in 1987, and there are in fact a limited number of convincing examples of successful application of emissions charges. The primary reason for the limited application of emission charges is that although they are theoretically more desirable, they require highly sophisticated monitoring and enforcement capability, which is beyond the capacity of most countries, and is extremely expensive, requiring a wide range of complementary policies and factors to be present.

Monitoring and inspection problems are a major obstacle to the use of many economic instruments, and indeed to regulatory instruments as well. While this issue has been addressed by the use of product charges as opposed to emission charges, these may be very blunt instruments. Their administrative advantages may be outweighed by the lack of clear technological relationships between material inputs and pollutants generated, particularly in the case of complex interactions between various forms of hazardous material. In consequence, incentives to curb the use and emission of pollutants do not work well. Nevertheless these and other market based instruments may play a role in facilitating and complementing command and control measures. Fines and liability measures as well as performance bonds and deposit refund systems can typically play a useful role.

Revenues from such charges are often earmarked to contribute to the costs of pollution control measures, but levels of charge are generally too low to create incentives to influence environmental behavior. One important exception to this rule has been tax differentiation between leaded and non-leaded gasoline, which has typically had an overtly environmental objective, and been aimed, with some success, at shifting production and consumption from leaded to unleaded fuel. User charges for waste collection and disposal and for sewerage and sewage treatment are common in OECD countries, and usually cover total costs of these services.

Energy-related pollution taxes, typically based upon inputs rather than emissions, (i.e. product or presumptive charges), are becoming increasingly advocated in OECD countries. In the energy sector the tax is levied on oil, coal, natural gas and liquid petroleum gas; in the transport sector the tax is imposed on gasoline, diesel and on domestic air traffic. There are now several examples of carbon taxes.

Deposit-refund schemes are now widely employed. When the product is purchased its price contains a tax which is then refundable on proper disposal or recycling of the product. Traditionally used for purely commercial purposes for beverage containers, this approach continues to be used for bottles and aluminum cans, and has been extended to car hulks in some countries.

Tradable permits are employed in a number of countries, notably in the United States

for air pollution (SO2), and were introduced for a limited period for lead in gasoline and for one case of effluent to a watercourse. The permit system introduced under the U.S. Clean Air Act is the most ambitious to date. The amount of trading activity between different polluters has been less than anticipated. This has possibly been due uncertainties regarding other firms' willingness to trade, the costs of obtaining regulators' permission to trade, uncertainty about just what emissions credits ensue under legislation, and uncertainty due to the prospect of rising permit prices. However, emissions trading either within firms or between firms have apparently resulted in considerable cost savings compared with a command-and-control approach.

Although the "polluter pays principle" is widely advocated, in fact, in many cases, governments actually provide subsidies to induce industry to cooperate in pollution abatement policy. Various forms of subsidy are to be found and used either as purely political measures to ensure cooperation, or to alleviate short-term transition problems, such as the avoidance of industry closure or unemployment. Subsidies might take the form of low interest loans, tax breaks such as accelerated depreciation, or outright grants. Japan, for example, has had a comprehensive and highly successful program of assisting small businesses to meet increasingly stringent environmental standards. But subsidy programs (as U.S. experience indicates) clearly have major disadvantages. These include large administrative costs of ensuring that subsidies are used for the intended purpose, distortion of investment decisions where some expenditures qualify for subsidy while others do not, and of course the fiscal costs of the program.

Solid waste is frequently financed by user charges which are usually at a flat rate for households, while charges by weight or volume are often levied on industrial waste. Increasingly municipalities are contracting with private waste operators to collect and dispose of solid waste.

Liability payments, performance bonds and non-compliance fees are also used in several countries for various aspects of environmental protection. The proposed EU Environmental Liability Directive should result in increased litigation and the consequent need to be able to assess the economic costs of environmental damage[1].

Voluntary agreements between local governments and industrial enterprises have traditionally been an important aspect of pollution control in Japan, while in the EU it is estimated that more than 300 are in force.[2]

Measures to encourage the reuse of waste material include industrial zoning and creation of industrial parks to facilitate collective treatment, as well as establishment of conditions encouraging the development of a market for waste, or for waste exchange. This approach is characteristic of the "Zero Emissions" program in Japan.

