This training material has been produced collaboratively by—

I../PAC

Industry and Environment Programme Activity Centre

Tour Mirabeau
39-43, quai André Citroën
75739 PARIS CEDEX 15
France

Tel	33 (1) 40 58 88 50
Telex	204 997 F
Cable	UNITERRA PARIS
Fax	33 (1) 40 58 88 74

EETU

Environmental Education and Training Unit

UNEP
PO Box 30552
NAIROBI
Kenya

Tel	254-2-230 800
Telex	22068 UNEPKE
Cable	UNITERRA NAIROBI
Fax	254-2-226 6886

ISWA

The International Solid Waste and Public Cleansing Association

Vodroffsveij 22A
COPENHAGEN
Denmark

Tel	45-33 156565
Fax	45-31-24 43 28

This is the tenth publication in a new Technical Series that regroups the Guidelines, Overviews, Technical Reviews and Workshop Proceedings previously published by UNEP IE/PAC. The regrouping into a single series will ensure a greater cohesion among future publications, and allows a single document to include the various elements of IEO work that had earlier been presented separately.

As before, the Technical Series aims to meet the needs of a wide range of government officials, industry managers and environment protection associations, by providing information on the issues and methods of environmental management relevant to various industrial sections.

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CONTENTS OF THE PACK

EVALUATION QUESTIONNAIRE

HAZARDOUS WASTE: POLICIES AND STRATEGIES
A TRAINING MANUAL

As part of its continuing review of the impact of the publications it supports, the United Nations Environment Programme would appreciate your cooperation in completing the following questionnaire.

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The Director
Industry and Environment Programme Activity Centre
United Nations Environment Programme
Tour Mirabeau
39-43 Quai Andre Citroën
75739 Paris Cedex 15
France

Fax 33-1-40 588874

PREFACE

The need for improved management of hazardous waste everywhere is clear. Such management requires not only technical resources and regulations, but also skilled personnel. The lack of sufficient personnel is unfortunately delaying the implementation of proper management regimes, and to make things worse, there are few facilities to teach the necessary skills. This lack is particularly obvious in developing countries, although even in the industrialised world there is a serious shortage of trained personnel.

This manual is intended to assist with the further training of decision-makers who have already—or are likely to have soon—direct responsibility for the management of hazardous waste. The manual is the result of collaboration between UNEP's Industry and Environment Programme Activity Centre (IE/PAC) and ISWA's Working Group on Hazardous Wastes (WGHW). A particular emphasis of this collaborative programme is on information exchange and training.

The idea for the manual came from the training workshops run by IE/PAC during the 1980s. The Environmental Education and Training Unit of UNEP supported the concept and contributed to the preparation of the manual.

Support from ISWA came through the technical expertise of the WGHW, particularly the orientations provided by expert meetings in Honolulu (1989) and Barcelona (1990).

The manual simulates the problems and options for solutions that are faced by many national administrators. It is directly applicable to the implementation of national and international initiatives in hazardous waste management, as for example the Basel Convention.

The present manual can be used in a number of ways; for example—

- ◊ professional trainers and educators will find a proposed training programme and technical material that can be used in its entirety, or adapted to short courses on specific subjects
- ◊ environmental and waste control administrations can build in-house training sessions around the simulation exercises in the manual
- ◊ national administrations will find advice on waste situation reports, and where to locate relevant information in their countries
- ◊ individuals can obtain a more detailed appreciation of how hazardous waste management is carried out at the national level
- ◊ technical personnel will find guidance on waste management procedures such as assessments and surveys, reduction measures, disposal options, administration and so on
- ◊ consultants will particularly find the waste survey exercises and annex useful in their work with national authorities
- ◊ all users will find in the manual important background information, tabular data, and key information on management options.

Nevertheless, the manual is not perfect, nor is it static. It will adapt as the hazardous waste situation changes, and in response to changes in the needs of its readers. Further material on specific technical subjects, and on industry-specific themes, may be added later.

UNEP hopes that this manual will assist all those concerned with improving the management of hazardous waste worldwide, and welcomes suggestions for improvements and updates to the manual, as well as active participation in its various training activities.

PRELIMINARIES

ABOUT THIS MANUAL AND ITS ORIGINS

INTRODUCTION

Hazardous waste management is undoubtedly one of the important environmental issues of our time. Despite the universal agreement that industrial production without waste is our long-term goal, the present situation will see an ongoing need for the proper management of our industrial and other residues for some time to come. The public demands, justifiably, a closer control and better treatment of these residues, and yet our management arrangements and legal controls continue to lag far behind the need. Among the regular calls for more and better technologies, we tend to forget that technologies must be adapted to local needs, legislation must be framed to address real problems, and practical arrangements must be made for transport, handling and storage.

The need for trained personnel is great in all countries, but never more so than in developing countries that only now are beginning to recognise some of the implications of industrial development.

More and more often international meetings unite in the call for more training, more assistance, and more information. There are few international forums able to respond. In their limited way, agencies such as UNEP, WHO and the World Bank try to provide such a service. Professional societies such as ISWA work through their members and journals to transfer information and expertise.

The resource limits of all these contributors are plain to see. They cannot bring the skills and information to all people. "Train the Trainers" has been one of the responses to the resource problem.

This manual aims to do just that—to provide a package of information that can be used by anyone, anywhere in the world, to continue the important and urgent task of training local staff in the principles and practice of hazardous waste management. The manual can be used in may ways, and it complements the more detailed technical information already in print.

ABOUT THIS MANUAL

The best way of learning is by doing. This manual allows the user to explore the complex aspects of hazardous waste management by working on practical exercises.

The exercises are based on a case study specifically developed for the manual. The case study is in the form of a country report such as might be prepared for any country around the world.

The manual deals with a national situation. It does not deal extensively with in-plant waste management in industry. This is intended to be covered in subsequent companion volumes addressed at the industry sector.

The entire set of exercises forms a simulation exercise to solve the hazardous waste problems of a fictitious country, *UDANAX*.

The problems are, in fact, drawn from the collective experiences in several regions of the world.

Of course, other problems not listed in the manual can also be encountered in many places.

2 The manual as first compiled was a series of practical exercises for the training workshops organised by UNEP-IE/PAC.

Formal lectures presented the factual information needed for the casework tasks, country reports explored the particular circumstances in developing countries, and field visits demonstrated the practical aspects of what had, up to then, been theoretical. The origin in group exercises in workshops explains the structure of the manual.

The deliberate ambiguity in some exercises—and in background data—allows considerable freedom of discussion. It also requires careful guidance from expert session leaders.

Accordingly, some parts of this manual will not be appropriate for individual study. Nevertheless, the individual will find many parts of the manual rewarding and challenging.

3 As presently structured, the manual serves best as a resource book for the professional trainer. Exercises can be selected, adapted and grouped into a package for either short or long courses on hazardous waste management.

In its entirety, the manual would suit a curriculum extending over several semesters.

4 Many exercises require particular technical information as input. Some of this is given in the tables and figures of the manual itself. In a few cases, the references will need to be consulted.

As far as possible, the manual has been designed to stand by itself, although previous technical training is of course necessary to understand the behaviour of wastes, the functioning of treatment plants, and so on.

There are no 'right' answers to the exercises. The purpose of the manual is to provide insight into the methodology and constraints of hazardous waste management, not to turn out a numerical answer according to predetermined rules.

Accordingly, it serves best as a component in a more comprehensive training curriculum. This is the way it is being used by UNEP itself.

5 The present version of the manual has been compiled from diverse inputs. Proper waste management is still a subjective art, requiring experience, insight, and adaptability.

Although the technical content has been reviewed by hazardous waste experts, the manual is far from perfect—additional material could be added, the validity of the exercises will sometimes be disputed, the layout could be improved.

No doubt some errors and ambiguities remain in the text. Rather than spend more time on a lengthy review process, we have decided to publish it as it is, with an apology in advance for any difficulties the user may find.

Any comments, corrections and suggestions which are received by IE/PAC may find their way into future revised versions.

ABOUT UNEP–IE/PAC

UNEP's Industry and Environment Programme Activity Centre (IE/PAC)* in Paris was established in 1975 to bring industry, governments and non-government organisations together to work towards environmentally sound forms of industrial development. To this end, IE/PAC seeks to—

- ◊ define and encourage the incorporation of environmental criteria in industrial development
- ◊ formulate and facilitate the implementation of principles and procedures to protect the environment
- ◊ promote the use of safe, low- and non-waste technologies (that is, cleaner production)
- ◊ stimulate the exchange of information on environmentally sound forms of industrial development.

One of the priority work areas for IE/PAC is the Cleaner Production Programme. Cleaner production is a broad concept that considers and minimises environmental impact from all parts of the product cycle, from conception and design of the product, through to final residue management. Under this programme, IE/PAC has developed activities on information exchange and training in hazardous waste management, including the organisation of training workshops in all regions of the world. Technical information is produced in support of these workshops.

In pursuing these activities, IE/PAC works closely with other UNEP divisions, and with other international organisations.

* Prior to 1992, IE/PAC was called the Industry and Environment Office (IEO)

ABOUT UNEP/EETU

UNEP's Environment Education and Training Unit (EETU) is concerned with all aspects of environmental education. EETU promotes the incorporation of environmental subjects into education programmes around the world, as well as fostering more specialised environmental training for professionals.

EETU has played a key role in the preparation of this manual.

ABOUT ISWA

The International Solid Waste and Public Cleansing Association (ISWA) is a worldwide association of professionals concerned with the proper management and disposal of all kinds of waste.

Within ISWA, the Working Group on Hazardous Waste (WGHW) is concerned with promoting the rational management of hazardous waste. This is carried out through the preparation of special publications and holding of conferences and seminars. The Working Group has established a Developing Country Programme, which works closely with UNEP IE/PAC on matters of training, documentation, and information exchange.

SETTING THE SCENE

This manual deals with the problems of a fictitious country—UDANAX.

The situation in Udanax is as follows ...

Consciousness of hazardous waste and pollution has been growing steadily in the country. However, there is still relatively little reliable documentation, and opinion is divided over how serious the issues really are.

There have been some attempts by authorities to control pollution, but they have not been systematic, and results have not been satisfactory in all instances.

There has recently been pressure from agricultural and fishing interests for the government to take further action on pollution control, so as to reduce the damage to their resources.

At the same time, it has come to light that a foreign waste disposal company has been negotiating with a local entrepreneur to set up a solvent recycling and incineration plant, and import 50,000 tonnes per year of industrial waste. The government is not in favour of this scheme, which is—however—not illegal under current laws.

International affairs have further underscored the need for action. The Prime Minister will soon chair a meeting of regional heads of state. The Basel Convention, and more generally hazardous waste control, will be an agenda item at this meeting.

For both local and international reasons, the Prime Minister of Udanax has therefore—through the National Environmental Bureau—asked for a report on hazardous waste, and an indication of the useful options for action.

The Bureau has convened a Task Force to help it investigate and recommend on the issue. The Task Force is headed by the Deputy Director of the Environmental Bureau. Other members are drawn from relevant ministries of health, industry, transport, resources and energy.

The Task Force is approaching its work in a series of stages—

- ◊ assessment of the hazardous waste situation
- ◊ technology options for hazardous waste reduction, treatment and disposal
- ◊ legislation and administration options
- ◊ building up a hazardous waste management strategy
- ◊ measures that would be needed to implement the Basel Convention
- ◊ other issues as decided by the Task Force itself.

In order to be better able to consider the situation in Udanax, the Task Force commissioned the National Research Institute to prepare a country report of important background information.

The Task Force will ultimately prepare its final report as it sees fit; however, all the above points must be incorporated.

The relationship of hazardous waste management initiatives with other existing government programmes and legislation has to be considered, too.

The Task Force will also prepare a two-page briefing note for the Prime Minister to present to his cabinet.

This workshop will simulate some of the work of the Task Force.

ACKNOWLEDGEMENTS

Since the original, much shorter version of this manual was first used in UNEP workshops, considerable extra material has been added.

Suggestions and helpful criticism have been received from many sources; in particular—

- ◊ the UNEP/ISWA expert group that met for two days in Barcelona, Spain, 23-24 July 1990. Participating in the group were: *G. Andreottola, F. Balkau, J-M. Baldasano Recio, R. Barnard, E. Kupchanko, F. Relea Gines, J. Smith,* and *J. Gonzales Nicolas.*
- ◊ *J. Butlin, H-C. Steinmetzer, J. Ward, D. Wilson,* and *H. Yakowitz,* who reviewed all or part of the earlier versions, and contributed to the text.
- ◊ *P. Portas* from the Interim Secretariat of the Basel Convention who critically revised the text, and advised on the sections dealing with the Convention.
- ◊ participants of several UNEP workshops, who trialled some of the exercises.

UNEP and ISWA owe a special thanks to *Dr. G. Tharun* of the CDG-SEAPO (Bangkok), whose ideas on groupwork training were an important early source of inspiration in structuring this manual.

A number of the exercises and some of the material are drawn from an ISWA workshop held in Honolulu in September 1989, under the leadership of *Dr John Skinner*, Chairman of ISWA's Working Group on Hazardous Waste. The conclusions of this seminar are described in one of the references listed in Part I.

HAZARDOUS WASTE AND THE BASEL CONVENTION

A major recent event in the area of hazardous waste is the coming into force in 1992 of the *Basel Convention on the Transboundary Movements of Hazardous Waste and their Control.* This Convention seeks to improve the national management of hazardous waste as well as any transboundary movement that may occur. By outlining a training programme for national authorities, this manual can assist in the implementation of the Convention by signatory countries.

In fact, the implementation of the Basel Convention will be facilitated and monitored by the Secretariat of the Convention, located in Geneva, Switzerland. During 1990 and 1991 the Interim Secretariat had already contributed significantly to the preparation of this manual, and to several of the UNEP workshops based on it. Further development of training initiatives and technical guidance on hazardous waste management will be undertaken as a matter of course by the Secretariat in its role as defined by the Convention.

For further information about the Basel Convention and the activities of the Secretariat, please write to—

Secretariat of the Basel Convention
Palais des Nations
1211 Geneva 10
Switzerland

PART I

BACKGROUND MATERIALS AND REFERENCES

A NOTE ON HAZARDOUS WASTE CLASSIFICATIONS

A variety of different national and international classifications and rating systems are in use around the world. These may be based on the origins of wastes, their susceptibility to treatment, their chemical composition, or on other factors.

Each system has its particular application, but none is perfect for all uses. Accordingly, it may be necessary to work with different classification systems from time to time in order to solve different problems. This will also be the case in the manual.

One central system that will come into increasing use is that used in the *BASEL CONVENTION* (see further on in the manual). When appropriate, this system should be used in preference to other systems of more local origin.

A means of cross-referencing local systems to the Basel classification then needs to be developed.

A cross-reference to the classification system used for hazardous materials (*i.e.* industrial chemicals) is also often useful.

Many of these systems are based on the *UN Transport of Dangerous Goods Code*.

Note, however, that a waste classification which is based *only* on such a hazardous materials system is good for improving safety, but is of limited use for other management aspects.

This is because such systems do not pay regard to waste origin, nor the fact that wastes are usually complex mixtures of unspecified composition rather than pure substances.

A cross-reference to the *UN Code*, where possible, is useful for improving handling and transport safety, and storage aspects.

CATEGORIES OF WASTE TO BE CONTROLLED UNDER THE BASEL CONVENTION

Waste Streams

Y1 Clinical wastes from medical care in hospitals, medical centres and clinics.

Y2 Wastes from the production and preparation of pharmaceutical products.

Y3 Waste pharmaceuticals, drugs and medicines.

Y4 Wastes from the production, formulation and use of biocides and phytopharmaceuticals.

Y5 Wastes from the manufacture, formulation and use of wood preserving chemicals.

Y6 Wastes from the production, formulation and use of organic solvents.

Y7 Wastes from heat treatment and tempering operations containing cyanides.

Y8 Waste mineral oils unfit for their original intended use.

Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions.

Y10 Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs).

Y11 Waste tarry residues arising from refining, distillation and any pyrolytic treatment.

Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish.

Y13 Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives.

Y14 Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known.

Y15 Wastes of an explosive nature not subject to other legislation.

Y16 Wastes from production, formulation and use of photographic chemicals and processing materials.

Y17 Wastes resulting from surface treatment of metals and plastics.

Y18 Residues arising from industrial waste disposal operations.

Waste having as constituents—

Y19 Metal carbonyls.

Y20 Beryllium; beryllium compounds.

Y21 Hexavalent chromium compounds.

Y22 Copper compounds.

Y23 Zinc compounds.

Y24 Arsenic; arsenic compounds.

Y25 Selenium; selenium compounds.

Y26 Cadmium; cadmium compounds.

Y27 Antimony; antimony compounds.

Y28 Tellurium; tellurium compounds.

Y29 Mercury; mercury compounds.

Y30 Thallium; thallium compounds.

Y31 Lead; lead compounds.

Y32 Inorganic fluorine compounds excluding calcium fluoride.

Y33 Inorganic cyanides.

Y34 Acidic solutions or acids in solid form.

Y35 Basic solutions or bases in solid form.

Y36 Asbestos (dust and fibre).

Y37 Organic phosphorous compounds.

Y38 Organic cyanides.

Y39 Phenols; phenol compounds including chlorophenols.

Y40 Ethers.

Y41 Halogenated organic solvents.

Y42 Organic solvents excluding halogenated solvents.

Y43 Any congenor of polychlorinated dibenzofuran.

Y44 Any congenor of polychlorinated dibenzo-p-dioxin.

Y45 Organohalogen compounds other than substances referred to in this Annex (*e.g.* Y39, Y41, Y42, Y43, Y44).

MAIN INDUSTRIAL SECTORS OF THE INTERNATIONAL STANDARD INDUSTRIAL CLASSIFICATION (ISIC) SYSTEM

DIVISION	INDUSTRIAL SECTOR
31	Food
32	Textiles, Wearing Apparel and Leather
33	Wood and Wood Products
34	Paper and Paper Products
35	Chemical, Petrochemical, Coal, Rubber and Plastic Products
36	Non-Metallic Mineral Products
37	Basic Metal Industry
38	Fabrication of Machinery and Equipment
39	Other Manufacturing Industry

Note that the full ISIC system subdivides industry sectors according to a four-digit classification. The above two-digit division shows only the major groups.

REPORT FORMAT: HAZARDOUS WASTE COUNTRY REPORT

The report format below is used to obtain a first description of the national situation concerning hazardous waste. It includes the relevant factors that influence waste generation, its impact on the environment, and the options for control.

1 *NATIONAL PROFILE*: geographical, resources, economic base, administration and government, technical services, environment.
2 *INDUSTRY PROFILE*: sectors, location, output, employment.
3 *ENVIRONMENTAL PROBLEMS BEING EXPERIENCED DUE TO HAZARDOUS WASTE DUMPING OR DISPOSAL*: for example, pollution adverse health impact, unsafe landfilling, illegal dumping, unsafe transport, unsatisfactory storage, soil contamination, etc.
4 *MAIN TYPES AND QUANTITIES OF IMPORTANT HAZARDOUS WASTES IN THE COUNTRY*, including both industrial and other sources of waste.
5 *EXTENT OF CURRENT TREATMENT, RECYCLING OR DISPOSAL FACILITIES*: for example, oil recovery plants, solvents recovery, incineration, storage sites, treatment plants, land disposal, export operations, and any similar installations.
6 *EXTENT OF INFRASTRUCTURES AND SERVICES ALREADY AVAILABLE*: for example, specialised chemical transport, emergency clean-up service, waste exchange service, experienced consultants, training institutes, laboratories, professional associations, research groups and so on.
7 *CURRENT SYSTEM OF POLICIES, LAWS AND REGULATIONS TO REDUCE AND CONTROL POLLUTION, SOLID WASTE DISPOSAL, AND HAZARDOUS CHEMICALS*: for example, water standards, sewer standards, landfill restrictions, waste transport, pesticides and chemicals controls, facility permits, EIA, etc.
8 *WHICH ORGANISATIONS HAVE RESPONSIBILITY FOR*: pollution, solid waste, hazardous wastes, toxic chemicals, industry permits, export/import of wastes and chemical pesticides, environmental monitoring, industrial training, clean technologies.

REFERENCES AND INFORMATION SOURCES ON HAZARDOUS WASTE

A number of important references are published by UN agencies—

1 *Safe Disposal of Hazardous Wastes: the special needs and problems of developing countries*
3 vols, World Bank/WHO/UNEP, 1989.

2 *Treatment and Disposal Methods for Waste Chemicals*
UNEP/IRPTC, 1985.

3 *Wastes and their Treatment: information sources and bibliography*
UNEP/INFOTERRA, 1986.

4 *Management of Hazardous Waste:* WHO *regional publications*
European Series, N° 14, 1983.

5 *Rapid Assessment of Sources of Air, Water and Land Pollution*
WHO, Offset Publication N° 62, WHO, 1982.

6 *The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*
UNEP, 1989.

7 *The Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes*
UNEP, 1987.

8 *Encyclopaedia of Occupational Health and Safety (3rd Edition)*
2 vols, ILO, 199...

9 *Legal File*
UNEP/IRPTC.

10 *Guidelines for Establishing Policies and Strategies for Hazardous Waste Management*
ASEAN/UNEP/CDG, 1986.

11 *"Industry and Environment"*
Special editions on—
Hazardous Waste Management, March 1988.
Waste Minimization, March 1989.

12 Many UNEP/IEO technical guides include recommendations on waste minimization and management.

Many references are also available from the technical literature. Additionally, government authorities frequently publish their findings and recommendations for wider readership. Some particularly useful references are—

101 *International Perspectives on Hazardous Waste Management*
W.S. Forrester and John H. Skinner [Eds], Academic Press, 1987.

102 *Adapting Hazardous Waste Management to the Needs of Developing Countries*
A special edition of *Waste Management and Research*, vol 8, N° 2, March 1990.

103 *Management of Hazardous Waste: treatment/storage/disposal facilities*
John R. Cahman, Technomic, 1986.

104 *Hazardous Waste Management*
G.W. Danson & B.W. Mercer, Wiley Interscience, 1986.

105 *Audit and Reduction Manual for Industrial Emissions and Wastes*
UNEP-IEO and UNIDO, 1991.

106 *Waste Minimization Opportunities Assessment Manual*
US EPA, 1988.

PART II

A COUNTRY REPORT: UDANAX

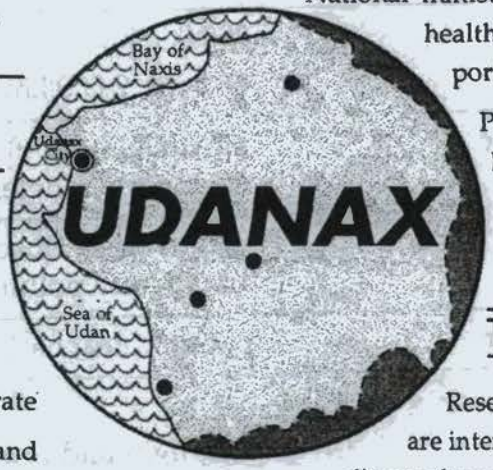
NATIONAL PROFILE

GEOGRAPHICAL

AREA	700 000 km²; 11 000 km of coastline
TERRAIN	undulating to flat
CLIMATE	temperate to hot
POPULATION	20 million, six cities with a population above 200 000
	8% of the population belongs to poor minority groups.

RESOURCES AND URBAN SERVICES

MINERALS AND ENERGY	moderate minerals; substantial, oil, gas, coal
AGRICULTURAL LAND	moderate
WATER SUPPLY	limited surface and groundwater
TRANSPORT	good network
SEWERAGE	one town 50% sewered, primary treatment only.



ECONOMICS AND INDUSTRY

See *Table 2* for details

Energy resource based, heavy industry, some light manufacturing, and service industries are represented. Extensive trade and commerce with foreign countries.

Agriculture is extensive, with many export crops based on irrigated production of fruit, vegetables and livestock. Fisheries are an important export industry. Most fishermen belong to the largest of the ethnic minority groups.

ADMINISTRATION

GOVERNMENT

Constitutional Monarchy with a Prime Minister and parliament; four provinces with Governors and parliaments; 65 local government authorities.

ADMINISTRATION

National ministries of development, industry, health, resources and energy, transport, navigation, agriculture.

Provincial ministries of planning, land, factories, roads. Local departments of sanitation, water supply.

TECHNICAL SERVICES

Researchers in the three universities are interested in marine pollution, and in climate change. Engineering departments occasionally help industries with production problems. Several engineering consultants have offices in the country. They have been mostly involved in plant design and operation.

There is a local Chamber of Commerce, but it is dominated by finance interests. The chemical and petroleum sector has its own trade association (UCPA).

ESTIMATE OF ENVIRONMENTAL SENSITIVITY

Background data which could be useful to see how sensitive the ecology of Udanax is to chemical pollution is shown in *Table 1*.

TABLE 1 ENVIRONMENTAL SENSITIVITY: UDANAX

COASTLINE	1 100 km
CORAL REEFS	1 000 km^2
ESTUARIES	250 000 ha
BATHING BEACHES	130 km
AGRICULTURAL LAND	200 000 km^2
% IRRIGATED	10% *i.e.* 2 000 km^2
GROUNDWATER QUALITY	Mostly good, but some aquifers are beginning to deteriorate
SURFACE WATER QUALITY	Some waters close to heavy industry are already polluted
MARINE WATER QUALITY	Polluted near harbours; otherwise OK
INDUSTRY ADJACENT TO—	
URBAN AREAS	Yes; light and heavy industry
AGRICULTURAL LAND	Yes; some heavy industry
COASTLINE, WETLANDS	Yes; refineries, heavy industry
TRANSPORT THROUGH URBAN AREAS	Yes
IMPORTANT NATIONAL SPECIES OF—	
LAND ANIMALS	No
MIGRATORY BIRDS	Yes
FISH AND OTHER MARINE SPECIES	Yes; including some rare species

SOURCE: Department of Biology, National University of Udanax

INDUSTRY PROFILE

The majority of manufacturing activity is concentrated in the three main towns—two of them on the coast. Mining and petroleum activity, including refining, is primarily in the dry interior of the country. Agriculture is mostly near the coastal strip, and along the main river valleys where irrigation water is available.

Industry output and employment is shown in *TABLE 2*. Data were supplied by the Ministry of Industry and the Ministry of Employment.

TABLE 2 ECONOMIC AND INDUSTRY DETAILS

[A] Employment by Sector

	% OF LABOUR FORCE
Agriculture	46
Industry	17
Services	37
Total	**100**

[B] Structure of Employment

	% OF TOTAL
Agriculture & Fishing	40.6
Petrolum, Mining & Quarrying	1.3
Manufacturing	10.3
Construction	2.9
Commerce	11.2
Transport	3.6
Electricity, Gas, Water	0.3
Government, Community, Social & Personal Services	30.0
Total	**100.0**

[C] Main Origins of Gross Domestic Product *(in million Pesos)*

Agriculture	12,923
Industry	15,974
Hydrocarbons	51,191
Building & Public Works	20,198
Transport	6,804
Communications	886
Trade	18,976
Services	5,936
Other Branches	10,816
GDP	**143,703**

1987 Exchange Rate:
4 Udanax pesos equivalent to 1 $US

[D] Structure of Manufacturing Industry

	TOTAL AVERAGE EMPLOYMENT ('000)
Food & Beverages	80
Textiles & Clothing	110
Leather Products	6
Paper & Paper Products	10
Printing & Publishing	50
Industrial Chemicals & Plastics	30
Petroleum Refining	8
Cement	2
Aluminium	2
Iron & Steel	12
Non-Ferrous Metal	1
Fabricated Metal Products	20
Electrical Machinery & Apparatus	4
Transport Equipment	20
Miscellaneous Products	6
Total	**361**

[E] Industrial Output

The following industries are found in Udanax. Production output figures are not always available.

Petroleum Production & Refining	n.a.
Nitrogenous Fertiliser (Urea)	500 t/day
Phosphate Fertiliser	300 t/day P_2O_5
Aluminium Smelter	50 000 t/yr
Plastics Production PE	n.a.
Styrene Plant	n.a.
PVC Plant	100 000 t/yr
Sulphuric Acid Plant	500 t/day
Iron and Steel Plant	1 300 000 t/yr
Chlorine Plant	n.a.
Battery Production Plant	uses 4 000 t/y of acid
Textile Production (three plants)	26m m. of material
Leather Production (eight companies)	3m hides/yr
Pulp & Paper (two plants)	95 000 t/yr
Printing	n.a.

[F] Mineral Production ('000 tonnes)

Iron Ore	2,750.0
Lime Phosphates	1,124.0
Zinc	7.6
Lead	3.5
Copper	0.7
Salt	171.0
Mercury *(tonnes)*	1,034.0
Silver *(tonnes)*	2.0

ENVIRONMENTAL INFORMATION

Current Information available about Environment and Hazardous Waste in Udanax

Only a preliminary appraisal of environmental damage and of safety problems from hazardous waste has been carried out. Few waste streams are properly quantified.

Results of Preliminary Investigations on Waste-Related Problems

In 1987, the Environmental Bureau recorded the following events from interviews with personnel in several ministries—

- ◊ Many factories discharge industrial wastewaters to drains or watercourses, and dump residues at the municipal landfill, but volume and composition is not known. No measurement is required by law.
- ◊ Explosion of drums at a landfill injured a driver and burnt two vehicles in 1983.
- ◊ Fish kills in rivers due to toxic discharge were known in 1982, 1984, 1986, 1987. Recording is not systematic, but in general marine fish catches are declining.
- ◊ The owner of 200 tonnes of chemical waste located in an abandoned warehouse in the harbour area cannot be traced.
- ◊ Oil from ships off the coast periodically fouls the beach.
- ◊ A chemical warehouse fire left large quantities of contaminated debris for disposal. These were dumped in the local landfill near the beach (July 1985).
- ◊ Waste oil is often dumped on unused ground outside towns. Waste oil from small local fishing boats is accumulating on the wharves. The fate of waste oil from the vehicle repair centres in the city is not known.
- ◊ The National Power Company wished to replace PCB capacitors, but decided against this as no local disposal facilities exist (mid-1986).
- ◊ Swimming pool chemicals dumped at the local landfill caused a serious fire, releasing clouds of chlorine gas. 23 persons were hospitalised.
- ◊ Three chemical companies—affiliates of overseas TNCs—have been stockpiling chlorinated hydrocarbons, cyanide salts and arsenic wastes, as there are no local disposal facilities. Total volume so far is 850m³.
- ◊ Agricultural inspectors report surplus pesticides being stored under unsatisfactory conditions. One report referred to the death of sixteen farm animals due to contaminated water supply; one warehouse has twelve tonnes of off-specification DDT.
- ◊ The Ministry of Education has asked for advice about the disposal of 20m³ of surplus laboratory chemicals collected from schools and research laboratories.

Results of Environmental Monitoring Programmes

In Udanax, no environmental monitoring is carried out specifically for hazardous chemicals, wastes or toxic pollutants.

There are few laboratories able to analyse trace chemicals in water or food. These are, in any case, in research institutes, and are busy on research work.

The Health Ministry monitors bacteria levels in domestic water supplies.

The Agriculture Ministry monitors some pesticide levels in food and fish sent for export.

Scavenger communities belonging to an ethnic minority make a living by recovering materials from the local garbage dumps. They are known from health surveys to be frequent carriers of communicable disease, and suffer more illness generally, but they have resisted attempts to remove them from the sites which are their only means of livelihood.

The dumpsites are know to receive industrial and medical waste.

Media Coverage and Local Action

◊ A leading national newspaper has reported incidents of waste dumping and damage to the health of workers handling industrial wastes. Local newspapers sometimes report on fires at landfill sites.

◊ Some local and provincial representatives have complained to the Ministry of Health that their constituents living near the landfill sites have trouble with vermin and litter. Several claim to be suffering from illness caused by asbestos waste dumped there.

◊ A local group representing fishermen has written to the Minister about fish kills caused by water pollution and wastes dumped in rivers. The livelihood of the fishermen is threatened, and the group has collected a dossier of six cases based on interviews with local people.

◊ There is a proposal for a low-cost government housing project on the site of an old refinery. The newspaper claims that the site is polluted with toxic chemicals, and will affect the health of future residents.

◊ Some food-processing industries near to chemical plants have complained that their underground water supply is becoming more and more polluted, and they will soon have to seek costly alternative supplies or else relocate. The chemical plants pump toxic wastewaters down old boreholes.

◊ A newspaper has reported that a waste contractor from Gibraltar has commenced negotiations with a local company to import 50 000 tonnes of unspecified wastes per year from Europe and the USA. The entrepreneur has said the scheme will create local employment, but has refused further interviews.

◊ Greenpeace has claimed that 100 000 tpa of imported waste is dumped somewhere in the region.

HAZARDOUS WASTE GENERATION IN UDANAX

TABLE 3 summarizes information gathered by the *Environmental Bureau* from a variety of ad-hoc sources over the space of four years, but it is not complete.

Note that not all of the anecdotal information from the earlier Sections appears in this table.

TABLE 3 WASTE TYPES AND QUANTITIES ESTIMATES (1987*) [INDUSTRIAL AND NON-INDUSTRIAL]

ACIDS, ALKALIS	presumed but not measured
CYANIDE SALTS	50 m^3 (company disclosure)
CHLORINATED HYDROCARBONS	500 m^3 (company disclosure)
PCBs**	quantities not measured
POTLINER WASTE**	15 000 m^3
ARSENIC CHEMICALS	250 m^3 (concentration not known)
MIXED CHEMICALS	20 m^3 (school chemicals)
	200 tonnes abandoned chemicals
PESTICIDES	reported; not measured above 12 tonnes
OILS	presumed but not measured
SOLVENTS	unknown but presumed
FIRE DEBRIS [CHEMICALS RESIDUES]	200 m^3 from one incident alone
FACTORY EFFLUENTS	unknown volume and composition
TREATMENT SLUDGES	some but quantity not known
SHIP BALLAST AND BILGE WATERS	unknown quantity

* *Data compiled from particular conversations and diverse internal reports (1985–87)*

** EXPLANATORY NOTES

PCBs	Polychlorinated biphenyls. Commonly used as cooling liquids in heavy electrical equipment, and as heat transfer fluids.
POTLINER WASTE	Discarded graphite lining material from aluminium smelting pots. Usually has become impregnated with fluoride, cyanide and other substances produced during smelting.

THE CURRENT STATE OF HAZARDOUS WASTE DISPOSAL

It is known from informal conversation that a number of companies treat their own wastewaters and air emissions, but this is not universal.

Many treatment systems are known to be ineffective, or badly operated. One large company sent fifteen tonnes of PCB to Europe for incineration in 1988.

Most residues and chemical wastes are dumped on factory land or taken away to local dumping grounds.

No records are kept. Only the larger city dumping grounds are officially recognised in planning records.

Two industrial waste recyclers are active in reclaiming profitable waste streams such as oils and solvents respectively. Total capacity is around 400 m^3 p.a. solvents, and 1000 m^3 p.a. of oil.

Around 4000 m^3 of waste oil is also burnt as supplementary fuel in two industrial boilers. Refineries burn waste oil and sludge as fuel on-site. One company collects and reclaims batteries.

Asbestos waste from building sites is dumped along with other building debris.

One large landfill site has been established on the shoreline by the aluminium smelter for its own use. The company disposes of all solid waste from the smelter there, except for food waste which goes to the city dumpsite. Other local garbage dumps are nearby.

A number of potential disposal options are currently not being used, presumably due to distance and/or management reluctance. These include—

- ◊ three old claypits in the nearby hills, about 35 km from the port

  and

- ◊ two cement kilns—one dry, one wet process—and one brick factory continue to use only virgin fuel, despite several informal approaches by the chemical sector.

INFRASTRUCTURE AND ENVIRONMENTAL SERVICES

Oil companies and some chemical companies have bulk chemical transport vehicles and trained drivers, but most chemical products and wastes are transported in drums in conventional trucks.

Emergency service teams exist at the major petrochemical complexes. A permanent oil spill response team has been created in the major port that handles tankers.

Engineering consultants are reasonably well represented in Udanax, but have little experience designing treatment plants.

Apart from four chemical laboratories in the Universities and the Health and Agriculture Ministries, there are no public facilities for sophisticated chemical analysis. Company laboratories sometimes carry out analytical waste for outside bodies during emergencies.

Neither the Institution of Engineers nor the Chamber of Commerce has an environmental committee.

The Universities between them train about fifty chemists a year.

A SUMMARY OF CURRENT POLLUTION LAWS

WATER POLLUTION REGULATIONS [1981] under the WATER RESOURCES ACT [1978]—

- ◊ offence to pollute
- ◊ can set standards for effluents
- ◊ can order action to clean up.

MARINE POLLUTION ACT [1968]—

- ◊ offence to discharge oil or oily water from ships.

AIR POLLUTION REGULATIONS [1979] under the PUBLIC HEALTH ACT—

- ◊ can set standards for emissions
- ◊ fines for violations.

ENVIRONMENT ASSESSMENT ACT [1985]—

- ◊ EIA required for all large industrial projects $2m+
- ◊ EIA report format is prescribed.

WASTE DISPOSAL REGULATIONS under the PUBLIC HEALTH ACT [1958]—

- ◊ wastes must be placed in designated locations
- ◊ deposit sites to be kept free of disease, vermin, fires
- ◊ only approved operators may run a waste disposal operation
- ◊ must be safe at all times
- ◊ municipalities have duty to ensure collection of waste.

TABLE 4 STANDARDS APPLYING TO ENVIRONMENTAL RELEASES IN UDANAX

	DISCHARGE TO WATER (mg/1)	DISCHARGE TO SEWER (mg/1)	DISCHARGE TO AIR (mg/m³)	DISCHARGE TO LANDFILL
Cadmium	0.1		3	
Chromium	1			
Cyanide	0.1			
Copper	1			
Lead	1		10	
Zinc	2			
Nickel	1			
Phenols	10			
Oil	none			
Suspended Solids	50			
COD	150			
pH Range	6–9			
Chlorine Compounds			200	
As+Cd+Hg+Pb			10	
Particulates			250	

CURRENT ADMINISTRATIVE RESPONSIBILITIES IN ENVIRONMENT

Water pollution regulations are administered by three inspectors in the *MINISTRY OF RESOURCES AND ENERGY (Water Supply Department)*.

The main emphasis has been on the quality of drinking water supplies. Specific monitoring and enforcement is carried out by regional office staff in the provinces.

Air pollution is controlled by three scientific staff in the *MINISTRY OF HEALTH*. Their duties include outside air quality, and vehicle emissions. They also operate the air monitoring stations that provide data input to GEMS.

The *MINISTRY OF AGRICULTURE* is responsible for ***pesticides and groundwater affairs***. It has delegated day-to-day responsibility to provincial administrations. The main purpose of the *Groundwater Act* is to provide a mechanism for collecting pumping fees. The Ministry has the power to approve or ban pesticides.

Occupational health regulations do not yet include ***chemical exposure limits***.

The *TRANSPORT MINISTRY*, through its *Ports Division*, administers the ***Marine Pollution Act***. This Act covers oil spills and ballast water discharges from ships. Each of the three ports has a small oil-combating team, but only in the capital is this on a full-time basis.

Environmental Impact Assessments are evaluated by the *MINISTRY OF PLANNING* when it examines major projects.

A single part-time officer handles these assessments and advises the Minister accordingly.

An ***Environmental Bureau*** of four persons within the *PRIME MINISTER'S DEPARTMENT* is responsible for coordinating environmental programmes, acting as international focal points, and advising the Prime Minister.

The Bureau has no formal links with other Ministries.

PART III

CASEWORK SESSIONS

A NOTE FOR SESSION LEADERS

What follows consists of *six* CASEWORK SESSIONS—

SESSION 1	*Assessment of the Hazardous Waste Situation*
SESSION 2	*Technology for Hazardous Waste Minimisation, Treatment and Disposal*
SESSION 3	*Legislation and Administration*
SESSION 4	*Administrative and Organisational Measures*
SESSION 5	*Building up a Hazardous Waste Strategy*
SESSION 6	*Implementing the Basel Convention*

The notes we provide in this manual are centred around a series of tasks that need to be completed in order to prepare a hazardous waste strategy. Such a strategy was foreshadowed by the task force described in the early part of this document.

The notes for each Session—

- ◊ specify the tasks to be carried out and
- ◊ give some further information that will assist you in carrying them out.