6.5.3 Supplementary Information

Supplementary information for economic aspects consists of two tables, one showing examples of environmental funds, the other a listing of economic instruments for pollution control now existing in Romania.

[1] Economics in Environmental Damage Assessment: An Evaluation of the US Experience with Suggestions for the European Union, T. Swanson, A. Kontoleon, Green Giants Conference, European University Institute, Florence, December 2001.
[2] Voluntary Approaches for Environmental Protection in the European Union, OECD December 1998

Table 6.5.1 Examples of Environmental Funds

Fund	Type	Revenues	Main Expenditures	Beneficiaries	Disbursement
Hungary - Central Env. Protection Fund	ETF	Fuel Tax, product charges, traffic fee, pollution fines, EU grant	Air and water pollution abatement, waste management, public awareness	Public transport companies, municipalities, industrial enterprises, research institutes	Grants, low interest loans
Poland – Natl. Fund for Env. Protection and Water Mgmt.	ETF	Air and water pollution charges, water and waste charges	Air and water pollution, soil protection, env. monitoring and education	Industrial enterprises, municipal companies, universities	Soft loans, loan guarantees, grants
Russia – Federal Env. Fund	ETF	Pollution charges, fines	Pollution control, env. R&D, institution bldg.	Municipal companies, industrial enterprises, research institutes	Grants
Slovakia – State Env. Fund	ETF	Econ. Instruments (75%), State Budget (25%)	Pollution control	Industrial enterprises	Subsidized loans
Russia – Pollution Abatement Facility	DCF	IBRD loan	Waste recovery	Public and private industrial enterprises	On lending IBRD rate plus 400 basis points
Slovenia – Eco-Fund	DCF	Budget allocation, IBRD loan	Urban pollution abatement	Households, cooperatives, commercial and industrial enterprises, municipalities	LIBOR plus 200 basis points

Sources: World Bank; Regional Environmental Center for Central and Eastern Europe.

Table 6.5.2 Economic Instruments for Pollution Control in Romania

Instrument	Objective of Tax/charge	Tax base	Tax rate	Total Revenue	Revenue collection authority	Use of Revenue
Excise Tax motor fuel	Revenue raising taxes	Leaded petrol Unleaded petrol	248.6 EUR/kl 204.1 EUR/kl	26.51 mil EUR 3.409 mil EUR	Tax Administration Units	Central budget
Fuel road tax	Revenue raising taxes	Leaded petrol Unleaded petrol	0.071 EUR/kl 0.061 EUR/kl		National Road Agency	Special Road Fund
Non-compliance fee for sulphur content of diesel	Incentive	Non-compliance with the limit values for sulphur content of diesel (0.2% until 2005, and 0.05% after 2005)	2,507-4,011 EUR/violation			
Air emission non-compliance fee	Incentive/ ear marked environ-mental charge	Excess emissions of 22 air pollutants, including SO_2, NO_x, dust etc.	Determined on case-to-case basis	0.336 mil EUR	Environmental Protection Agencies	Central budget