However, the information is not necessarily complete. Similarly, you needn't always follow the examples we give.

Often, guidance by Session Leaders will be necessary to interpret and adapt the practical exercises.

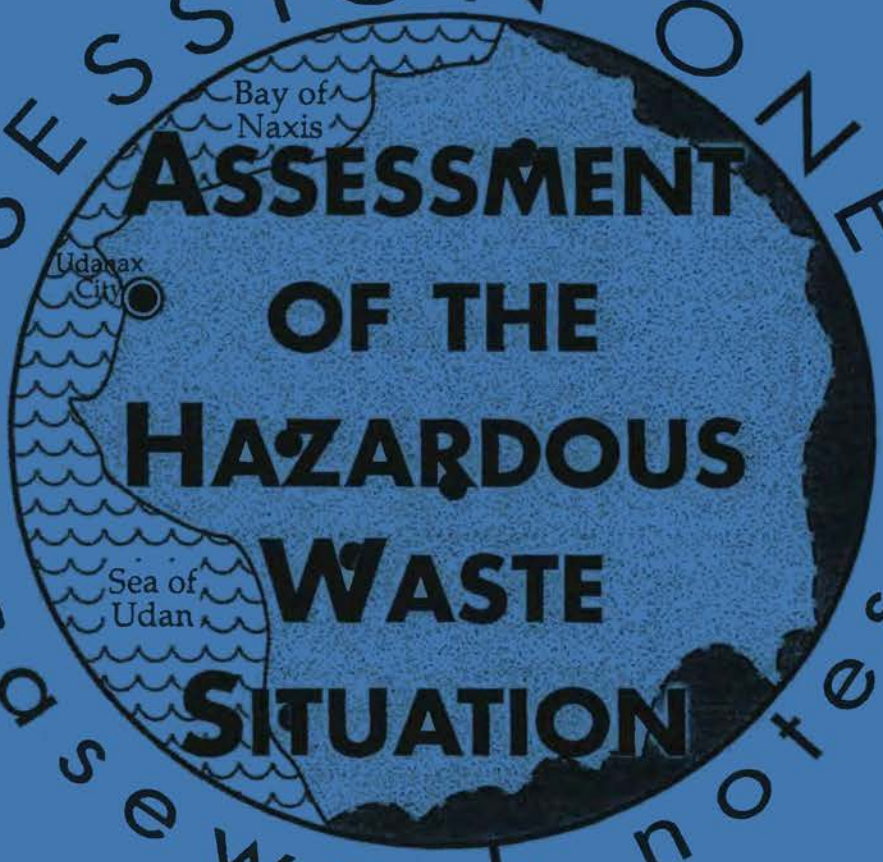
Many of the exercises are open-ended.

A time limit should be set for the exercises chosen. Not all the exercises may be completed in the time available.

The notes are intended to stimulate—but not substitute for—group work.

Local experience of participants may be valuable in guiding the discussion.

SESSION ONE



ASSESSMENT OF THE HAZARDOUS WASTE SITUATION

casework notes

INTRODUCTION

An efficient response to a problem requires, first of all, that the problem itself is clearly identified.

Hazardous waste related problems need to be described from two points of view—

1 *the assessment of environmental damage (actual and potential) and hazards*

and

2 *the assessment of waste quantities and sources which cause the damage*

The first item will give the urgency of the problem. The second item suggests where the control should occur.

As future control action will benefit different social groups to different extents, it is also useful to identify at an early stage the likely supporters and opponents of any hypothetical action (key player analysis).

This Session examines all these factors through a series of structured tasks.

Some tasks comprise a number of alternative exercises to allow a comparison of different methodologies.

We have organised the notes for this Session into a number of *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION ONE

In all, there are four tasks involved in this Session. The working group should report on the following—

Task One

Report on the major environmental problems that can be attributed to hazardous waste in Udanax

Exercise 1.1 *Environmental problems*

Exercise 1.2 *Social problems*

Task Two

Report on environmental hazards and consequences

Exercise 2.1 *Environmental hazards*

Exercise 2.2 *Effects*

Task Three

Report on waste materials (types and quantities) generated in Udanax, and the sources

Exercise 3.1 *Direct observation*

Exercise 3.2 *Indirect estimation of industrial sources (method A)*

Exercise 3.3 *Indirect estimation of industrial sources (method B)*

Exercise 3.4 *Indirect estimation of industrial sources (method C)*

Exercise 3.5 *Indirect estimation of industrial sources ('INVENT' computer model)*

Exercise 3.6 *Comparison of models*

Exercise 3.7a *Industrial waste survey*

Exercise 3.7b *Small generator survey*

Exercise 3.8 *Non industrial sources*

Exercise 3.9 *Other forms of estimation*

Task Four

Identify the key socio-economic influences likely to impact on future waste management strategy

Exercise 4.1 *Key player analysis*

Exercise 4.2 *Key agency analysis*

Exercise 4.3 *Other socio-economic influences*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised in one page on the worksheets provided at the end of the Chapter.

Also provided is a Session Report form to review the work of the entire Session.

SECTION ONE: BACKGROUND INFORMATION

TABLE 1.1 LIST OF HAZARDOUS CHARACTERISTICS (Annex III of Basel Convention)

UN CLASS*	CODE	CHARACTERISTICS
1	H1	**Explosive** An explosive substance or waste is solid or liquid substances or waste (or a mixture of substances or wastes) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such speed as to cause damage to the surroundings.
2	H3	**Flammable Liquids** The word 'flammable' has the same meaning as 'inflammable'. Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in suspension or solution (for example, paints, varnishes, lacquers, etc., but not including substances or wastes otherwise classified on account to their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60.5°C, closed-cup test, or not more than 65.6°C, open-cup test (since the results by the same test are often variable, regulations varying from the above figures to make allowance for such differences would be within the spirit of this definition).
4.1	H4.1	**Flammable Solids** Solids, or waste solids, other than those classed as explosives, which—under conditions encountered in transport—are readily combustible, or may cause or contribute to fire through friction.
4.2	H4.2	**Substances or Wastes liable to Spontaneous Combustion** Substances or wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating under normal conditions encountered in transport, or to heating up on contact with air, and being then liable to catch fire.
4.3	H4.3	**Substances or Wastes which, in contact with Water, emit Flammable Gases** Substances or wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.
5.1	H5.1	**Oxidizing** Substances or wastes which, while in themselves not necessarily combustible, may—generally by yielding oxygen—cause or contribute to the combustion of other materials.
5.2	H5.2	**Organic Peroxides** Organic substances or wastes which contain the bivalent –O–O– structure are thermally unstable substances which may undergo exothermic self-accelerating decomposition.
6.1	H6.1	**Poisonous (Acute)** Substances or wastes liable either to cause death or serious injury or harm to human health if swallowed or inhaled or by skin contact.
6.2	H6.2	**Infectious Substances** Substances or wastes containing viable micro-organisms or their toxins which are known or suspected to cause disease in animals or humans.
8	H8	**Corrosives** Substances or wastes which, by chemical action, will cause severe damage when in contact with living tissue or, in the case of leakage, will materially damage or even destroy other goods or the means of transport; they may also cause other hazards.
9	H10	**Liberation of Toxic Gases in contact with Air or Water** Substances or wastes which, by interaction with air or water, are liable to give off toxic gases in dangerous quantities.
9	H11	**Toxic (Delayed or Chronic)** Substances or wastes which, if they are inhaled or ingested or if they penetrate the skin, may involve delayed or chronic effects, including carcinogenicity.
9	H12	**Ecotoxic** Substances or wastes which, if released, present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems.
9	H13	Capable by any means, after disposal, of yielding another material—e.g. leachate—which possesses any of the characteristics listed above.

* Corresponds to the hazard classification system included in the United Nations recommendations on the Transport of Dangerous Goods (ST/SG/AC.10/1/Rev.5, United Nations, New York, 1988).

TABLE 1.2 SOME TYPICAL WASTES, SOME TYPICAL WASTE SOURCES

TYPES OF WASTE GENERATED

Flammable	Corrosive	Reactive	Toxic	Environmental
Solvents —including acetone, benzene, ethanol, isopropanol, kerosene, toluene, turpentine, paint thinners	**Acids/alkalis** —including ammonium hydroxide, hydrochloric acid, sulphuric acid	**Bleaches/oxidizers** —including organic peroxides, sodium perchlorate	**Heavy metals/ pesticides/ cyanides** —including mercury, arsenic, cadmium, barium, cyanide and most pesticides	**Bio-accumulative chemicals that accumulate in the food chain** —including PCBs, lead and some other heavy metals and pesticides such as DDT

TYPES OF BUSINESSES

Building, cleaning and maintenance companies	Building, cleaning and maintenance companies	Building, cleaning and maintenance companies		
Chemical manufacturers	Chemical manufacturers	Chemical manufacturers	Chemical manufacturers	Chemical manufacturers
Businesses using or manufacturing cleansing agents (abrasives and fluids) and cosmetics	Businesses using or manufacturing cleansing agents (abrasives and fluids)	Businesses using or manufacturing cleansing agents (abrasives and fluids)	Businesses using or manufacturing cleansing agents (abrasives and fluids) and cosmetics	
Educational and vocational shops	Educational and vocational shops	Educational and vocational shops		Educational and vocational shops
Equipment repair businesses	Equipment repair businesses			Electrical equipment replacement and repair businesses
Funeral service firms				
Furniture manufacturers and wood refinishers				
Laboratories (schools, hospitals, research institutions)	Laboratories (schools, hospitals, research institutions)	Laboratories (schools, hospitals, research institutions)	Laboratories (schools, hospitals, research institutions)	Laboratories (schools, hospitals, research institutions)
Laundries and dry cleaners				
Metal manufacturing and plating companies	Metal manufacturing and plating companies		Metal manufacturing and plating companies	Metal manufacturing and plating companies
			Photo processing laboratories	
				Operations using old transformers, capacitors and electrical equipment (PCBs are no longer manufactured)
Other manufacturing businesses including textiles, plastics and leather				Other manufacturing businesses including textiles, plastics and leather
Pesticide end-users and application services			Pesticide end-users and application services	
Petrochemical producers				
Petroleum refining industry (oil wastes)				Petroleum refining industry (heavy metals contained in waste materials)
			Photographic processors (photo chemicals/silver)	
Printing and allied industries			Printing and allied industries	
Vehicle maintenance and body shops	Vehicle maintenance and body shops (lead acid batteries)		Vehicle maintenance and body shops	

Source: Alberta Special Waste Management Corporation

TABLE 1.3 PROPERTIES AND DISPOSAL OF COMMON INDUSTRIAL WASTES

Reprinted from *Safe Disposal of Hazardous Wastes: The Special Needs and Problems of Developing Countries* 3 vols, World Bank/WHO/UNEP, 1989.

Recommendations are those for general situations. Practical choices will be influenced by appropriate pre-treatment and/or availability of suitable facilities. Disposal to sewers, watercourses and landfill is subject to acceptance criteria of relevant authorities.

Key

S	=	toxic, carcinogenic	r	=	recovery, recycle
F	=	flammable	pc	=	physical/chemical treatment
R	=	corrosive, highly reactive	s	=	solidification
P	=	putrescible	l	=	landfill (normal) (licensed)
Od	=	odorous	l*	=	landfill (impervious) (licensed)
			b	=	biological treatment
			i	=	incineration
			d	=	water/sewer discharge subject to agreement or licence

Source: Environment Protection Authority of Victoria
Draft Industrial Waste Strategy for Victoria, 1985.

WASTE TYPE	CODE	PROPERTY					RECOMMENDED DISPOSAL *items in ( ) refer to treatment residue*							
		S	F	R	P	Od	r	pc	s	l	l*	b	i	d
Abbatoirs residues	061				✓	✓				✓		✓	✓	(✓)
Acids and solutions *(inorganic)*														
Alkylation acid	029	✓		✓			✓	✓			(✓)			(✓)
Boric	029	✓					✓	✓			(✓)			(✓)
Chromic	023	✓		✓			✓	✓			(✓)			(✓)
Fluosilic	029	✓		✓			✓	✓			(✓)			(✓)
Fluoboric	029	✓		✓			✓	✓			(✓)			
Hydrochloric	021	✓		✓			✓	✓			(✓)			
Hydrofluoric	023	✓		✓			✓	✓			(✓)			
Nitric	022	✓		✓			✓	✓			(✓)			
Perchloric	029	✓		✓			✓	✓			(✓)			
Phosphoric	022	✓		✓			✓	✓			(✓)			
Pickling acids	029	✓		✓			✓	✓			(✓)			
Sulphurous	029	✓		✓			✓	✓			(✓)			
Sulphuric	021	✓		✓			✓	✓			(✓)			
Acids, organic														
Acetic	029	✓	✓	✓		✓	✓	✓			(✓)			(✓)
Butyric	029		✓			✓	✓	✓			(✓)	✓	✓	(✓)

WASTE TYPE	CODE	PROPERTY					RECOMMENDED DISPOSAL *items in ( ) refer to treatment residue*							
		S	F	R	P	Od	r	pc	s	l	l*	b	i	d
Acids, organic *(ctd)*														
Formic	029	✓	✓	✓		✓	✓	✓			(✓)		✓	(✓)
Lactic	029					✓	✓	✓			(✓)	✓		(✓)
Oxalic	029	✓		✓			✓	✓			(✓)			(✓)
Sulphonic acids	029	✓		✓			✓	✓			(✓)			(✓)
Trichloacetic	029	✓		✓			✓	✓			(✓)			(✓)
Alkaline materials														
Ammoniacal solutions	031	✓		✓		✓	✓	✓			(✓)			(✓)
Caustic soda or *Sodium hydroxide*	031	✓		✓			✓	✓			(✓)			(✓)
Lime slurries	032			✓		✓	✓	✓		✓				
Lime neutralised metal sludge	033	✓							✓		✓			
Soda ash or *Sodium carbonate*	031			✓			✓	✓			(✓)			(✓)
Sodium phosphate or *polyphosphates*	031	✓		✓			✓	✓			(✓)			(✓)
Sodium silicate	031	✓		✓			✓	✓			(✓)			(✓)
Sodium sulphode	045	✓				✓	✓	✓			(✓)			(✓)
Sodium peroxide	051	✓		✓			✓	✓			(✓)			(✓)
Alkaline cleaners	031	✓		✓			✓	✓			(✓)			(✓)
Alkali metals	055	✓	✓	✓			✓	✓			(✓)			(✓)
Animal residues	061				✓	✓	✓			✓		✓	✓	
Antimony compounds	045	✓					✓	✓	(✓)		(✓)			
Arsenic compounds	045	✓					✓	✓	(✓)		(✓)			
Asbestos wastes	181	✓							✓	✓				
Bags—*previously contained hazardous materials*	121	✓							✓		✓		✓	
Barium salts	045	✓					✓	✓	✓		(✓)			
Bleaching powders and solutions	051	✓		✓		✓	✓	✓			✓			
Boron (compounds of)	045	✓					✓	✓			✓			
Cadmium (compounds of)	045	✓					✓	✓	(✓)		(✓)			
Cannery wastes	062				✓	✓				✓		✓		
Cattle dips and residues	049	✓			✓	✓		✓	✓	(✓)	(✓)			
Carbonisation liquors *wood or coal*	159					✓		✓					✓	
Chlorinated hydrocarbons														
Chloroform	074	✓				✓	✓						✓	
Carbon tetrachloride	074	✓				✓	✓						✓	
Ethylene dichloride	074	✓				✓	✓						✓	
Perchlorethylene	074	✓				✓	✓						✓	
Trichloroethane	074	✓				✓	✓						✓	
Trichloroethylene	074	✓				✓	✓						✓	
Chromium compounds	045	✓					✓	✓	✓		(✓)			
Copper compounds	045	✓					✓	✓	✓		(✓)			
Cyanides														
Plating residues	013	✓					✓	✓			(✓)			(✓)
Heat treatment residues	014	✓					✓	✓			(✓)			(✓)

WASTE TYPE	CODE	PROPERTY					RECOMMENDED DISPOSAL *items in ( ) refer to treatment residue*							
		S	F	R	P	Od	r	pc	s	l	l*	b	i	d
Cyanides *(ctd)*														
Metal complexes	015	✓					✓	✓			(✓)			(✓)
Organo cyanides	159	✓	✓	✓			✓	✓			(✓)			
Detergents	155	✓					✓	✓			✓			(✓)
Disinfectants	159						✓	✓			(✓)			(✓)
Drugs—*see Pharmaceuticals and residues*														
Dyestuffs	061/9	✓									✓		✓	
Explosives	053	✓	✓	✓				✓						
Fats, grease	104				✓	✓	✓			✓		✓	✓	
Fish residues	081				✓	✓				✓		✓	✓	
Fluorides and compounds containing fluorine	042	✓					✓	✓	✓		✓			
Fruit residues	082				✓	✓				✓		✓		(✓)
Fungicides—*see Pesticides*														
Grease trap residues														
domestic	083				✓	✓				✓		✓		
commercial	084				✓	✓					✓	✓		
Hydrocarbons														
Lubricating oil	101		✓				✓						✓	
Light oil	101		✓				✓						✓	
Solvents (low flashpoint)	072		✓				✓						✓	
Insecticides and contaminated containers—*see Pesticides*														
Isocyanates	159	✓	✓	✓			✓	✓			(✓)			(✓)
Lead compounds	045	✓					✓	✓	(✓)		(✓)			
Lime slurries	032			✓			✓	✓		✓				
Lime neutralised metal sludges	033	✓							✓		✓			
Manganese compounds	047	✓					✓	✓	(✓)		(✓)			
Mercaptans	153	✓	✓			✓		✓					✓	
Mercury and compounds	045	✓					✓	✓	(✓)		(✓)			
Methacrylates	153	✓	✓			✓	✓	✓					✓	
Motor fuel additives and residues	071	✓	✓								✓		✓	
Nickel compounds	045	✓					✓	✓	✓		(✓)			
Nitrates	051	✓		✓			✓	✓			(✓)			(✓)
Oils														
Cutting oils	101		✓				✓				✓		✓	
Cutting emulsions	103					✓		✓			✓		(✓)	(✓)
Hydrocarbon	101		✓				✓				✓		✓	

Key S = toxic, carcinogenic; F = flammable; R = corrosive, highly reactive; P = putrescible; Od = odorous

r = recovery, recycle; pc = physical/chemical treatment; s = solidification; l = landfill (normal) (licensed); l* = landfill (impervious) (licensed); b = biological treatment; i = incineration; d = water/sewer discharge subject to agreement or licence

WASTE TYPE	CODE	PROPERTY					RECOMMENDED DISPOSAL *items in ( ) refer to treatment residue*							
		S	F	R	P	Od	r	pc	s	l	l*	b	i	d
Oils (ctd)														
Lubricating	101		✓				✓				✓		✓	
Organo-Nitrates	159	✓	✓	✓			✓	✓						
Oxidising agents														
Chlorates	051	✓		✓			✓	✓			(✓)			(✓)
Chromates	051	✓					✓	✓			(✓)			(✓)
Nitrates	051	✓		✓			✓	✓			(✓)			(✓)
Permanganates	051	✓		✓			✓	✓			(✓)			(✓)
Peroxides	051	✓		✓			✓	✓			(✓)			(✓)
Paint thinners (low flashpoint)	072		✓				✓						✓	
Pesticides	161/9						✓	✓	(✓)		(✓)		✓	
Peroxides	061	✓		✓			✓	✓			(✓)			(✓)
Pharmaceuticals and residues	154	✓						✓	✓	(✓)	✓		✓	
Phenol and phenolic compounds	152	✓				✓							✓	
Phosphorous residues	054	✓	✓	✓		✓		✓	✓		(✓)		✓	
Pickling acids/solutions	029	✓		✓			✓	✓			(✓)			(✓)
Poisons—*any material which would be labelled under Schedules 1-7 of the Poison Act*	045	✓							✓		✓			✓
Polychlorinated Biphenyls (PCBs)	156	✓						✓					✓	
Radioactive materials—*controlled under other Acts*	171/2	✓						✓	(✓)		(✓)			
Scallop shells	081				✓	✓				✓				
Selenium compounds	045	✓					✓	✓	✓		(✓)			
Sheep dips and residues	049	✓						✓	✓	(✓)	(✓)			
Solvents, low flashpoint	072		✓				✓						✓	
Sulphides	045	✓				✓	✓	✓			(✓)			(✓)
Sulphites	045	✓				✓	✓	✓			(✓)			(✓)
Surfactants	155	✓					✓				✓		✓	
Tetraethyl lead residues	151	✓	✓						✓		(✓)		✓	
Timber preservatives	049	✓						✓	(✓)		(✓)			
Thallium compounds	045	✓					✓	✓	(✓)		(✓)			
Triple Interceptor Trap residues (TIT)	103					✓		✓		✓				✓
Turpentine residues	071	✓	✓				✓						✓	
Vanadium compounds	045	✓					✓		✓		(✓)			
Vegetable wastes	082				✓	✓	✓			✓		✓		
Waxes—animal and plant	182		✓			✓	✓			✓			✓	
Weedicides—*see Pesticides*														
White spirits	072		✓				✓						✓	
Zinc compounds	045	✓					✓	✓			✓			

Key S = toxic, carcinogenic; F = flammable; R = corrosive, highly reactive; P = putrescible; Od = odorous

r = recovery, recycle; pc = physical/chemical treatment; s = solidification; l = landfill (normal) (licensed); l* = landfill (impervious) (licensed); b = biological treatment; i = incineration; d = water/sewer discharge subject to agreement or licence

SECTION TWO: THE CASEWORK TASKS

TASK 1 REPORT ON THE MAJOR ENVIRONMENTAL PROBLEMS THAT CAN BE ATTRIBUTED TO HAZARDOUS WASTE IN UDANAX

Before starting a detailed assessment of environmental hazards and impacts of industrial waste, we should look at the information on environmental damage which is already close to hand.

As precise definitions of hazard have not yet been considered, it is appropriate to use everyday concepts of 'environmental problems' as might be used by the non-specialist person in the street (and government ministers!).

EXERCISE 1.1: *ENVIRONMENTAL PROBLEMS*

From the country report, identify the environmental problems that can be attributed to hazardous waste in Udanax.

Evidence on 'problems' can come from two sources—

- ◊ Environmental problems related to air, water or human safety may be recorded in data on water quality, human health, food purity and so on. Check the country report for monitoring results in Udanax.
- ◊ If monitoring results are insufficient, the use of indirect indicators may be a useful substitute. Incidents of fishkills or declining fish catch, hospital admittances from chemical accidents, bad taste in drinking water, bad odours from landfills and so on are all indications of serious environmental impact.

Again, check the country report for such indirect indicators.

Concentrate on environmental problems (for example, water contamination) rather than on causes (for example, unsafe storage).

Also, these exercises deal only with environmental problems. Management problems—such as public opposition—are not discussed here.

Use the work sheet provided to summarise your results.

SUPPLEMENTARY EXERCISE 1.1A

Monitoring Programmes

Discuss in the group a monitoring programme to document more thoroughly the environmental problems of Udanax—

- ◊ what impacts will you look for?
- ◊ where?
- ◊ what parameters will you record?
- ◊ who will do it?

EXERCISE 1.2: *SOCIAL PROBLEMS*

On the basis of the country report, identify social issues linked to the disposal of hazardous waste in Udanax.

From your personal experience, what other issues or controversies could arise in future in Udanax as the situation develops further?

Persons suffering illness or reduced income often search for reasons for their problems. Conditions imposed on them by another social group or by the authorities are often very visible and may be believed by the disadvantaged person as the cause of their problems.

Some situations can become very bitter.

Some social issues (both good and bad) that have arisen in other countries are—

- ◊ social stigma of workers handling waste
- ◊ employment prospects in a waste disposal industry
- ◊ reduced property value of adjacent land or houses
- ◊ reduced amenity adjacent to dumpsites
- ◊ effect on health and well-being of residents
- ◊ loss of income as a result of pollution damage

Such social issues could be the direct consequence of unsafe disposal practices. They can also arise when the authorities try to improve disposal—for example, by restricting public access to sites accepting hazardous industrial waste, or trying to establish new sites.

Try to look both for existing problems and for ones which might arise in the future.

Summarise your views on the worksheet.

TASK 2 REPORT ON ENVIRONMENTAL HAZARDS AND CONSEQUENCES

Although a more comprehensive estimation of waste quantities will be carried out later—in **Task 3**—the country report has already revealed several important waste types.

We will now try to predict some of the environmental hazards that could occur from these wastes *(Exercise 2.1)* and the target organisms—people, plants, animals—that could be affected *(Exercise 2.2)*.

EXERCISE 2.1: *ENVIRONMENTAL HAZARDS*

For this exercise, use an appropriate notion of hazard given in one of the earlier tables to indicate in the third column of **Table 1.4** the major hazards arising from the listed wastes.

Summarise your results on a worksheet.

It is common to list environmental hazards as the types of damaging stimuli that chemicals may produce.

For example—

- ◊ toxicity (including carcenogicity)
- ◊ flammability
- ◊ extreme chemical reactivity, including explosions
- ◊ corrosivity to biological tissue and materials
- ◊ pollution by interfering with ecological processes (as well as being possibly ecotoxic)
- ◊ aesthetics—for example, unpleasant odours, or dust fallout
- ◊ infectiousness
- ◊ radioactivity

Some properties—such as *bioaccumulation*—are not a hazard in themselves, but they serve to make the wastes more accessible to target organism later.

The **consequences** of a release of waste material will depend, among other things, on the environmental hazard that the waste represents.

The **severity** of the potential hazard depends on the amount of waste, its concentration, its location, and so on. A comprehensive list of hazardous properties appears in *Annex III* of the Basel Convention (**TABLE 1.1**).

TABLES 1.2 and **1.3** show two different approaches to determining the type of environmental hazard incurred by different waste types.

Table 1.4 on the next page is the same as **Table 3** in the Country Report.

Additional lines and a column have been added to allow you to list extra information.

TABLE 1.4 WASTE TYPES AND QUANTITY ESTIMATES (1987)

[INDUSTRIAL AND NON-INDUSTRIAL]

WASTES	QUANTITY	HAZARDS
acids, alkalis	presumed but not measured	skin burns, corrosion damage to materials
cyanide salts	50 m^3 (company disclosure)	
chlorinated hydrocarbons	500 m^3 (company disclosure)	
PCBs**	quantities not measured	
potliner waste**	15 000 m^3	
arsenic chemicals	250 m^3 (concentration not known)	
mixed chemicals	20 m^3 (school chemicals) 200 tonnes of abandoned chemicals	
pesticides	reported, not measured above 12 tonnes	
oils	presumed, not measured	
solvents	unknown, but presumed	
fire debris (chemicals residues)	200 m^3 from one incident alone	
factory effluents	unknown volume and composition	
treatment sludges	some, but quantity not known	
ship ballast and bilge waters	unknown quantity	

** EXPLANATORY NOTES:

PCBs polychlorinated biphenyls—commonly used as cooling liquids in heavy electrical equipment, and as heat transfer fluids

Potliner waste discarded graphite lining material from aluminium smelting pots—usually has become impregnated with fluoride, cyanide and other substances produced during smelting

OPTIONAL EXERCISE 2.2

Effects

The degree to which the potential hazard of a chemical waste is actually realised depend on whether the waste comes into contact with a TARGET ORGANISM or object.

The effects of certain types of hazards also may vary. Some may be immediate, others delayed. Some effects may be reversible, others may be permanent.

The assessment of target organisms and effects is sometimes fairly simple, as when acute poisoning of workers handling waste occurs.

However, there are also many indirect and long-term effects which are difficult to calculate precisely—though of course, they can still be serious.

This exercise should be carried out as a discussion session, in which you will discuss the questions below with an expert resource person.

A simple way to start is to consider the environmental problems listed as outcomes of *Exercise 1.1*.

For each of the problems listed, discuss—

◊ which target (people, animals, objects) are directly affected? Which ones are indirectly affected?

> As an example, consider fish that are poisoned by a toxic waste discharge. The fish are the first targets.
>
> Some fish may live to be caught, and then be eaten. People eating the fish are a subsequent target.
>
> If there is publicity, and people no longer buy the fish, the fishermen lose their livelihood. They are also an indirect, but economic, target.
>
> One can continue further in this fashion ...

◊ what are the actual health effects on the targets?

◊ how serious are the effects expected to be? That is—

—severe/not severe;
—costly to remedy/not costly;
—reversible/irreversible damage;
—immediate/delayed.

Does the country report give any insight into these questions?

Another way is to consider the wastes listed in **Table 1.4** *(Exercise 2.1)*.

Again discuss, as far as your experience allows, the potential targets, the expected effects, and the seriousness of the effects arising from the wastes listed in this table if they are carelessly handled or dumped.

Summarise your discussion on a worksheet.

TASK 3 REPORT ON WASTE MATERIALS (TYPES AND QUANTITIES) GENERATED IN UDANAX, AND THE SOURCES

EXERCISE 3.1: *DIRECT OBSERVATION*

From the information already in the country report, determine the amount of hazardous waste known to be produced in Udanax.

You should comment on how reliable you believe the figures to be.

Certain information on waste types (and sometimes on volumes) can be obtained ***directly*** from information collected by the authorities. Some such source data is already compiled—for example, **TABLE 1.4**.

Some other data which is *not* in Table 1.4 can nevertheless be *inferred* from various other parts of the country report—for example, asbestos waste, polluted boreholes, and so on. The existence of certain problems, such as chlorine fires, is evidence of certain types of waste.

Some wastes can also be inferred from industry data. For example, the existence of a mercury mine and smelter and of a battery manufacturing plant will probably give rise to toxic heavy metal residues. Leather production will probably produce chromium sludges.

Official reports, if correctly compiled, are reasonably reliable—although they may not be comprehensive.

News reports and publications from NGOs frequently try to estimate waste quantities. These reports use different reporting mechanisms and different sources. They can reveal certain problems that are not covered in official reports—however, as their prime purpose is to raise concern rather than to document facts, their numerical accuracy and their interpretation of figures may vary from that of the authorities.

Use a worksheet to make a summary of the information available.

EXERCISE 3.2: *INDIRECT ESTIMATION OF INDUSTRIAL SOURCES—METHOD A*

Overseas experience with particular types of industry processes has revealed that these often produce a certain fixed quantity of particular wastes.

The use of simple coefficients published in the literature can thus give a quick answer using a pen and paper only.

Such coefficients generally exist for **industrial sources only**. Important non-industrial sources—can you identify some?—must be estimated in other ways. This exercise uses published coefficients based on **employment** statistics.

The coefficients are derived from *Reference 1.5*. In order to use these coefficients, the waste classification system has to be the same as that in the reference. Accordingly, the waste streams as shown in **TABLE 1.5** will be used.

TABLE 1.6 shows the waste load coefficients that will be used. Note that these do *not* include effluents or wastewaters discharged to sewers or drains.

Coefficients may vary for countries where employment habits differ from those in the country where the original surveys were carried out.

Results based on such coefficients are therefore a general guide only.

First, complete **Table 1.7**, using the information available in the country report.

You are now in a position to calculate some of the waste generation rates in **Table 1.8**. For this exercise, try to calculate as far as the method allows—

- ◊ solvent waste expected from the printing industry (tpa)
- ◊ heavy metal sludge from the textile and tanning industry (tpa)
- ◊ the total amount of acid/alkaline waste from all industries (tpa)
- ◊ the total hazardous waste produced by the fabricated metals industry (tpa)
- ◊ the hazardous waste produced by the aluminium smelter (tpa)

You will see that this method does not provide answers to all the questions above. Why not?

What information is available in these tables about the *strength* of the wastes, and hence the *severity* of the hazards?

Comment on the usefulness of this method in calculating—

- ◊ effluents, wastewaters, and sludges
- ◊ small quantities of hazardous wastes
- ◊ hazardous waste from non-manufacturing industries, for example printing
- ◊ national or regional hazardous waste totals for an industry sector or for a specific waste
- ◊ hazardous waste from a single company

What is the main advantage and applicability of the method? What are its weaknesses?

Note again that this method does* not *estimate non-industrial sources.

TABLE 1.5 A SIMPLIFIED INDUSTRIAL WASTE CLASSIFICATION SYSTEM

Plating/metal treatment/cyanide wastes

Acids	**Alkalis**
Inorganic wastes	**Reactive waste**
Paints/resins etc	**Organic solvents**
Putrescible wastes	**Textile waste**
Oils/oily waste	**Contaminated containers**
Inert wastes	**Organic chemicals**
Pesticides	

Explanatory Note

The type of waste classification system chosen depends on the management objectives.

- ◊ if the objective is to build disposal facilities, then a classification based on treatability is appropriate;
- ◊ if the objective is to ensure safe transport, then the UN hazard classification is best;
- ◊ if the objective is to implement a waste surveillance and waste minimisation programme, then a system based on process origin is best.

As the important casework exercise here is to consider disposal options, **Table 1.5** above is largely based on the first classification concept mentioned above.

TABLE 1.6 COEFFICIENTS USED TO ESTIMATE WASTE GENERATION IN EXERCISE 2

INDUSTRY SECTOR (ISIC) / ITEM	TONNES OF WASTE/1 000 PRODUCTION EMPLOYEES/YEAR										
	FOOD, BEVERAGES, TOBACCO	TEXTILES, CLOTHING, FOOTWEAR	WOOD, WOOD PRODUCTS	PAPER PRODUCTS, PRINTING	CHEMICALS, PETROLEUM, COAL	NON-METALLIC PRODUCTS	BASIC METAL PRODUCTS	FABRICATED METAL PRODUCTS	TRANSPORT EQUIPMENT	OTHER MACHINERY, ETC	MISCELLANEOUS MANUFACTURING
	31	32	33	34	35	36	37	38(a)	38(b)	38(c)	39
Plating/metal treatment	0.2	0.2	0.3	0.3	0.3	0.2	0.1	40.0	10.0	10.0	20.0
Acids	0.3	1.0	0.1	1.0	50.2	5.1	401.7	50.0	99.9	100.0	50.0
Alkalis	100.0	1.4	3.0	6.0	200.6	50.2	100.4	50.0	10.0	20.0	30.0
Inorganic wastes	2.0	3.4	4.0	10.0	40.1	80.3	40.2	8.0	6.0	8.0	6.0
Reactive waste	0.0	0.0	0.0	4.0	8.0	0.0	2.0	2.0	2.0	0.0	2.0
Paints/resins etc	0.0	8.6	20.0	20.0	20.1	10.0	0.0	20.0	10.0	20.0	100.1
Organic solvents	2.0	2.3	2.0	5.0	7.0	0.1	1.0	5.0	3.0	1.0	6.0
Putrescible wastes	200.0	5.0	1.0	5.0	10.0	0.0	0.0	0.0	1.0	5.0	10.0
Textile wastes	0.0	69.2	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	15.0
Oils/oily wastes	10.0	38.2	10.0	10.0	80.2	10.0	60.2	30.0	59.9	30.0	30.0
Contam. containers	2.0	1.3	2.0	2.0	20.1	1.0	2.0	3.0	2.0	10.0	10.0
Inert wastes	10.0	17.3	20.0	50.1	200.6	401.8	200.9	40.0	30.0	40.0	30.0
Organic chemicals	0.2	0.1	0.1	0.2	2.0	0.0	0.0	0.0	0.0	0.1	0.2
Pesticides	0.0	0.0	0.1	0.1	10.0	0.0	0.0	0.1	0.2	1.0	0.1

NOTE These coefficients are based on a survey of industries carried out in Canada in 1982. The situation in other countries *this* year will differ to a greater or lesser extent from this.

TABLE 1.7 EMPLOYMENT IN ISIC SECTORS (UDANAX)

INDUSTRY SECTOR (ISIC) / ITEM	FOOD, BEVERAGES, TOBACCO	TEXTILES, CLOTHING, FOOTWEAR	WOOD, WOOD PRODUCTS	PAPER PRODUCTS, PRINTING	CHEMICALS, PETROLEUM, COAL	NON-METALLIC PRODUCTS	BASIC METAL PRODUCTS	FABRICATED METAL PRODUCTS	TRANSPORT EQUIPMENT	OTHER MACHINERY, ETC	MISCELLANEOUS MANUFACTURING	TOTAL
	31	32	33	34	35	36	37	38(a)	38(b)	38(c)	39	
Production employees 1000s												

Using information available in *Part 1*, complete the above table by estimating relevant employment levels in the industry sector shown.

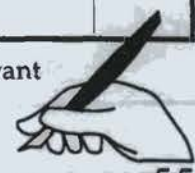


TABLE 1.8 ESTIMATE OF WASTE GENERATION IN UDANAX

	TONNES OF WASTE/1 000 PRODUCTION EMPLOYEES/YEAR				
INDUSTRY SECTOR (ISIC) / ITEM	FOOD, BEVERAGES, TOBACCO 31	TEXTILES, CLOTHING, FOOTWEAR 32	WOOD, WOOD PRODUCTS 33	PAPER PRODUCTS, PRINTING 34	
Plating/metal treatment					
Acids					
Alkalis					
Inorganic wastes					
Reactive waste					
Paints/resins etc					
Organic solvents					
Putrescible wastes					
Textile wastes					
Oils/oily wastes					
Contaminated containers					
Inert wastes					
Organic chemicals					
Pesticides					
TOTAL					

TONNES OF WASTE/1 000 PRODUCTION EMPLOYEES/YEAR							
CHEMICALS, PETROLEUM, COAL 35	NON-METALLIC PRODUCTS 36	BASIC METAL PRODUCTS 37	FABRICATED METAL PRODUCTS 38(a)	TRANSPORT EQUIPMENT 38(b)	OTHER MACHINERY, ETC 38(c)	MISCELLANEOUS MANUFACTURING 39	TOTAL

TABLE 1.9 EXAMPLE OF RAPID ASSESSMENT OF HAZARDOUS WASTE GENERATION IN AN INDUSTRIAL COUNTRY

TONNES OF WASTE/1 000 PRODUCTION EMPLOYEES/YEAR

INDUSTRY SECTOR (ISIC) / ITEM	FOOD, BEVERAGES, TOBACCO 31	TEXTILES, CLOTHING, FOOTWEAR 32	WOOD, WOOD PRODUCTS 33	PAPER PRODUCTS, PRINTING 34	CHEMICALS, PETROLEUM, COAL 35	NON-METALLIC PRODUCTS 36	BASIC METAL PRODUCTS 37	FABRICATED METAL PRODUCTS 38(a)	TRANSPORT EQUIPMENT 38(b)	OTHER MACHINERY, ETC 38(c)	MISCELLANEOUS MANUFACTURING 39	TOTAL
Production employees 1000s	37.7	51.6	14.9	22.0	12.4	8.9	9.3	26.8	47.0	36.8	19.7	287.2
Plating/metal treatment	8	11	4	7	4	2	1	1,071	470	368	394	2,338
Acids	11	53	1	22	622	45	3,736	1,339	4,695	3,679	985	15,190
Alkalis	3,770	64	45	132	2,487	447	934	1,339	470	736	591	11,024
Inorganic wastes	75	178	60	220	497	715	374	214	282	294	118	3,029
Reactive waste	____	____	____	88	99	____	19	54	94	____	39	393
Paints/resins etc	____	445	298	441	249	89	____	536	470	736	1,971	5,234
Organic solvents	75	117	30	110	87	1	9	134	141	37	118	860
Putrescible wastes	7,539	258	15	110	124	____	____	____	47	184	197	8,475
Textiles wastes	____	3,570	____	____	124	____	____	____	____	____	296	3,990
Oils/oily wastes	377	1,972	149	220	995	89	560	803	2,817	1,104	591	9,678
Contam. containers	75	66	30	44	249	9	19	80	94	368	197	1,231
Inert wastes	377	892	298	1,102	2,487	3,576	1,868	1,071	1,409	1,472	591	15,143
Organic chemicals	8	4	1	4	25	____	____	____	____	4	4	50
Pesticides	____	1	1	2	124	____	____	3	9	37	2	180
TOTAL	12,315	7,641	933	2,504	8,172	4,974	7,520	6,645	10,997	9,017	6,095	76,814

Source: Industrial Waste Strategy, State of Victoria, Australia, 1985

EXERCISE 1.3: *INDIRECT ESTIMATION OF INDUSTRIAL SOURCES–METHOD B*

This exercise uses published coefficients based on industrial output statistics.