Instrument	Objective of Tax/charge	Tax base	Tax rate	Total Revenue	Revenue collection authority	Use of Revenue
CFCs and/or halons charge and non-compliance fees	Incentive	Ozone depleting substances; -Import, usage, trading -using CFCs without licence	501-1,504 EUR/tonne 1,504-2,507 EUR/tonne		Environmental Protection Inspectorates (starting from March 2001)	Central Budget
Municipal waste user charges	Cost recovery	Charge for population Charge for enterprises	0.75 EUR/ person/month 12.53 EUR/m^3		Local municipality	Local budget
Waste disposal charge	Incentive/ Earmarked environ-mental charge	Industrial and hazardous waste, dependent on the level of hazard	The rates are not established yet			
Waste non-compliance fees	Compliance incentive	Type of violation and level of hazard	(5-3,760 EUR)			
Water consumption charge	Cost recovery	Domestic users Industrial users	0.1050 EUR/m^3 0.028 EUR/m^3		Local water companies	
Sewage treatment charge	Cost recovery		0.015 EUR/m^3		Municipalities	
Water effluent charge	Cost recovery	Direct discharge: -Suspended solids -BOD -Nitrogen -Phosphorous Indirect discharge	2.66 EUR/tonne 10.88 EUR /tonne 43.62 EUR /tonne 43.62 EUR /tonne 0.031 EUR/m^3	15.541 mil EUR	National company “Apele Romane”. Local water companies	Central budget (earmarked for Water Fund) Local water companies
Water pollution non-compliance fees	Compliance	Excess discharges of pollutants and/or illegal discharges:” -Suspended solids -BOD -Nitrogen -Phosphorous	5.01 EUR/tonne 40 EUR/tonne 1,504 EUR /tonne 1,504 EUR /tonne		National Company “Apele Romane” Local water companies	Central Budget (earmarked for Water Fund) Local water companies
Water extraction charge	Revenue raising taxes	Domestic use from: -Inland water -Danube -Ground water Industrial use from: -Inland water -Danube	0.0076 EUR/m^3 0.0006 EUR/m^3 0.0084 EUR/m^3 0.009 EUR/m^3 0.001 EUR/m^3 0.0073 EUR/m^3	39.354 mil EUR	National Company “Apele Romane”s	Central budget (earmarked for Water Fund)

Instrument	Objective of Tax/charge	Tax base	Tax rate	Total Revenue	Revenue collection authority	Use of Revenue
		-Ground water Agricultural use from:-Inland water -Danube -Ground water	0.00006 UR/m^3 0.00003EUR/^{3} 0.000015EUR^3			

Note: Air Emissions Governmental Ordinance 243/28 November 2000 changes the above regarding air emissions non-compliance. This establishes emission taxes for specific air pollutants and non-compliance fees for violations. List of pollutants, emission limits and non compliance fees were to be established in 2001.

Source: Regional Environmental Center for Central and Eastern Europe, updated.

6.6 Information and Data Management

This section provides some additional information and observation concerning the information and data management, which is discussed in Volume 1 Section 7.3.1 and Volume 2 Section 3.4.4.

6.6.1 Current Situation .

(1) Data Management Requirements

1) Romanian Legislation

Reporting on waste generation is required by the GEO 78/200 and the Waste Law 426/2001. Reporting on waste transiting through the waste facilities (disposal sites, storage sites, or recycling centres) is required by the Waste Law 426/2001 and GEO 78/200. Reporting of waste at the level of collection and transportation is more specific and is also required by the same legislation, together with the Basel convention as the basic framework in the case of international transportation.

Waste Law 426/2001 requires the development of county waste management plans which indicate how waste data reporting is to be implemented. The law also requires hazardous wastes generated to be listed and registered for each place of generation and storage.

This law also specifies that waste management activities should be covered by an environmental authorisation procedure which should identify types and quantities of waste, technical requirements for their waste management, safety measures etc. This potentially has a similar effect to the more focused permitting / licensing systems common in Europe.

The existing legislation requires that hazardous waste management is undertaken in such a way as to avoid harm or impacts on the environment or to human health. The MEWP and the local EPIs are charged with the duty of ensuring that this legislation is implemented.

2) International Legislation

Currently the only relevant international agreements or laws which require reporting of waste data are:

- The Basel Convention on Transboundary Movement of Hazardous Waste (Romania has acceded to the Basel Convention);
- The EU draft proposal for waste statistics.

However, there is also an Amended Draft Proposal for a Regulation of the European Parliament and of the Council on Waste Statistics (COM(2001) 737 final). This specifies certain reporting requirements and it seems appropriate to assume that these will at some point become European Law. It is therefore reasonable to consider waste data reporting in the context of these proposals.

The Basel Convention requires hazardous waste reporting, and Article 13 specifies transmission of information and requires that:

- Changes in the definition of hazardous waste are notified,
- Certain decisions are notified,
- Quantities of wastes which were imported, exported or which had transited the country are notified,
- Information on disposals which did not proceed as intended is provided,
- Efforts aimed at minimising amount of wastes subject to transboundary movement are notified,
- Information on accidents related to transboundary movements are notified,
- Statistics on hazardous waste generation, transportation, treatment and disposal which are held should be passed to the convention secretariat,
- Information on waste disposal options available and on efforts for avoidance and minimisation of wastes are notified.