The coefficients used are those in **Reference 1.3.** This uses a waste classification that is very general, but which allows calculation of the concentrations of some polluting constituents.

TABLE 1.10 shows some extracts from *Reference 1.3* that relate to the printing, paper, textile and tanning industries. However, as the full set of tables is quite extensive, the entire reference document will be required to complete all parts of this exercise. Copies are available from the *World Health Organisation, Geneva.*

First of all, work out the industrial output in the relevant industrial sectors in Udanax, using information given in *Part I*, and enter this in the appropriate columns of **TABLE 1.10.**

Try to calculate as far as the method allows, the amount of—

1 solvent waste expected from the printing industry (tpa)
2 heavy metal sludge from the textile and tanning industry (tpa)
3 acid/alkaline waste from all industries (tpa)
4 hazardous waste produced by the fabricated metals industry (tpa)
5 hazardous waste produced by the aluminium smelter (tpa).

Again, the exercise does not provide answers to all questions.

Comment on the usefulness of this method in calculating—

- ◊ effluent, wastewater, and sludge volumes for industry
- ◊ small quantities of hazardous wastes
- ◊ hazardous waste from non-manufacturing industries; printing, for example
- ◊ national or regional hazardous waste totals for an industry sector or a specific waste type
- ◊ hazardous waste from a single company.

What is the main advantage and applicability of the method?

Note again that this method does not estimate non-industrial sources.

TABLE 1.10 WORKING TABLES FOR CALCULATING WATER POLLUTION AND WASTE LOADS FROM INDUSTRIAL SOURCES

Working table for the calculation of water pollution and waste loads from industrial effluents

INDUSTRY AND PROCESS	UNIT	Production 10^3 units/year	pH	WASTE VOLUME		BOD_5		COD	
				m^3/unit	10^3m^3/year	kg/unit	t/year	kg/unit	t/year
BEVERAGE INDUSTRY									
3131a Alcohol distilleries	t of prod			63		220			
3133a Malt and malt liquor manufacturing	m^3 of beer			4.5		1.1			
3133b Beer fermenting	–"–			10		7.5			
3133c Total for beer	–"–			14.5		8.6			
3133d Wine production	m^3 of wine			4.8		0.26			
3134 Soft drinks factory	t of prod			7.1		2.5			
MANUFACTURE OF TEXTILES									
3211a Wool *(scouring included)*	t of prod		2-10	544		314		1 140	
3211b Wool *(no scouring)*	–"–		2-10	537		87		347	
3211c Cotton	–"–		8-11	317		155			
3211d Rayon	–"–			42		30		52	
3211e Acetate	–"–			75		45		78	
3211f Nylon	–"–			125		45		78	
3211g Acrylic	–"–			210		125		216	
3211h Polyester	–"–			100		185		320	
MANUFACTURE OF LEATHER									
3231a Leather tanneries	t of hides		1-13	52		89		258	
WOOD AND WOOD PRODUCTS									
3511a Plywood manufacturing	10^3m^2 prod		10.5	4.1				7.3	
3511b Fibreboard manufacturing	t of prod			20		125			
SUBTOTAL a									

Reprinted from: *Rapid Assessment of Sources of Air, Water, and Land Pollution*
WHO Offset Publication N° 62, WHO, 1982

Note These tables show a *selection* of pollution and waste loads as given in the original reference. For a full set of coefficients, the WHO document should be consulted.

Area ..... Year .....

SS		TDS		OIL		N		OTHERS					
kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year
257		385											
0.2													
14.5													
14.7													
		1.3						alkalinity 3.7					
196		481		191				Cr 1.33		Phenols 0.22			
43		365		—				Cr 1.33		Phenols 0.17			
70		205											
55		100											
40		100											
30		100											
87		100											
95		150											
138		351		20		15		Cr 3.5				S^{2-} 7	
1.1		5.1				0.24				Phenols 0.5			
20													

Working table for the calculation of water pollution and waste loads from industrial effluents

INDUSTRY AND PROCESS	UNIT	Production 10^3 units/year	pH	WASTE VOLUME		BOD_5		COD		
				m^3/unit	$10^3 m^3$/year	kg/unit	t/year	kg/unit	t/year	
MANUFACTURE OF PULP, PAPER AND PAPERBOARD										
3411a Sulfate *(kraft)* pulp	t of prod			61.3		31				
3411b Sulfate pulp	–"–			92.4		130				
3411c Semi-chemical pulp	–"–			47		27				
3411d Paper mills	–"–			54		8				
3411e Paper mills *(with water recovery system)*	–"–			22		6.4				
MANUFACTURE OF INDUSTRIAL CHEMICALS										
3511 BASIC INORGANIC CHEMICALS				only						
3511a Hydrochloric acid	t of prod			cooling water		Negl.		Negl.		
3511b Sulfuric acid	–"–			1.62		Negl.		Negl.		
3511c Nitric acid	–"–			c.w		Negl.		Negl.		
3511d Phosphoric acid *(without pond)*	t P_2O_5			670						
3511e Phosphoric acid *(with pond)*	–"–		1-1.6	2.8						
3511f Phosphoric acid *(thermal process)*	–"–			4.6						
3511g Ammonia	t of prod			2.1		0.2		0.26		
3511h Sodium hydroxide *(mercury cell)*	t of Cl_2									
3511i Sodium hydroxide *(diaphragm cell)*	–"–									
3511j Hydrofluoric acid	t of prod			11.0		Negl.		Negl.		
3511k Chrome pigments	t of prod									
3512 FERTILISERS										
3512a Normal superphosphate (19% P_2O_5)	t of prod	Major effluents are those from the production of phosphoric acid (3511d or e and sulfuric acid 3511b)								
3512b Triple superphosphate (48% P_2O_5)						ditto				
3512c Ammonium phosphate (20% P_2O_5)						ditto				
3512d Diammonium phosphate (20% P_2O_5)						ditto				
SUBTOTAL b										

Area ..... Year .....

SS		TDS		OIL		N		OTHERS					
kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year
18		166											
26		258											
12.5		134											
23		37											
15.2		30											
Negl.		Negl.		Negl.		Negl.							
Negl.		Negl.		Negl.		Negl.							
Negl.		Negl.		Negl.		Negl.							
								P_2O_5		F-		Cu	
3 772						6		32.3		22.2		0.74	
								P_2O_5		F-		SO_4	
						0.15		25.2		11.2		82.2	
								P_2O_5				SO_4	
								1.0				8.4	
				10		0.12							
								NaOH		Hg		CH^a	
								13.5		0.15		0.7	
								NaOH				NaOH	
								Negl.				Negl.	
2 711								F- 45.4		Zn 0.4			
70.4								Cr^{+6} 30.5		Cr 21.5		Zn 8.6	
Major effluents are those from the production of phosphoric acid (3511d or e and sulfuric acid 3511b)													
				ditto									
				ditto									
				ditto									

Working table for the calculation of water pollution and waste loads from industrial effluents

INDUSTRY AND PROCESS	UNIT	Production 10^3 units/year	pH	WASTE VOLUME		BOD_5		COD	
				m^3/unit	$10^3 m^3$/year	kg/unit	t/year	kg/unit	t/year
INDUSTRIAL CHEMICALS -CTD									
3512 *PESTICIDES*									
3512e DDT	t of prod			5.3					
3512f Chlorinated hydro-carbon herbicides	–"–		0.5	3.6		22.7		30	
3512g Carbonate	–"–		7-10			0			
3512h Parathion	–"–		2			0			
3513 *SYNTHETIC RESINS, PLASTICS AND FIBRES*									
3513a Rayon fibres	t of prod			471		68.4		355	
3513b Vulcanisable elastomers *(synthetic rubber)*	–"–			19.6		2.6		20	
3513c Polyolefine *(polyethelenes)*	–"–			0					
3513d Polystyrene resins and copolymer	–"–			5.7		Negl.		Negl.	
3513e Vinyl resins (PVC)	–"–			12.5		10			
3513f Polyester and alkyd resins	–"–								
3513g Phenolic resins	–"–		6.4	4		47.3			
3513h Acrylic resins *(bulk polymer)*	–"–			0					
3513i Acrylic resins *(emulsion polymer)*	–"–			0.5		1.5			
3521 *PAINS, VARNISHES AND LACQUERS*				Negligible water pollution					
3522 Manufacture of Drugs and Medicines									
3522a Erythromycin	t of prod		7.2	4 000		13 800			
3522b Streptomycin	–"–		8.5	4 000		7 400			
3522c Tetracyclin	–"–		9.4	4 000		5 200			
3522d Penicillin	–"–		4.5	4 000		12 800			
3522e Aureomycin	–"–		8	4 000		14 280			
3523 *SOAP AND CLEANING PREPARATIONS*									
3523a Soap by kettle boiling	t of prod			4.5		6		10	
3523b Soap from fatty acids	–"–			3.1		13.5		29.5	
3523c Detergents	–"–			2.8		0.4		1.2	
SUBTOTAL c									

Area ..... Year .....

SS		TDS		OIL		N		OTHERS					
kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year
								H_2SO_4 1 166		EHS[a] 38		CB[b] 38	
9		365						CP[c] 4		CP[c] 0.85		Cl 187	
0													
0													
193.0		2 447.0											
12.0				1.2									
Negl.													
1.5													
1.6		0.5						Phenols 6.6					
5 600													
1 776													
4				0.9						ZnO 9			
23				3.5									
0.7				0.4									

Working table for the calculation of water pollution and waste loads from industrial effluents

INDUSTRY AND PROCESS	UNIT	Production 10^3 units/year	pH	WASTE VOLUME		BOD_5		COD		
				m^3/unit	10^3m^3/year	kg/unit	t/year	kg/unit	t/year	
INDUSTRIAL CHEMICALS -CTD										
3523 *SOAP AND CLEANING PREPARATIONS: CTD*										
3523d Glycerine refining	–"–			10 (1 120)		20		40		
3523e Liquid detergents	–"–					5.3		7.9		
3529a Animal glue *(from fleshing)*	–"–			421		2 500		4 800		
3529b Animal glue *(from hides)*	–"–			457		580.0		1 420		
3529c Animal glue *(from chrome stock)*	–"–			426		280		650		
3530 ***PETROLEUM REFINING***										
3530a Typical topping refineries	10^3m^3 feedstock			66		3.4		37		
3530b Old topping refineries	–"–					190				
3530c Low-cracking refineries	–"–			79		71.5		200		
3530d High-cracking refineries	–"–			93		72.9		217		
3530e Lubrication refineries	–"–			117		217		543		
3530f Petrochemical refineries	–"–			108		171.6		463		
3530g Integrated refineries	–"–			234		197		328		
3540 ***ASPHALT PRODUCTS***										
3540a Asphalt paving				No significant pollution						
3540b Asphalt roofing products				50		8				
SUBTOTAL d										

Area ..... Year .....

SS		TDS		OIL		N		OTHERS					
kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year	kg/unit	t/year
4				2									
0.6													
4 280													
1 920													
400													
								Phenols				TOC	
11.7				8.3		1.2		0.034				8.0	
								Phenols					
				115		24		4.3		S^{2-} 5			
								Phenols				TOC	
27				27		10		2.86				45.7	
								Phenols				TOC	
18.2				31.4		28.3		4.0		S^{2-} 0.9		41.5	
								Phenols				TOC	
71.5				120		24.1		8.3				108	
								Phenols				TOC	
48.6				52.9		34.3		7.7		S^{2-} 0.86		148.9	
								Phenols				TOC	
58				75		20.5		3.8		S^{2-} 2.9		139	
40													

Working table for the calculation of some industrial solid waste and sludge loads

	Industry and Process	Production Unit	Production 10^3 units/year	Solid Waste		Nature of Waste	Reference
				kg/unit	t/year		
3720n	Primary mercury and refining	t		207 000		Calcine residue (As, Pb, Cu, Zn, Ni, Hg, Mn, Sb, Cd, Cr)	14
3720o	Primary titanium refining	t		330		Chlorinator and condenser sludges (V, Cr, Zr, Ti, Cl)	14
3840	Electroplating of Cu anodes	t of Cu		9*		Cu in the effluent treatment sludge (cyanide may also be present)	3, 15
	Electroplating of Ni	t of Ni		4*		Ni in the effluent treatment sludge	3, 15
	Electroplating of Cr	t of Cr_2O_3		250*		Cr in the effluent treatment sludge	3, 15
	Electroplating of Zn anodes	t of Zn		220*		Zn in the effluent treatment sludge (cyanides may also be present)	3, 15
3840	Dry docks	—		N/A		Oily sludge from cleaning tanker ships; toxic sludge from cleaning tanker ships	
4101a	Lignite powered power plants [B]	Mwh		10(A) [A]		Ash from chimneys and air pollution control equipment	3
4101b	Bituminous coal powered power plants	Mwh		4.3 (A) [A]		Ash from bottom and air pollution control equipment	3
		Mwh				Polychlorinated biphenyls from transformers	
3211b	Wool dyeing and finishing	t		38		Flock, dye and chemical containers etc	5
		t		25*		Pretreatment screening fibres	
		t		100		Pretreatment screening fibres	
3211c	Cotton (yarn prep)	t		32		Fibre and yarn	5
	Weaving	t		11		Fibre, yarn and cloth	
	Dyeing and finishing	t		7		Cloth and flock	
		t		0.8*		Pretreatment screening fibres	
		t		2.8		Pretreatment screening fibres	
		t		20*		Wastewater treatment sludge	
		t		2 300		Wastewater treatment sludge	

Working table for the calculation of some industrial solid waste and sludge loads

INDUSTRY AND PROCESS	PRODUCTION UNIT	PRODUCTION 10^3 UNITS/YEAR	SOLID WASTE		NATURE OF WASTE	REFERENCE
			KG/UNIT	T/YEAR		
3231a Complete chrome tanneries: cattle [C]	1000 hides		450*		Process wastes (scrap products etc)	6
	1000 hides		550			
	1000 hides		910*		Process wastes containing Cr, Pb, Zn	
	1000 hides		1 770		Process wastes containing Cr, Pb, Zn	
	1000 hides		90*		Wastewater screenings containing Cr, Pb, Zn	
	1000 hides		390		Wastewater screenings containing Cr, Pb, Zn	
	1000 hides		300*		Wastewater sludge containing Cr, Pb, phenols	
	1000 hides		2 700		Wastewater sludge containing Cr, Pb, phenols	
3231b Complete vegetable tanning: cattle [C]	1000 hides		230*		Process wastes (scrap products etc)	6
	1000 hides		250		Process wastes (scrap products etc)	
	1000 hides		910*		Process wastes containing Cr, Pb, Zn	
	1000 hides		1 770		Process wastes containing Cr, Pb, Zn	
	1000 hides		10*		Wastewater screening containing Cr, Pb, Zn	
	1000 hides		40		Wastewater screening containing Cr, Pb, Zn	
3231c Leather finishing only: cattle [C]	1000 hides		75*		Process wastes (scrap products, dust etc)	6
	1000 hides		84		Process wastes (scrap products, dust etc)	
	1000		55*		Process wastes containing Cr, Pb	
	1000		161		Process wastes containing Cr, Pb	
3411 Pulp mills	t		50		Cellulose, lignins, reducing sugars etc	1

NOTE * Factors marked with an asterisk yield the solid waste loads on a dry basis.

A A is the percentage of ash content in the fuel.

B If no air emission controls are employed, only 70% of the ash quantities calculated above are obtained.

C For sheepskin tanneries similar wastes are normalised per tonne of product. One cowhide weighs 25 kg, and one sheep/goat skin weighs 3 kg.

EXERCISE 3.4: *INDIRECT ESTIMATION OF INDUSTRIAL SOURCES–METHOD C*

This exercise uses a set of coefficients developed from experience in OECD countries. They are only reliable for industrialised regions with a mixed economy.

Countries with economies dominated by a single sector such as agriculture are advised not to use the coefficients in this exercise.

TABLE 1.11 shows the coefficients used. Note that a strong influence on these coefficients is the chemicals sector, which typically contributes 4% of the GDP, but accounts for 50% to 70% of the total hazardous waste.

The partitioning of the coefficient among different waste types is shown in **TABLE 1.12.**

From the data in the country report, determine if Udanax is—

① an industrial or agricultural economy

② how significant chemicals production is in the industry sector.

On the basis of your conclusions, use an appropriate coefficient from **TABLE 1.11 (a)** or **(b)** to calculate the total amount of hazardous waste expected in Udanax, in all categories. Cross check these with the amount expected on the basis of total population. Use appropriate indicators—for example, GDP/person, average national income, or others to make a judgement as to how far from OECD expectations Udanax will be.

Next, examine the waste types as given in **TABLE 1.12.** Discuss—over a maximum of 20 minutes—how the relative proportions might be different from Udanax.

Finally, try to calculate as far as the method allows—

1 solvent waste expected from the printing industry (tpa)

2 heavy metal sludge from the textile and tanning industry (tpa)

3 acid/alkaline waste from all industries (tpa)

4 hazardous waste produced by the fabricated metals industry (tpa)

5 hazardous waste produced by the aluminium smelter (tpa).

Again, note that the exercise does not provide answers to all questions.

Comment on the usefulness of this method in calculating—

◊ effluents, wastewaters, and sludges volumes for industry

◊ small quantities of hazardous wastes

◊ hazardous waste from non-manufacturing industries; printing, for example

◊ national or regional hazardous waste totals for an industry sector or a specific waste

◊ hazardous waste from a single company.

What is the main advantage and applicability of this method?

Note that this method does not estimate non-industrial sources.

TABLE 1.11 COEFFICIENTS OF TOTAL WASTE PRODUCTION IN OECD COUNTRIES*

(a) per unit of GDP	
Total generation of hazardous waste	6×10^3 t/US $ B GDP/year to 3×10^3 t/US $ B GDP/year
Range adjusted according to—	
■ relative contribution of *industry* to GDP	
■ relative importance of *chemical sector* within the industry	

(b) per value of output in sector
Total generation of hazardous waste
■ 1 tonne/$15 000 product output/year in chemical sector
■ 1 tonne/$300 000 product output/year in other sectors
To be adjusted for any obvious bias in sector activities

(c) per unit of population
Total generation of hazardous waste:
■ 100 kg/person/year for highly industrialized countries with a strong chemical sector
■ 6 kg/person/year for OECD countries with predominantly agricultural economies

Source: OECD

* *Organisation for Economic Cooperation and Development:* Australia, Austria, Belgium, Canada, Denmark, Federal Republic of Germany, Finland, France, Greece, Iceland, Ireland, Italy, Japan, Luxemburg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States of America.

TABLE 1.12 RELATIVE PROPORTIONS OF HAZARDOUS WASTE TYPES IN OECD COUNTRIES

The figures below give the approximate proportions of hazardous waste types for countries with a well developed, general mixed industry base.

The proportions will be different for non-industrialized countries, or for countries whose economies depend strongly on a single activity sector.

TYPE	%
Solvent	6
Paints	4
Adhesives	0.5
Corrosives	35
Oily wastes	20
Metal finishing (including cyanides)	5
Mercury bearing	0.4
Biocides	0.6
Phenolics	0.5
Other organics	6
Other metal bearing residues	10
Other inorganics	9
Medical waste	3

Source: OECD

EXERCISE 3.5: *INDIRECT ESTIMATION OF WASTE SOURCES*

'INVENT' COMPUTER MODEL

This is an extension of **EXERCISE 3.2**, but as it also considers effluent, it gives some of the information normally provided by **EXERCISE 3.3**. Note that INVENT uses different coefficients to those in TABLE 1.6.

INVENT (for 'Inventory') is a computer programme developed for the World Bank by ASHACT Ltd (UK). It uses waste generation coefficients from mostly European sources. The full INVENT programme takes some time to run on a PC, so this exercise works with output tables for *UDANAX* that have already been calculated.

TABLE 1.13 shows the calculation results for heavy metal wastes from the leather/textile sector (ISIC Code 32). As this includes listings of wastewaters as well as chemical wastes and sludges, the totals are not immediately comparable with those from EXERCISE 3.2.

TABLE 1.14 is a working table where the results of outputs such as TABLE 1.13 and similar can be inserted. **TABLE 1.15** shows the total of such compilations after conversion to correspond with some of the categories used for *EXERCISE 3.2*.

Using data from *TABLE 1.13*, estimate and put into *TABLE 1.14* the amount of heavy metal sludge expected from the textile and leather industry together (Industry Group 32).