The draft proposal for a regulation of waste statistics requires that waste generation must be reported by waste type (using EWC-Stat Rev.2; substance oriented waste statistical classification) and by industrial group (First level of NACE Rev1 Classification). The proposal includes a “Transposition Table” to convert European Waste Codes to EWC-Stat codes.

Recovery and disposal of wastes is also to be reported by waste type and by categories of recovery (10 categories), incineration (2 categories of activity) and disposal by other methods (8 categories of activity). In addition to the quantity of wastes recovered or disposed of, there is a requirement to report the number of operational facilities and capacity.

(2) Responsibilities

1) Overview

The MWEP has responsibility for hazardous waste data collection,

processing and reporting. The ministry in charge of waste has the same task as regards medical waste. The Ministry of Industry receives data from recycling operators. Local agencies (EPI and health departments) collect and transmit the data to their respective surpervising agencies. EPI is the key component of this information system between generation, processing and disposal of waste and the MWEP.

2) Central Government

Central government roles and functions are largely based on determination of state policies and strategies with respect to hazardous waste management, development of national legislation, regulations, standards and guidelines for hazardous waste management and monitoring. In order to fulfil these functions it is necessary to:

- Assess the state of hazardous waste management
- Assess trends in hazardous waste management
- Identify problem areas
- Prioritise problems
- Identify activities / instruments aimed at mitigating problems
- Forecast changes

Information is needed to support these functions. It is necessary to have information on hazardous waste generation and management and this information needs to be sufficient to determine whether the current situation is satisfactory or not. This means that information is required on different aspects of hazardous waste management sufficient to make judgements and thereby identify policies, strategies and actions necessary to rectify deficiencies.

Information can be “direct” i.e. information about hazardous waste generation and management, or “indirect” i.e. information on environmental or health aspects which may be affected by hazardous waste management.

The information required at this level is generally aggregate information other than for specific identified problems. The aggregate data will be the first indicator of potential problems and trigger the collection of specific additional data.

One of the most difficult aspects is assessing how good (or how bad) the current hazardous waste management system is.

(3) Data Collection Pathways (Information Reporting Flows)

Producers of industrial waste are required to return waste records to the local EPIs once per year. These records provide data about quantity of waste generated, treatment alternatives, and disposal. Records are put on a formatted sheet prepared by the ICIM, with periodic modification by the MWEP. The list of industrial units receiving the questionnaire is about 7000 units, which includes industrial producers, recycling companies, incinerator operators, landfill operators, and municipal waste collectors. Medical waste statistics are managed separately by the hazardous Clinical Waste department).

It is crucial that information reporting is uniform and consistent, and multi-directional. It is necessary to collect the detailed information required to support the day-to-day regulation and control functions, for this to be aggregated to support regional planning needs and for transmission to the national level in order to support national planning needs.

Each county should report aggregate information to the national level in the same format and using the same classification systems so that data from each county is mutually compatible and comparable.

(4) Data Base System

A hazardous waste data base is constituted and managed by ICIM for the MEWP by annual collection of key data through a questionnaire sent to factories. This data base is held in electronic form without integration into an information system. There is no means of browsing the data interactively.

Data output consists in the quantities of hazardous waste at the different stages of generation, treatment, and disposal, according to economic production sectors. Data output is then based on economic sectors codes and hazardous waste codes. Then, unit waste generation rates can be calculated, which provides a way to validate data. Waste statistics are going to be presented according to the new list of hazardous waste.

(5) Quality of Data

1) Outline

The quality of data is determined by the good selection of indicators for use and aggregation, a good understanding of indicators by data producers, and accuracy. Accuracy of data is strongly related to awareness of waste generators / operators, methods of collection of data, and presentation of the questionnaire sheet. Data quality checking is important.

Accuracy of data is the basic requirement for having a reliable national statistics data base on hazardous waste. Unreliability of the data would induce unreliability of studies and plans that will have been based on the data.

2) Accuracy

Verification of data collected is not done properly due to the lack of resources. There is no coordination between ICIM and IPH for medical waste data. Field surveys of the JICA study team have shown that some wastes are not reported by waste generators.