Check this against the value given in *TABLE 1.15*, and also against the results of **EXERCISE 3.2** (*TABLE 1.7* and *1.8*). The answer will not correspond to that in *TABLE 1.15* as this includes also dilute washwaters.

Note that you will yourself have to identify which items in *TABLE 1.13* correspond to 'heavy metal sludges' in order to provide the answer to this question.

You may wish to use *TABLES 1.13* and *1.14* to calculate other types of wastes from Industry Group 32.

TABLE 1.13 INVENT RUN DETAILS

AREAS FROM FILE	—	UDANAX							
WASTE CATEGORY	—	HEAVY METALS							
ISIC CODE		31	32	33	34	35	36	37	38	39
FACTOR		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CODE		2	2	2	2	2	2	2	2	2
ORIGIN(S)		IT	IT	IT	IT	IT	IT	IT	IT	IT
INDUSTRY EG. 32	—	GROUPS OR GENERIC?						GROUPS		

UDANAX

ISIC	DESCRIPTION	WASTE CODE		QUANTITY T/YR	FACTOR	T/YR*FACTOR	SD
32	SLUDGE FROM CHEM/PHYS WASTEWATER TM	F1IMXN	NNY	4370.416	1.0	4370.4160	0.00
32	SLUDGE FROM CHEMICAL WASTEWATER TMT	F1IMXN	NNY	1688.032	1.0	1688.0320	0.00
32	SLUDGE FROM GALVANISING TEXTILES	F1IMXN	NNY	27.608	1.0	27.6080	0.00
32	SLUDGE FROM SETTLEMENT	F1IMXN	NNY	376.188	1.0	376.1880	0.00
32	SLUDGE FROM CHEMICAL WASTEWATER TMT	F1OMXN	NNY	3448.680	1.0	3448.6800	0.00
32	SLUDGE FROM DYING	F1OMXP	NNY	3.712	1.0	3.7120	0.00
32	SLUDGE FROM PRIMARY SEDIMENTATION	F1OMXP	NNY	44057.844	1.0	44057.8440	0.00
32	PRINTING INK PASTE	F1OMNX	NNY	37.584	1.0	37.5840	0.00
32	SLUDGE FROM CHEM/PHYS WASTEWATER TM	F1OMNX	NNY	347.768	1.0	347.7680	0.00
32	TOXIC SLUDGE	F1VMMM	NNY	13.804	1.0	13.8040	0.00
32	SLUDGE FROM BIOLOGICAL WASTEWATER T	F1VMNP	NNY	4902.160	1.0	4902.1600	0.00
32	SLUDGE FROM CHEMICAL AND BIOLOGICAL	F1VMNP	NNY	1567.624	1.0	1567.6240	0.00
32	SLUDGE FROM SETTLEMENT	F1VMNX	NNY	3.944	1.0	3.9440	0.00
32	SLUDGE FROM WASTEWATER TREATMENT	F1VMNX	NNY	480.356	1.0	480.3560	0.00
32	DEWATERED TOXIC SLUDGE	F2VMXN	NNY	339.300	1.0	339.3000	0.00
32	DEWATERED SLUDGE FROM FILTERPRESS	F2VMXP	NNY	1316.832	1.0	1316.8320	0.00
32	USED OIL	L2OMNC	XNY	2.088	1.0	2.0880	0.00
32	USED ETHYL ACETATE	L3VMNX	PNY	43.848	1.0	43.8480	0.00
32	PROCESS WATER	L4BMXN	NSY	24052.832	1.0	24052.8320	0.00
32	SODIUM CHLORIDE SOLUTION	L4IMXN	NNY	175.624	1.0	175.6240	0.00
32	WASH WATER FROM PRINTING ROLLERS	L4IMNX	NNY	0.464	1.0	0.4640	0.00
32	NICKEL FROM GALVANIC TMT TEXTILES	L4IMXN	XNY	71.688	1.0	71.6880	0.00
32	WATER FROM GAS SCRUBBING	L4OMXN	NXY	30.044	1.0	30.0440	0.00
32	WATER FROM LEATHER DRESSING	L4VMXN	NNY	28.884	1.0	28.8840	0.00
32	PROCESS WATER	F11MXN	NSY	79568.924	1.0	79568.9240	0.00
32	TREATED WASTEWATER	L4VMXN	NSY	355935.792	1.0	355935.7920	0.00
32	WASH WATER FROM METAL WASHING	L4XMXN	NNY	5.684	1.0	5.6840	0.00
32	WATER FROM GAS SCRUBBING	L4XMXN	NNY	1.856	1.0	1.8560	0.00
32	EXHAUSTED ACTIVATED CARBON	S1VMNC	XNY	3.016	1.0	3.0160	0.00
32	RESIDUAL FROM SHAVING	S2BMNC	NNY	73.892	1.0	73.8920	0.00
32	LEATHER TRIMMINGS	S2BMNX	NNY	5.104	1.0	5.1040	0.00
32	TIN OXIDE	S2IMNN	NNY	3.712	1.0	3.7120	0.00
32	USED BATTERIES	S3IMAN	PNY	6.380	1.0	6.3800	0.00
32	SAWDUST FROM TANNERY	S3XMNC	NNY	200.680	1.0	200.6800	0.00
				TOTAL FOR MAJOR AREA		523192.3640	
				TOTAL FOR 32		523192.364000	
				TOTAL		523192.3640	
				TOTAL FOR 32		523192.364000	

TABLE 1.14 INVENT WORKING TABLE

Waste amounts in tonnes per year for UDANAX

INDUSTRY	ISIC Code	Employees x 1000	Washwater/Effluent	Liquid Acid/Alkali	Heavy Metals	Toxic Inorganics	Reactive Waste	Non Toxic Inorganics	Solvents/Oils	Organic Sludges	Organic Chemicals	Pesticides	Chlorohydrocarbons	Biodegradable Waste
Food Industry	31	80												
Textile/Wearing Apparel	32	116												
Wood and Wood Products	33	0												
Paper and Paper Products	34	60												
Chemical Industry	35	38												
Non-Metallic Minerals	36	2												
Basic Metal Industry	37	15												
Fabrication of Machinery	38	44												
Other Manuf. Industry	39	6												
TOTAL														

TABLE 1.15 INVENT RESULTS

Waste amounts in tonnes per year for UDANAX

INDUSTRY	ISIC Code	Employees x 1000	Washwater/Effluent	Liquid Acid/Alkali	Heavy Metals	Toxic Inorganics	Reactive Waste	Non Toxic Inorganics	Solvents/Oils	Organic Sludges	Organic Chemicals	Pesticides	Chlorohydrocarbons	Biodegradable Waste
Food Industry	31	80	12237674	118	464	128	3	220356	290	379649	7246521	51	0	460469
Textile/Wearing Apparel	32	116	1169232	27330	523192	15100	0	603	11281	98845	106778	0	612	129896
Wood and Wood Products	33	0	0	0	0	0	0	0	0	0	0	0	0	0
Paper and Paper Products	34	60	254859	141	2441	1838	0	307	1714	62221	73703	0	126	84991
Chemical Industry	35	38	1362497	32731	12138	3705	74	29969	15925	35537	433068	4318	6642	4943
Non-Metallic Minerals	36	2	139674	0	157	235	0	8081	14	465	538	0	0	872
Basic Metal Industry	37	15	294551	3250	24148	22451	0	55448	460	35	3747	0	208	188
Fabrication of Machinery	38	44	552782	1824	4124	2786	0	5648	1369	322	4432	0	322	322
Other Manuf. Industry	39	6	241	9	245	142	0	52	51	417	171	0	5	5
TOTAL			16011510	65403	566909	46385	77	320464	31104	577491	7868958	4369	7915	681686

The above results are initial run calculations using the full waste database supplied with INVENT

SUPPLEMENTARY EXERCISE 3.5A

USE OF 'INVENT' COMPUTER MODEL

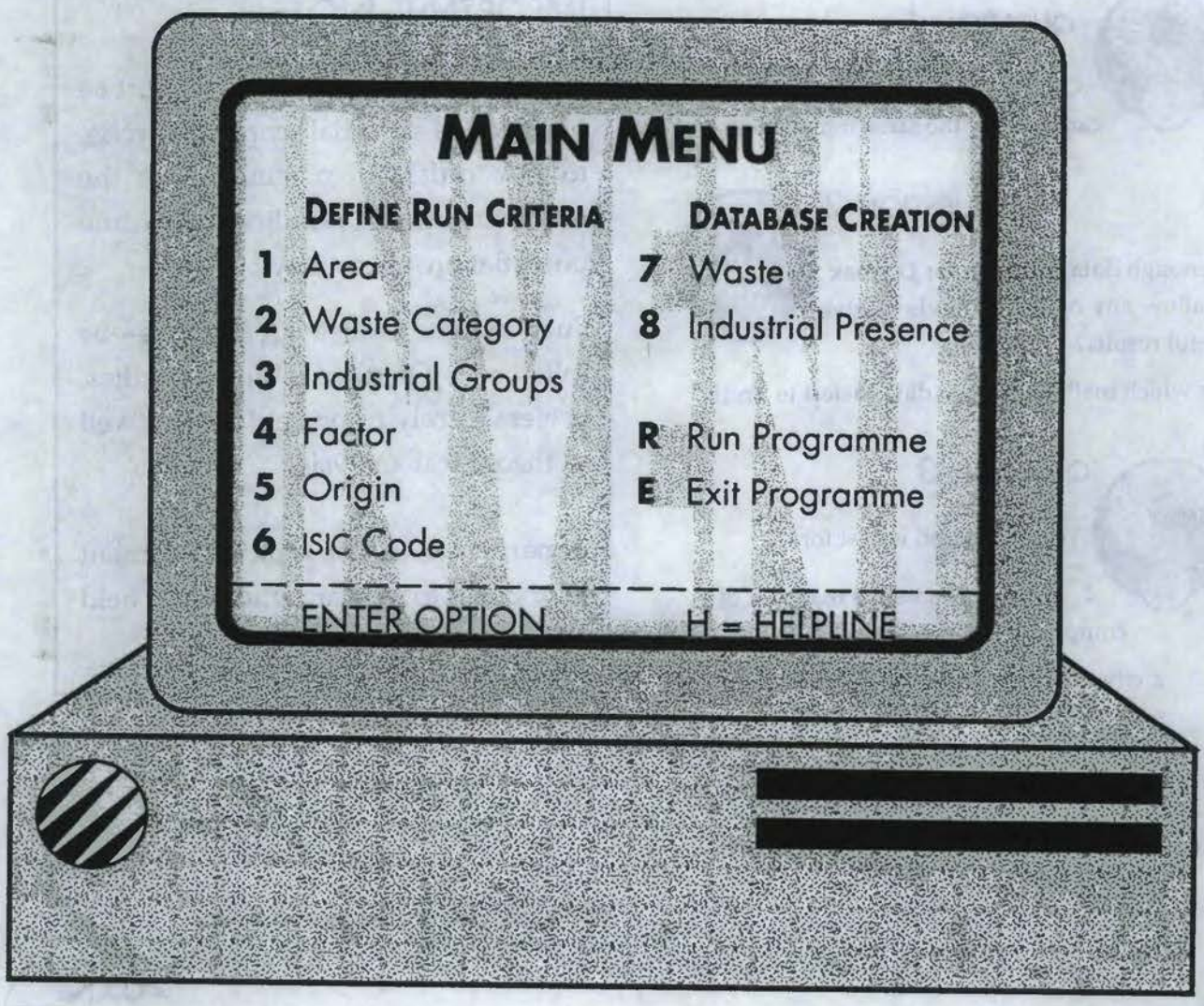
If you have a demonstration diskette of INVENT (available from UNEP IEO/PAC), load it into your PC (IBM compatible, MSDOS) by accessing the programme INVENT in the directory of the same name.

You will now be able to try out various functions of the programme, according to the menus attached.

You can try to simulate *EXERCISE 3.5*. However, as the database has been greatly reduced in the demonstration version, you will not get the same result.

Choose: AREA: Udanax.

The main menu for INVENT is shown below. An example of the output was shown in *TABLE 1.13*.



The full version of *INVENT* is available from the *World Bank* or from *ASHACT*.

EXERCISE 3.6: *COMPARISON OF METHODS*

The previous exercises employ different approaches, and use different input data or coefficients derived from different sources.

Each method has its advantages and limitations—no method is perfect.

QUESTION 1

Comment on whether each method can provide the same information.

QUESTION 2

Is enough data available for Udanax to allow any of the methods to give useful results?

For which method is input data easiest to find?

QUESTION 3

Which method is best for—

- ◊ the environmental manager of a company?
- ◊ a city engineer providing waste disposal sites?
- ◊ a consultant hired to assess the need for a centralised, national disposal facility?
- ◊ an environmental administrator in a national government?

IMPORTANT NOTE

All rapid assessment methods must be regarded as an initial scoping exercise, to give orders of magnitude for the waste stream, and to indicate where the potential problems may be.

Such methods must—in all cases—be followed by further in-depth studies, preferably relying on field work as well as theoretical analysis.

A particular use of rapid assessment methods is to indicate where such field work should be carried out.

Summarise your answers on a worksheet.

EXERCISE 3.7: *INDUSTRIAL WASTE SURVEY*

It is intended to follow up the rapid assessment procedure in Udanax with a field survey of manufacturing industry.

A questionnaire form is being developed which will be initially posted to a random sample of companies of all sizes.

A team of experts will subsequently visit each company to verify the accuracy of the information—or, if the form has not been returned, to complete the form on behalf of the owner.

You are required to indicate to the person who is preparing the form which information you want to collect.

QUESTION 1

List the essential information you want to collect from each enterprise. Limit yourself to ten items from **TABLE 1.16**.

QUESTION 2

Who—i.e. which organisation—should carry out the survey? Explain your choice.

QUESTION 3

How will the survey information be compiled and stored?

Comment how the information will help you make decisions.

Summarise your results on a worksheet. Attach a copy of the questionnaire that you have prepared.

TABLE 1.16 OPTIONS MENU FOR QUESTIONS IN A WASTE SURVEY QUESTIONNAIRE

COMPANY IDENTITY

Company	Key personnel
Business activity	Products
Productions outputs	Employee number
Address	

WASTE HANDLING

Produced	Stored
Handled	Treated
Discharged	Transported
Recycled	Exchanged
Avoided	Sewered
Exported	Imported
Removed	Spilt

CHEMICALS

Produced	Purchased
Stored	Major impurities

COSTS

Storage costs	Transport fees
Disposal costs	

WASTE IDENTITY

Names/types	Codes
Composition/components	Sources/origins
Properties/hazards	Forms

WASTE QUANTITIES

Volumes/weight / units	Periodicity
Variability	Packages
On-site	Off-site

WASTE MANAGEMENT

Monitoring	Surveillance
Construction of plant	Approvals
Permits/licences	Manifests
Reporting	Regulated
Regulations/standards	Laws
Personnel responsible	Laboratories
Consultants	Company policies

Other considerations may also be included

SUPPLEMENTARY EXERCISE 3.7A

Small Generator Survey

This is a discussion exercise designed to explore the particular problems of small generators of hazardous waste.

First of all, list some small generators who are not normally considered as "industry". Some examples are motor car service stations and repair shops, small printing enterprises, dry cleaners, horticulturists (see also *TABLE 1.2*, page 42).

Nevertheless, many small manufacturing companies will also be waste generators.

QUESTION 1

What small generators of hazardous wastes are likely to be important in Udanax?

QUESTION 2

Which organisation will have a list of small enterprises?

QUESTION 3

How can you best survey such enterprises?

Next, consider that most small generators will not be technical people, and hence will know nothing about chemicals, or wastes, or environment.

QUESTION 4

What would be useful questions to ask if you were surveying such small generators?

QUESTION 5

How would you compile the results?

Summarise your discussion on a worksheet.

EXERCISE 3.8: *OTHER NON-INDUSTRIAL SOURCES*

Discuss in the working group some potentially important non-industrial sources of hazardous waste in Udanax.

Some sources have been hinted at in the country report. Others may come out of your discussion, based on reading and personal experience. Try to think how these wastes might be being disposed of in Udanax at the moment.

Some non-industrial origins may be quite important sources of hazardous waste.

Some wastes, such as hospital wastes, may even present new forms of hazard that are not common in industrial residues—for example, infectiousness, radioactivity.

Discuss how you might estimate the extent of generation of such wastes.

Summarise your results on a worksheet.

EXERCISE 3.9: *OTHER FORMS OF WASTE ESTIMATION*

Discuss other forms of hazardous waste estimation that may be able to be used in Udanax.

Consider implications of—

- ◊ cost
- ◊ manpower
- ◊ follow-up
- ◊ expertise
- ◊ data processing
- ◊ confidentiality
- ◊ reliability

You may use *TABLE 1.17* as a starting point for discussion.

Which methods are the most useful for particular waste streams?

The earlier forms of measurement you have examined so far are mainly useful for industrial sources.

You should here give particular consideration to how non-industrial sources can be evaluated.

Summarise your results on a worksheet.

TABLE 1.17 OPTIONS MENU FOR WASTE MEASUREMENT

1	Factory visits
2	Interviews with contractors
3	On-site inspections
4	Interviews with other government inspectors
5	Waste disposal records at sites
6	Special conferences/seminars
7	Industry associations to advise
8	Local government staff/inspectors
9	Import records of chemicals (census)
10	Chemicals manufactured (census)
11	Interviews with engineering consultants
12	Factory monitoring data
13	Random visits to industrial estates
14	Fire service records
15	Industrial Associations' records or surveys

NOTE This list is not exhaustive. Other methods may also be practicable.

KEY IMPLICATIONS Comprehensiveness, effectiveness, efficiency, cost, manpower, expertise, consistency, periodicity, data processing, confidentiality.

TASK 4 IDENTIFY THE KEY SOCIO-ECONOMIC INFLUENCES LIKELY TO IMPACT ON A FUTURE WASTE MANAGEMENT STRATEGY

The benefits and costs of waste management initiatives will be unevenly distributed.

Accordingly, such initiatives will have both supporters and opponents.

It is important to build support for waste management at an early stage, and also to be able to address competently any criticism that may arise.

The present task limits itself to an analysis of key players, key institutions, and important social constraints.

EXERCISE 4.1: *KEY PLAYER ANALYSIS*

On the basis of your own experience, discuss the key groups and individuals in Udanax who will be influential in any future debate on hazardous waste management. Include consideration of politicians, administrators, other professional groups, community leaders and members of the public.

How should the Task Force interact with each of these 'key players'?

Summarise the results on a worksheet.

EXERCISE 4.2: *KEY AGENCY ANALYSIS*

From the country report, prepare a list of agencies which have official responsibilities for—

- ◊ management of some hazardous wastes
- ◊ activities that could generate hazardous wastes—agriculture ministries/pesticide residues, for example
- ◊ other activities relevant to hazardous waste management operations—such as transport ministries/chemical storage.

Which other government department have an interest in controls over hazardous waste?

Summarise your list on a worksheet.

EXERCISE 4.3: *OTHER SOCIO-ECONOMIC INFLUENCES*

Indicate any other socio-economic influences that could affect hazardous waste management in future.

Other examples should be discussed in the group.

Some examples could be local control over planning permits conflicting with national attempts to site a disposal facility; strong identification of the merchant class as an ethnic group could lead to non-cooperation with government inspectors from a different cultural background.

SECTION THREE: THE SESSION REPORT

A separate worksheet should be completed for each exercise. A suggested worksheet is shown on the following page. Make copies of this worksheet for all exercises.

The information in these worksheets can be used to prepare a summary report for the entire session. The Session Report on the page following the worksheet should be used for this purpose.

As well as showing conclusions and results, any *missing information*, and *additional work* which may be needed, should be indicated.

Tables and *charts* can be attached to the report.

There is no set format or content, but the report should be intelligible to non-specialists such as a minister or a journalist.

A worksheet such as the one shown below can be conveniently used to summarise the results of each exercise. Make copies of this sheet for as many exercises as are attempted.

● WORKSHEET ●

Session ..... Date .....

Exercise .....

Work Group Members

This sheet is for your personal use.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

Session .....

Subject .....

Tasks ..... Exercises .....