3) Awareness of Data Producers

The 1st EPI questionnaire has shown that a significant number of enterprises did not understand how to use the waste coding system. It will be necessary to improve awareness raising activities for the waste managers in order to make them understand the objectives of reporting and the relevance of the questionnaire sheets for them.

(6) Day-to-Day Regulation and Control

In order to effectively implement day-to-day regulation and control, the regulators need to understand the specific subject-area (i.e. hazardous waste

management) and the requirements of the various parties under the extant legislation, standards and guidelines.

The regulators need information on hazardous waste generation and management within enterprises and by third parties, and need to assess adequacy in respect of regulatory requirements.

Whilst aggregate data is generally sufficient for national functions of policy and strategy development and planning, the day-to-day regulatory roles require detailed information/data.

In addition to the day-to-day regulation and control there is need for regional planning. Indeed the regulations require County Waste Management Plans (WMPs) to be developed. Information required to support the development of these WMPs is similar to the information required in support of the national policy and strategy development and national plans.

6.6.2 Key Issues and Recommendations for Strategy

(1) Hazardous Waste Generation

The various requirements indicate that it is necessary for enterprises to maintain a register of hazardous waste generated and report types and quantities of these wastes. As Romania wishes to gain accession to the European Union, reporting should be in accordance with the current and anticipated EU requirements, i.e. compliant with the requirements of EuroStat and perhaps the above mentioned draft proposal for a regulation of the European Parliament and of the council on waste statistics (COM(2001) 737 final).

The classification system for waste should use the EC Integrated Waste List which came into effect this year. The classification system used for industrial activity should be the current NACE. The classification system for waste management method should be the “D” and “R” codes introduced by the Basel Convention and specified in COM(2001)737.

The hazardous waste generation data and information on the management of those wastes is needed by the local EPIs to fulfil their regulation and control functions under Waste Law 426.

It is therefore logical that they should be the primary collectors of this data and that they should hold this data in a database which stores the data and presents the data in such a way as to assist their day to day regulation and control activities. It is sensible for EPIs to have a Waste Management Information System (WMIS) to store, manipulate and report this data. This WMIS would be an important tool.

It is necessary for the EPIs, as part of their normal inspection activities, to validate the data collected, to continuously improve the quality of the data. Ideally therefore the local EPIs should all use a standard WMIS. At the very least they should all use identical data formats and structures.

Aggregate data needs to be reported to the central government (MEWP) and to the Basel Convention Secretariat. It is important that data reported to MEWP by each EPI is consistent and compatible. The MEWP needs to report the necessary data to the Basel Convention Focal Point in Romania (FP), or detailed information reported so that

FP can generate the aggregate data.

(2) Waste Facilities Management

Waste facilities refer to waste storage and disposal sites, as well as recycling facilities. It is necessary to have a register of all waste management facilities handling hazardous wastes. This register should contain at least the following information for each facility:

The facility name, address, owner's details, operator's details,

The "R" and "D" codes for the activities undertaken at the facility (may be more than one code for any given facility)

The types of waste processed at the facility – using the EWC Integrated List (may be more than one type of waste processed at any given facility)

The annual capacity of the facility

The anticipated remaining capacity of the facility

Whether the facility has an environmental authorisation / permit / licence.

This information is needed by the local EPIs to enable them to effectively handle their day to day regulation and control activities so it is logical that they should be the primary collectors and holders of these data. The data should be validated as part of their normal inspection activities. In order to fulfil their day to day roles it would also be useful to have the following data/information:

The relevant standards that each facility needs to be designed and operated in accordance with;

Data on inspections.

Data on compliance with standards / authorisations / permits / licences.

It would be extremely valuable if all of the above data / information are held in a WMIS supporting the roles and functions of the EPIs. Again the Waste Management Information System used by each EPI should be the same, or at the very least the data should be standard formats and structures. Aggregate data needs to be reported to the MEWP to enable it to fulfil its reporting obligations.

(3) Waste Collection and Transportation

It is normal in Europe to regulate and control the movement of hazardous wastes using a consignment notification and/or manifest system. Such a system may require enterprises to pre-notify, or at least report, the movement of consignments of hazardous wastes to the regulatory authority.

The study has shown that the present reporting system of waste in Romania has received a lot of improvement but still remains incomplete. Waste transporters are not concerned, and there is no possibility to follow up the waste from generation to final treatment. However, the knowledge and control of hazardous waste from generation point to elimination point is a necessary condition to ensure good conditions of public hygiene and environment. The role of the regulatory authority is generally to ensure the "closed loop" i.e. to make sure that the notifications indicate that the waste (including

the correct quantity), once it leaves the source, arrives at the correct destination notification. This is intended to prevent illegitimate disposal of the waste. The system may also, in the case of a pre-notification system, allow the regulatory authority to veto the proposed movement.

Then, the highest priority in the field of waste data reporting improvement is the establishment of a waste manifest system. This system is already used by private companies in Romania (Dacia, for example). It requires the establishment of an authorisation system for hazardous waste transportation companies, and stipulation of their legal responsibilities for delivering waste at authorised waste treatment facilities. Implementation also needs to set up a simple reporting sheet with designation of waste and quantity to be fulfilled at each stage of the system, i.e. generation, transportation, and elimination. Facility operators must accept waste from the authorised transporters only and with manifest reporting sheets each time. Such a consignment of manifest system could in the future involve a significant number of notifications being received by EPIs. These notifications are also a potential source of accurate data on hazardous wastes. Such a system is ideal for incorporation into a computerised WMIS.

The EPIs must keep a register of authorised waste transportation companies, and provide public access to this register. EPI agents should be held responsible for controlling these companies (authorisation of transportation, validity of reporting sheet).

(4) Integrated Data Collection and Reporting System

Ideally, the reporting system should be developed as an integrated Waste Management Information System (WMIS). This could comprise two main components, a “Regional Component” which would be the system used by county EPIs to store, retrieve, view and report data in support of their regulation and control activities and reporting activities; and a “National Component” which would receive aggregated data from the “Regional” WMIS systems to support the policy development, strategy development, planning and reporting roles of the national government (MEWP).

The system could have a third component which could be a standard WMIS used by individual enterprises to generate data in a suitable form for reporting electronically to the Regional systems. An alternative to this would be to have an internet based reporting system for enterprises to use. One barrier to electronic reporting of data in countries like Romania is the necessity for an official company stamp and signature on hard copy forms for the submission to be “official”.

(5) Modern and Integrated Data Base

As shown in the study, the existing data reporting system at the facility level is good and involves a large coverage of hazardous waste generating companies. However, this system finds difficulties in getting reliable and accurate data. First of all, there is an urgent need to improve data quality through awareness raising at administrative and private companies level (need for accurate data, good identification of waste categories) and day-to-day control at the local level by EPIs. With development of the manifest system, the control task of EPI will need to cover generators, transporters and facility operators of hazardous waste. Validation of data must be performed at EPI local level through the activity of field inspection and analysis of reported information sheets, and at ICIM national level through analysis of the data. Awareness raising should concern the most important generators of waste in

each county, as a first step.

An integrated data collection and reporting system would be a valuable tool for the Ministry and the EPIs. One route to develop such a system would be:

Development of a Windows based front end to interactively view ICIM data and generate the reports by selection of report type from a menu which would then allow the user to specify criteria and filters.

Development of the above system in such a way as to be used at Regional level (e.g. counties) and National level.

Development of a simple waste audit/control software program for use by individual enterprises ("enterprise module") capable of generating the data, currently supplied via questionnaire, in electronic form for transmission to EPIs by email or on floppy disk.

Software could be developed economically using Microsoft Access or Microsoft Visual FoxPro. The "enterprise module" would either be MSDOS based or Windows based depending on the current level of IT in small to medium enterprises, i.e. if it is considered that the majority of enterprises have computers running Windows then the software would be Windows based.

It would be feasible to have a system for data reporting via the internet and, as internet access grows in Romania this may be the optimum solution.

(6) Formalisation of Reporting Requirements

It is recommended that the obligation to report hazardous waste generation annually should be formalised by enacting an appropriate legislative instrument and reporting guidelines.