Main Conclusions

continue on reverse if necessary

Work Group Members

Return completed sheet to workshop coordinator for inclusion inthe Workshop Report.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

REGIONAL

SECTION FOUR: REFERENCE MATERIAL

1.1 ***Safe Disposal of Hazardous Wastes:*** *The Special Needs and Problems of Developing Countries*

3 vols, World Bank/WHO/UNEP, 1989.

1.2 ***Management of Hazardous Waste,*** *WHO Regional Publications*

European Series, N° 14, 1983.

1.3 ***Rapid Assessment of Sources of Air, Water and Land Pollution***

WHO, Offset Publication N° 62, WHO 1982.

1.4 ***Training Manual on the Quantity and Type of Land-Based Pollutant Discharges into the Marine and Coastal Environment***

UNEP (COBSEA project EAS-21), 1988.

1.5 *'Estimation of Hazardous Wastes from Employment Statistics, Victoria, Australia'* by D.J. Monahan in ***Adapting Hazardous Waste Management to the Needs of Developing Countries***

A special edition of *Waste Management and Research* Vol 8, N° 2, March 1990.

1.6 *'Rapid Assessment of Industrial Waste Production Based on Available Employment statistics'* by R. Barnard and G. Olivetti in ***Adapting Hazardous Waste Management to the Needs of Developing Countries***

A special edition of *Waste Management and Research* Vol 8, N° 2, March 1990.

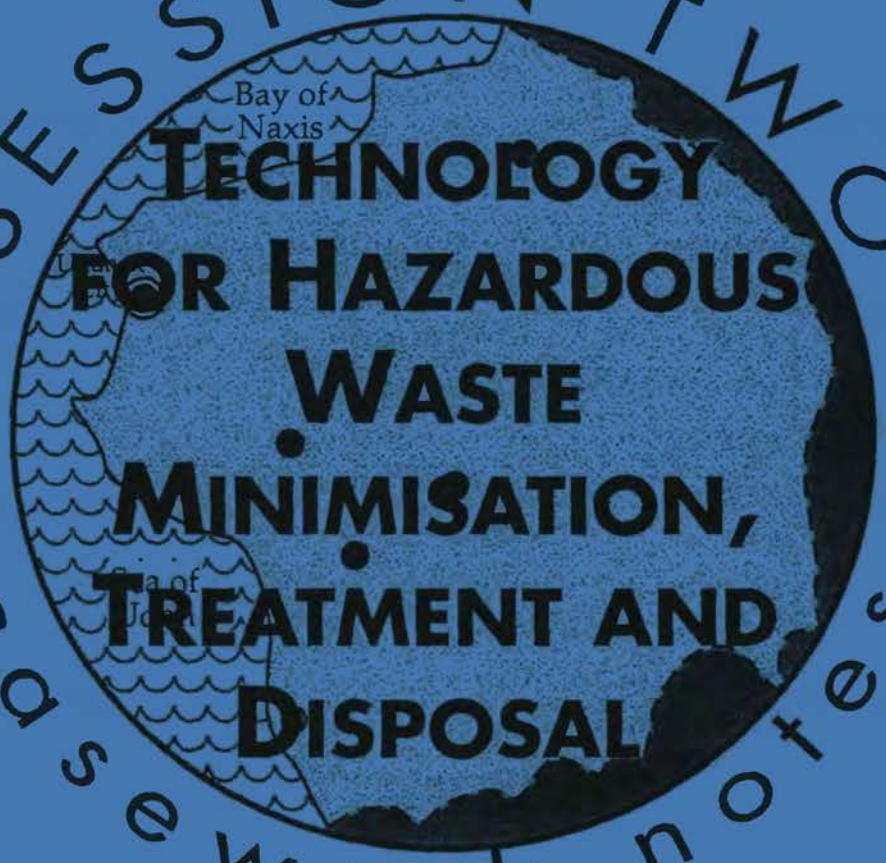
1.7 ***Hazardous Wastes in Northern and Western Canada—*** *Vol. 1 Assessment of Need*

Report by Reid Crowther and Partners to Environment Canada, 1980.

1.8 ***Guidelines for Establishing Policies and Strategies for Hazardous Waste Management in Asia and the Pacific***

Results of an ASEAN/UNEP/CDG Workshop, Singapore, 1986.

SESSION TWO



TECHNOLOGY FOR HAZARDOUS WASTE MINIMISATION, TREATMENT AND DISPOSAL

casework notes

INTRODUCTION

Once an estimate of waste types and quantities has been compiled, it is necessary to decide how these wastes should be treated and disposed of.

In the past, many governments have left the choice of disposal method to industry.

This has not always given good results, and it is more common now for governments to determine acceptable—and maybe unacceptable—disposal methods for hazardous waste types.

As each waste type will have one or more possibilities for disposal, specifying very detailed requirements is extremely burdensome. Governments usually limit themselves to recommending generic types of technology only. This is the course followed in this Session.

In *Session 1*, the working groups tried to assess the quantity of waste in Udanax.

The output in the *Session Report* could be used for this exercise; however, to ensure uniformity between working groups, the waste estimates in *TABLE 2.1A, B* and *C* should be used.

As was clear from *Session 1*, quantities could not always be estimated. In order to choose general types of technology, this is—in any case—not important, although technologies for very small and very large quantities may differ.

Quantities will be more important when it comes to calculating the capacity for whatever treatment processes have been chosen.

We have organised the notes for this Session into a number of *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION TWO

In all, there are three tasks involved in this Session. The working group should report on the following—

Task One

Report on the general treatment and disposal method for hazardous wastes generated in Udanax

Background Exercise — *Important properties of waste*

Exercise 1.1 — *Treatment and disposal options: I*

Exercise 1.2 — *Treatment and disposal options: II*

Exercise 1.3 — *Treatment scheme: I*

Exercise 1.4 — *Treatment scheme: II*

Exercise 1.5 — *Treatment scheme: II — Basel Convention*

Task Two

Alternatives to disposal

Exercise 2.1 — *Unacceptable disposal options*

Exercise 2.2 — *Wastes which can be avoided*

Supplementary Exercise 2.2A — *Cleaner Production Technologies*

Exercise 2.3 — *Waste recovery*

Task Three

Disposal facilities for Udanax

Exercise 3.1 — *Disposal facilities for Udanax*

Exercise 3.2 — *Facility concepts*

Exercise 3.3 — *Immediate disposal options*

Exercise 3.4 — *Interim facilities and arrangements*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised on the worksheets provided.

SECTION ONE: BACKGROUND INFORMATION

TABLE 2.1A HAZARDOUS WASTE IN UDANAX FROM INDUSTRIAL AND NON-INDUSTRIAL SOURCES

LISTED MOSTLY ACCORDING TO CHEMICAL GENERIC GROUP

This Table can be used to record the results of subsequent exercises

WASTE TYPE	QUANTITY*	TREATMENT/ DISPOSAL TECHNOLOGY	RESIDUE DISPOSAL
Effluent, Wastewaters			
Acid, Alkalis			
Heavy Metals			
solid			
in effluent			
Toxic Inorganics			
cyanides			
asbestos			
other			
Non-Toxic Inorganics			
soluble salts			
insoluble salts *(including neutralised sludges)*			
Reactive Wastes			
oxidising/reducing			
highly corrosive			
Solvents, Oils			
chlorinated			
non-chlorinated			
Resins, Paints, Adhesives			
Organic Sludges			
Organic Chemicals			
toxic			
non-toxic			
Pesticides			
PCBs			
Chlorinated Hydrocarbons from plastics industry			
Biodegradable Waste			
Infectious Wastes			
Radioactive Pharmaceuticals and Medical Equipment			

* From the preceding exercises, quantities may not be available for all wastes, or be available only for main groups.

TABLE 2.1B HAZARDOUS WASTE IN UDANAX FROM INDUSTRIAL AND NON-INDUSTRIAL SOURCES

LISTED MOSTLY ACCORDING TO PROCESS ORIGIN

This Table can be used to record the results of subsequent exercises

WASTE TYPE	QUANTITY*	TREATMENT/ DISPOSAL TECHNOLOGY	RESIDUE DISPOSAL
Manufacturing wastes			
Metal treatment wastes			
Mining			
Smelter wastes (e.g. aluminium)			
Treatment plant residues			
Petrochemical wastes			
Transformer fluids			
Photographic chemicals			
Lubricating oils			
Paint wastes			
Ship cleaning wastewaters			
Asbestos wastes (ex buildings)			
Hospital wastes			
Laboratory chemicals			
Dry cleaning sludges			
Fire debris and spills			
Contaminated soil			
Surplus pesticides			
Abandoned/dumped wastes			
Wood treatment residues			
Inks, dyes, varnishes, lacquers			
Tars and bitumens			
Pharmaceutical wastes			

* From the preceding exercises, quantities may not be available for all wastes, or be available only for main groups.

TABLE 2.2A WASTE TREATMENT/DISPOSAL TECHNOLOGIES CHECKLIST

GENERAL DIVISION	SUBDIVISION
RECYCLING	Gravity Separation Filtration Distillation Solvent Extraction Chemical Regeneration
PHYSICAL CHEMICAL	Neutralisation Precipitation/Separation Detoxification (chemical)
BIOLOGICAL	Aerobic Reactor Anaerobic Reactor Soil Culture
INCINERATION	High temperature Medium temperature Co-incineration
IMMOBILISATION	Chemical Fixation Encapsulation Solidification
LANDFILL	Secure Landfill Normal Landfill Co-disposal
OFFSHORE	Ocean Incineration Ocean Dumping Export

TABLE 2.2B DISPOSAL OPERATIONS IN THE BASEL CONVENTION (ANNEX IV)

A Operations which do not lead to the possibility of resource recovery, recycling, reclamation, direct re-use or alternative uses

Section A encompasses all such disposal operations which occur in practice

- D 1 Deposit into or onto land *(e.g. landfill etc.)*
- D 2 Land treatment *(e.g. biodegradation of liquid or sludgy discards in soils etc.)*
- D 3 Deep injection *(e.g. injection of pumpable discards into wells, salt domes or ponds or naturally occurring repositories etc.)*
- D 4 Surface impoundment *(e.g. placement of liquid or sludge discards into pits, ponds or lagoons etc.)*
- D 5 Specially engineered landfill *(e.g. placement into lined discrete cells which are capped and isolated from one another and the environment etc.)*
- D 6 Release into water body except seas/oceans
- D 7 Release into seas/oceans including seabed insertion
- D 8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in *Section A*
- D 9 Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in *Section A (e.g. evaporation, drying, calcination, neutralisation, precipitation etc.)*
- D10 Incineration on land
- D11 Incineration at sea
- D12 Permanent storage *(e.g. emplacement of containers in a mine etc.)*
- D13 Blending or mixing prior to submission to any of the operations in *Section A*
- D14 Repacking prior to submission to any of the operations in *Section A*
- D15 Storage pending any of the operations in *Section A*

B Operations which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses

Section B encompasses all such operations with respect to materials legally defined as or considered to be hazardous wastes and which otherwise would have been destined for operations included in Section A

- R 1 Use as a fuel *(other than in direct incineration)* or other means to generate energy
- R 2 Solvent reclamation/regeneration
- R 3 Recycling/reclamation of organic substances which are not used as solvents
- R 4 Recycling/reclamation of metals and metal compounds
- R 5 Recycling/reclamation of other inorganic materials
- R 6 Regeneration of acids or bases
- R 7 Recovery of components used for pollution abatement
- R 8 Recovery of components from catalysts
- R 9 Used oil refining or other re-uses of previously used oil
- R10 Land treatment resulting in benefit to agriculture or ecological improvement
- R11 Uses of residual materials obtained from any of the operations numbered *R1-R10*
- R12 Exchange of wastes for submission to any of the operations numbered *R1-R11*
- R13 Accumulation of material intended for any operation in *Section B*

TABLE 2.3 POSSIBILITIES* FOR TREATMENT AND DISPOSAL OF INDUSTRIAL WASTES

* These are the most common possibilities. In each case, however, there may exist other options of recovery or treatment not shown in this table.

	RECOVERY	INCINERATION	TREATMENT e.g. *Physical Chemical Biological*	IMMOBILISATION e.g. *Chemical fixation Encapsulation*	CONTROLLED LANDFILL
Effluents, Washwaters			XXX		
Acids, Alkalis			XXX		
Heavy Metals			XXX	XXX	*Residues*
Toxic Inorganics			XXX	XXX	*Residues*
Reactive Wastes			XXX		
Non-Toxic Inorganics	XXX				XXX
Solvents, Oils	XXX	XXX			
Resins, Paints, Organic Sludge	XXX	XXX			
Organic Chemicals	XXX	XXX	XXX		
Pesticides		XXX	XXX		
PCBs, Chlorinated Hydrocarbons		XXX			
Putrescible, Biodegradable Wastes		XXX	XXX		

Recommended Disposal Methods, State of Victoria, Australia

Note that the above Table has not considered the option of taking action to reduce or avoid the generation of waste. This point will be raised again later (see Task 4).

FIGURE 2.1 MODEL SCHEME FOR INDUSTRIAL WASTE DISPOSAL

This table can be copied and used for any of the wastes considered in these exercises.

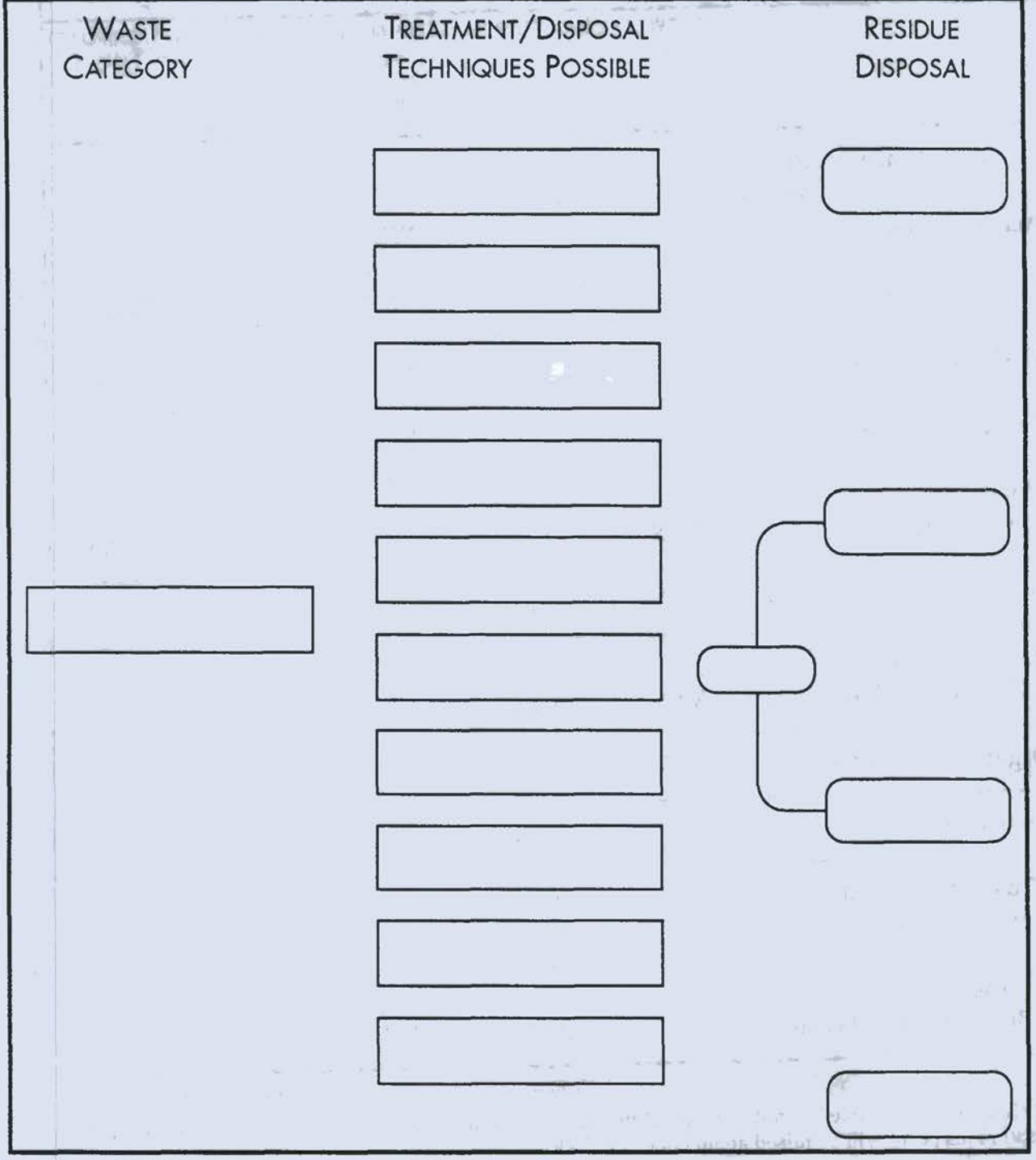
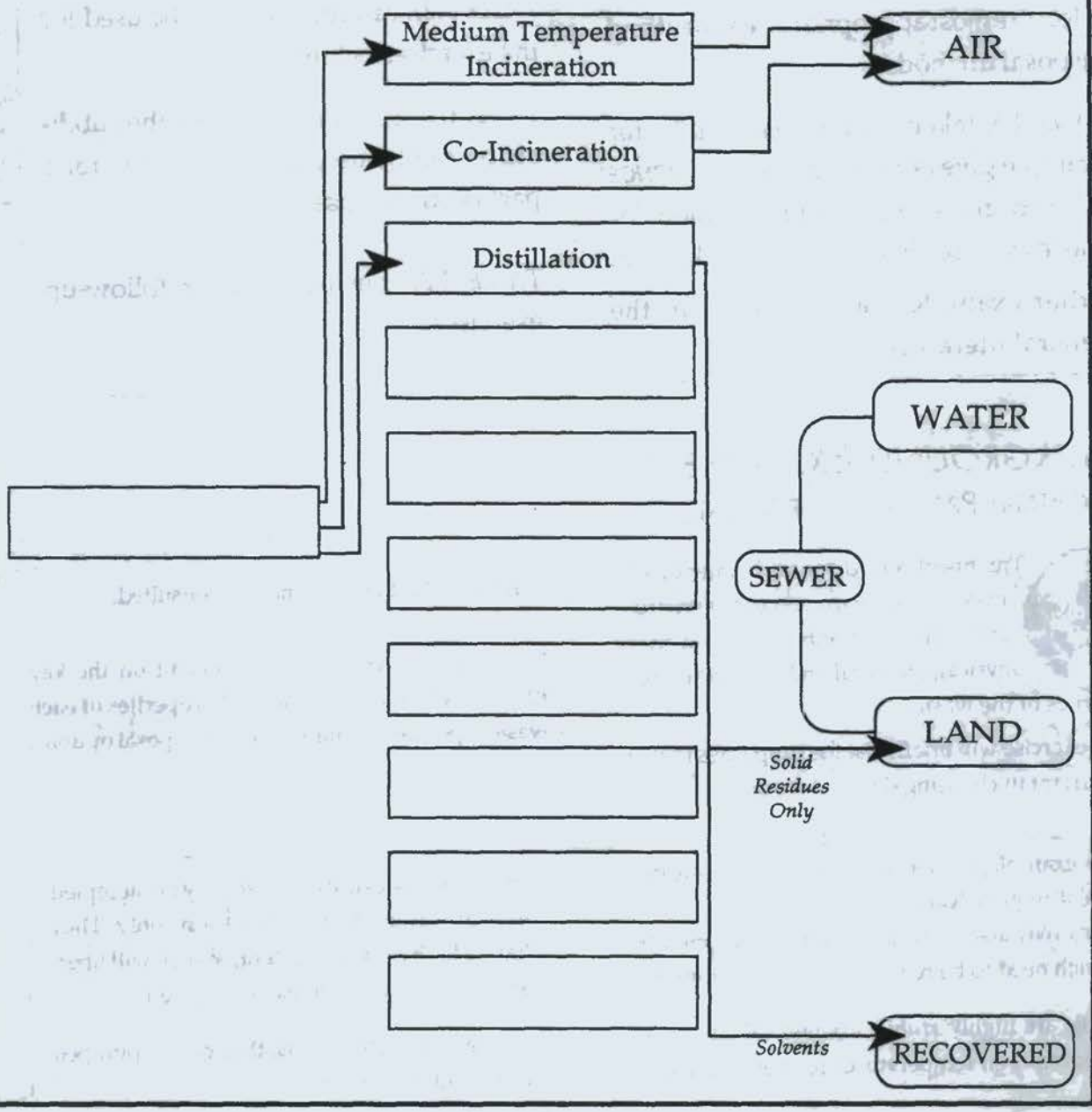


FIGURE 2.2 TREATMENT SCHEME FOR SOLVENTS

WORKED EXAMPLE

For this example, the disposal of non-chlorinated solvents is considered as shown below.



SECTION TWO: THE CASEWORK TASKS

TASK 1 REPORT ON THE GENERAL TREATMENT AND DISPOSAL METHOD FOR HAZARDOUS WASTES GENERATED IN UDANAX

Guidance documents are available to help select the most appropriate treatment and disposal methods.

TABLE 1.3, taken from *REFERENCE 2.1* for example gives somes advice. *REFERENCE 2.2* also gives detailed information for wastes whose chemical origin is known.

Other examples can be found in the general literature.

TABLE 2.2A can conveniently be used for the exercises below.

Either the general division or the subdivision can be used, as appropriate for a particular exercise.

TABLE 2.2B can be used for follow-up exercises.

BACKGROUND EXERCISE
IMPORTANT PROPERTIES OF WASTE

Treatment and disposal is intended to make wastes harmless to the environment. Suitable methods depend on the physical, chemical and biological properties of the waste.

This exercise will briefly list the properties that are important in choosing disposal methods.

REFERENCES 2.1 and 2.2 may be consulted.

In *TABLE 2.1A*, you should comment on the key physical, chemical or biological properties of each waste type that will influence the disposal options.

For example, effluents and washwaters are often strongly ***alkaline*** from the cleaners used. They may also contain ***phenols*** or ***toxic metals*** which need to be removed from the effluent.

PCBs are highly ***stable, organic*** substances—needing high temperatures for incineration—with a ***low calorific value***, so they are accepted in incinerators in low proportions only. They have a high ***chlorine*** content, so they will liberate HCl gas, which must be removed.

As they are often ***liquids***, they can be pumped and handled in bulk.

Optional ...

Repeat the exercise for *TABLE 2.1B* to the extent possible.

It is very helpful to have such an understanding before considering disposal options.

If time is limited, carry out this exercise for *four* wastes chosen at random.

EXERCISE 1.1: *TREATMENT AND DISPOSAL OPTIONS I*

For four wastes chosen from *TABLE 2.1A*, determine the most appropriate treatment/disposal method—or methods—as listed in *TABLE 2.2A*.

Carry this out as best you can; there may not always be enough information at this stage.

Indicate for each waste, with a 'A' for *'air'*, a 'W' for *'water'* or an 'L' for *'land'*, into which environmental medium any treatment residues will be discharged.

Use your worksheet to make any comments you wish.

If more time is available, carry out this exercise on all of the wastes in the table.

EXERCISE 1.2: *TREATMENT AND DISPOSAL OPTIONS II*

Repeat the above exercise for four wastes chosen from *TABLE 2.1B*, as far as you can.

Use your worksheet to make any comments you wish.

If more time is available, carry out this exercise on some further wastes in the Table.

EXERCISE 1.3: *TREATMENT SCHEME I*

For an effluent containing dissolved heavy metal salts, devise a simple flow diagram that shows the major treatment process—from *TABLE 2.2A*—and also shows the environmental fate of all residues.

Use *FIGURE* 2.2 as an example, and draw a similar scheme on your worksheet for the heavy metal effluent.

A detailed flow diagram that shows all process stages can be complex for some wastes.

Depending on time and expertise, it is suggested to initially use broad, generic treatment processes only, from *TABLE 2.2A* or *2.2B*, or other similar tables in the references.

EXERCISE 1.4: *TREATMENT SCHEME II*

Draw up similar flow diagrams to *FIGURE* 2.2 for some wastes shown in *TABLE* 2.1B. If working in a group, each member should do *two* wastes.

For some wastes, this presents certain difficulties if the chemical characteristics are not known—for example, treatment plant residues.

What extra information will you need to carry out this exercise for these wastes?

Report the results on your worksheet.

EXERCISE 1.5: *TREATMENT SCHEME III –BASEL CONVENTION*

Finally, prepare a treatment scheme for some of the wastes listed in the Basel Convention *(Annex I)*, by annotating each of the wastes Y1 to Y45 on page 14 with the appropriate disposal operations listed in the Convention *(TABLE 2.2B)*.

This exercise will be time consuming and difficult to do in a reasonable time by the working group (why?). It is recommended to carry this out in Session for only one or two wastes chosen at random.

TASK 2 ALTERNATIVES TO DISPOSAL

Logically, waste avoidance options should have been considered first—that is, before *TASK 1*.

However, practical necessity frequently postpones it for review until after the treatment/disposal technologies have been clarified.

This has the advantage of allowing avoided technologies as well as avoided wastes to be identified.

Irrespective of when it is considered, waste avoidance is now a key aspect of modern waste management strategies.

EXERCISE 2.1: *UNACCEPTABLE DISPOSAL OPTIONS*

Discuss in your group any treatment or disposal options which you feel are unacceptable for social, political or economic reasons in Udanax, even if they are technically satisfactory and safe.

Give the conclusions, with reasons, in your worksheet.

EXERCISE 2.2: *WASTES WHICH CAN BE AVOIDED*

Review again the wastes in *TABLES 2.1A* and *2.1B*.

Then examine the information on waste generation as shown in the ***UDANAX COUNTRY REPORT—PART 1, TABLE 1.4, SESSION 1***, as may be augmented by subsequent waste estimation exercises.

Discuss the possibility that some wastes in Udanax are generated unnecessarily or in excessive amounts, and that it would be better to avoid or reduce such wastes than to build disposal plants.

To which wastes in particular could this apply?

To what extent can they be reduced? How soon? Who can do it?

Record your conclusions on a worksheet.

SUPPLEMENTARY EXERCISE 2.2A

CLEANER PRODUCTION TECHNOLOGIES

Which hazardous wastes commonly come from the metal plating industry?

Use the ICPIC database to select some promising low waste production alternatives for the metal plating industry in Udanax.

The ICPIC (International Cleaner Production Information Clearing House) is an on-line computer network that includes, among other information, case studies on low waste production technologies.

Refer to UNEP IE/PAC for further information on how to access ICPIC.

Which hazardous wastes in *TABLE 2.1A* can be avoided or reduced in this way?

Which treatment/disposal options in *TABLE 2.2A* are avoided?

Which new wastes, if any, are produced by the alternative technologies?

EXERCISE 2.3: *WASTE RECOVERY*

Which wastes could be economically reclaimed and re-used, or recovered for other purposes?

What needs to be done to make this a reality? Who should do it?

What treatment/disposal facilities (see *TABLE 2.2A*) can be avoided by such recovery?

How much waste is already being recovered?

Record your conclusions on a worksheet.

TASK 3 DISPOSAL FACILITIES FOR UDANAX

This Task considers the total set of facilities needed in Udanax to treat/dispose of wastes that cannot be avoided.

Some facilities may be built for a single company.

For *'collective'* facilities, treating wastes from a variety of sources, it is first necessary to aggregate all the wastes produced.

This was the task of previous exercises.

The capacity of such facilities depends on the projected quantity of waste, always an uncertain figure to calculate.

Some facilities may take time to build. The best way to prevent pollution in the meantime needs to be considered.

EXERCISE 3.1: *DISPOSAL FACILITIES FOR UDANAX*

Considering the disposal methods available and the wastes being generated in Udanax, identify the most appropriate set of facilities to handle all the waste now generated.

Comment how this might change as additional waste sources are revealed.

List the existing facilities that are already handling wastes.

List the additional facilities you recommend on a worksheet.

EXERCISE 3.2: *FACILITY CONCEPTS*

Discuss the pros and cons of a single, centralised treatment/disposal facility *versus* multiple, dispersed plants of a smaller size.

Look also at the existing disposal/recycling facilities to see how they would be incorporated into a total system of facilities.

Some considerations to be taken into account are—

- transport between waste generators and a disposal site
- method of collection of wastes
- location of site with residue disposal and adjacent land use
- economies of scale of larger plant
- inability of large plant to adapt to small waste loads
- technical infrastructure and support services
- encouragement of on-site waste reduction

Other considerations will also apply. *You should list these during the discussion.*

Note that considerations of ownership, financing and so on will not be dealt with here except insofar as is necessary to decide on choice and location of technology.

Give the conclusions on a worksheet.

EXERCISE 3.3: *IMMEDIATE DISPOSAL OPTIONS*

The construction of new disposal facilities always takes time. This exercise looks at the wastes to see what immediate improvements can be made in handling and disposal, pending the establishment of new facilities.

TABLE 3 on page 27 gives wastes which are known, or strongly presumed, to exist. For each waste, suggest an immediate measure which will improve its management *(handling and disposal)*.

Mention the disadvantages of each action, as well as its benefit.

TABLE 2.4 on the next page will give some ideas, but other possibilities also exist.

An optional extra exercise is to repeat the above using *TABLE 2.1B*.

TABLE 2.4 SOME POSSIBILITIES FOR IMMEDIATE ACTION

OTHER POSSIBILITIES MAY ALSO EXIST

- removal for safe storage at official depot
- collection for safe storage or destruction
- disposal in a suitable local landfill and immediate cover
- landfill after solidification with cement or lime
- special burial at a secure site
- co-incineration in a cement kiln or other furnace
- collection for destruction at approved overseas facilities
- collection for recycling overseas
- collection for local re-use
- evaporation
- special on-site destruction
- sharing existing private facilities

EXERCISE 3.4: *INTERIM FACILITIES AND ARRANGEMENTS*

Discuss some interim treatment and disposal facilities that could be brought into operation in Udanax.

This exercise is an extension of *EXERCISE 3.3.*

It considers how facilities can be brought on-line progressively. The use of interim facilities—for example, upgrading existing landfills—and temporary disposal arrangements, such as sharing private facilities or controlled export, is an important part of such a progression.

Interim facilities also have an important function in allowing local authorities and industries to gradually develop waste management expertise.

What legal measures and infrastructure will be necessary to enable interim facilities to function effectively?

Summarise your conclusions on a worksheet.

SECTION THREE: THE SESSION REPORT

A separate worksheet should be completed for each exercise. A suggested worksheet is shown on the following page. Make copies of this worksheet for all exercises.

The information in these worksheets can be used to prepare a summary report for the entire session. The Session Report on the page following the worksheet should be used for this purpose.

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Tables and *charts* can be attached to the report.

There is no set format or content, but the report should be intelligible to non-specialists such as a minister or a journalist.

A worksheet such as the one shown below can be conveniently used to summarise the results of each exercise. Make copies of this sheet for as many exercises as are attempted.

● WORKSHEET ●

Session ..... Date .....

Exercise .....

Work Group Members

This sheet is for your personal use.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

Session .....

Subject .....

Tasks ..... Exercises .....

Main Conclusions

continue on following page if necessary

Work Group Members

Return completed sheet to workshop coordinator for inclusion inthe Workshop Report.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

SECTION FOUR: REFERENCE MATERIAL

2.1 ***Safe Disposal of Hazardous Wastes:*** *The Special Needs and Problems of Developing Countries*

3 vols, World Bank/WHO/UNEP, 1989

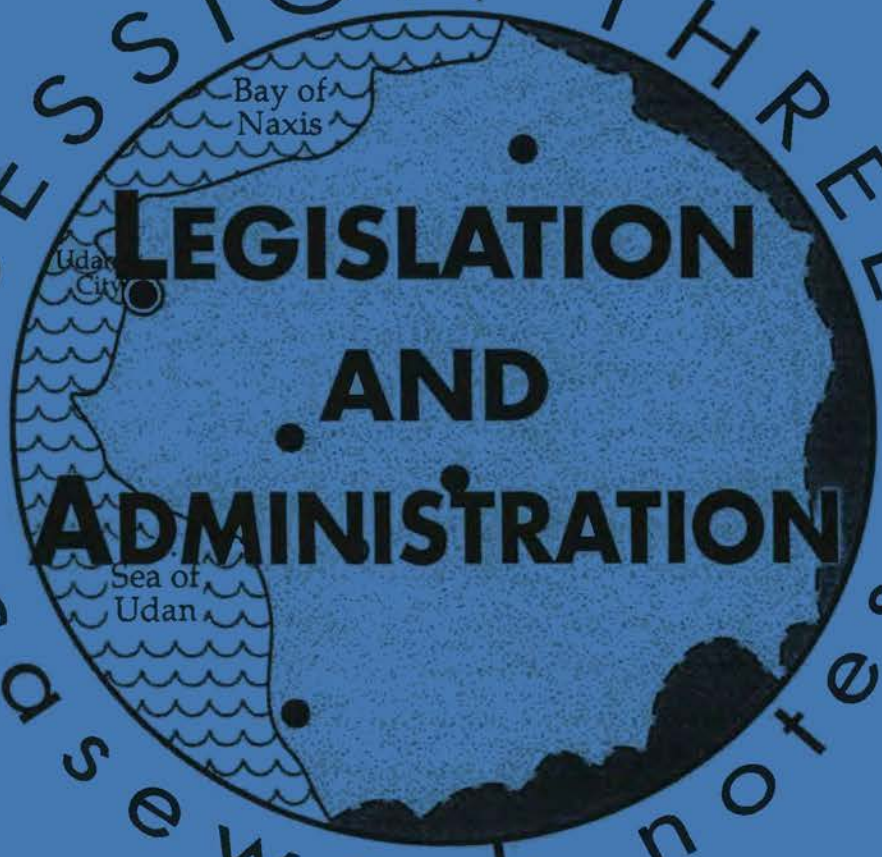
2.2 ***Treatment and Disposal Methods for Waste Chemicals***

IRPTC, 1985

2.3 ***Wastes and their Treatment***

INFOTERRA, 1986

SESSION THREE



LEGISLATION AND ADMINISTRATION

casework notes

INTRODUCTION

Legislation is an important element of any waste management plan.

It provides the coercion without which many of the essential waste handling operations would not occur. Legal standards for discharge provide the design criteria for facilities, and ensure that the same performance is expected of all waste operators.

It is essential that the purpose of any legislation is clear, and that regulations address the problems on the ground.

For this reason, it is necessary to first document the environmental problems experienced, and identify the causes.

Enforcement action is essential if regulations are to have any effect.

The administrative practicalities of enforcement should determine how the regulations are drafted in the first place.

Of course, the implementing agency must be clearly identified.

Once again, we have organised the notes for this Session into four *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION THREE

The working group should—

Task One

The need for, purpose and application of legislation

Exercise 1.1 *Identification of environmental problems*

Exercise 1.2 *Identification of policy matters*

Exercise 1.3 *Waste handling activities to be controlled*

Task Two

A package for legislation

Identification of measures to be implemented straight away, and those to be left to later.

Exercise 2.1 *Legislative instruments*

Exercise 2.2 *Existing regulations*

Task Three

Implementation of legislation (institutions)

i.e. Existing and/or new institutions which should be responsible for implementing these measures.

Exercise 3.1 *Existing agencies*

Exercise 3.2 *Implementing agencies*

Exercise 3.3 *Permitting arrangements*

Exercise 3.4 *Example of a storage site: I*

Exercise 3.5 *Example of a storage site: II*

Task Four

Review of a regulation proposal

Exercise 4.1 *Review of a proposal*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised on the worksheets provided.

SECTION ONE: BACKGROUND INFORMATION

TABLE 3.1 POLICY PROPOSAL FOR UDANAX

The following policies have been proposed in Udanax by a community group of health workers, ecologists and trade union leaders.

The government has not yet officially considered this proposal.

EXPORT/IMPORT	Udanax will aim to be self-sufficient in waste disposal facilities. Export of wastes is to be avoided. Import of wastes is to be banned.
DISPOSAL	Landfill of industrial waste is to take place to the least extent technically possible. Generators are to treat and destroy their own waste as far as practicable.
SOURCES	Chemicals that result in difficult to manage wastes shall be banned.
THE WASTE MANAGEMENT HIERARCHY	The priority of minimisation, recovery, treatment, disposal shall be implemented where possible through regulation as well as through discretionary means.
THE POLLUTER PAYS	This principle should be applied to all private and public sector generators of hazardous waste.

TABLE 3.2 LEGISLATION AREAS POTENTIALLY RELATED TO HAZARDOUS WASTE CONTROL

Some of the constituents of hazardous wastes such as drugs, pesticides, chemical substances etc. may already be controlled under other regulations. Waste handling itself may involve operations that fall under other laws, such as transport. Some waste sources are perhaps already subject to regulatory procedures for other purposes—for example, scheduled industries.

The table below shows some common legislation areas that may intersect with hazardous waste controls. Other areas of intersection may also exist in some countries.

Pollution Control
(Air, Water, Soil)

Water Laws

Waste Disposal

Industrial Chemicals Control

Pesticides Control

Pharmaceuticals

Household Poisons

Occupational Health and Safety

Public Health

Disasters and Emergencies

Transport

Land Planning

Environmental Impact Assessment

Sewerage and Drainage

General Industry laws covering—
classification, approval, registration, inspection

Specific Industry laws such as—
mines, petrochemicals, ports, hospitals

Note that, in covering their respective areas of application, the above laws may result in some overlap or even inconsistencies (i.e. conflicts).

In some cases, they may complement each other so as to provide a more complete coverage.

The nature of such interaction is determined by how each piece of legislation is written.

TABLE 3.3 OPTION MENU FOR HAZARDOUS WASTE LEGISLATION

PURPOSE AND SCOPE

- Public Health
- Pollution Prevention
- Workplace Safety
- Raising Funds
- Empower a Corporation
- Coordinate Agencies
- Control of Operations
- Establish Liabilities

TYPE

- Framework Law *(enabling legislation)*
- Subordinate Law
- Primary Laws on Hazardous Waste
- Complementary Laws on Hazardous Waste
- Waste Provisions in other Laws
- Subordinate Regulations
- Schedules

APPLICATION

WASTE HANDLING

- Chemical Use
- Waste Generation
- Storage
- Transport
- Treatment/Recycling
- Disposal
- Dumping
- Clean-Up

WASTE INFORMATION

- Definitions
- Assessments/Studies
- Research
- Measurements
- Training

INSTRUMENTS

- Notification
- Certification
- Labelling
- Orders to Act/Not to Act
- Bans
- Licensing/Permitting
- Standards
- Guidelines/Codes/Policies
- Monitoring
- Release of Information
- Assistance Measures
- Fiscal Measures

FISCAL MEASURES

- Fees and Charges
- Fines
- Subsidies
- Compensations
- Tax Concessions
- Levies

POWERS

- Obligations
- Responsibilities
- Offences
- Authorisations/Delegations
- Giving Directions/Orders
- Right of Refusal
- Right to Know
- Right to Secrecy

ENFORCEMENTS

- Which Agencies
- Extent of Proof
- Possible Conflict of Interest *(self licensing of agencies)*

Note: This list is not exhaustive

SECTION TWO: THE CASEWORK TASKS

TASK 1 THE NEED FOR, PURPOSE AND APPLICATION OF LEGISLATION

EXERCISE 1.1: *IDENTIFICATION OF ENVIRONMENTAL PROBLEMS*

Review again the environmental problems in Udanax which need to be resolved, at least in part, through legislation.

Identify clearly the environmental medium (i.e. air, land, sea, etc.), and the target organisations which are affected by such environmental problems.

All legislative change has its proponents and opponents. It is essential to explain clearly why new laws are needed and what they are intended to achieve. *TASK 1* examines some considerations that will probably need to be explained in parliament.

An explanation of environmental problems (impacts) is fundamental to any justification of need.

The most significant impacts were already considered in *SESSION 1, EXERCISE 1.1*.

The first exercise here, therefore, is to summarise again those impacts that will need legislation to resolve (not *all* impacts can be resolved through legislation).

*Use a worksheet to record your conclusion, and to describe the **purpose** of future new legislation in one sentence.*

EXERCISE 1.2: *IDENTIFICATION OF POLICY MATTERS*

Many governments also have strong political policies on hazardous waste (for example, export/import; ownership of facilities; who should pay; etc.). *Some* of these may need to be given effect through legislation.

We will briefly look at this aspect, using such information as given in these notes, and the opinions of group members.

TABLE 3.1 may help in the discussion.

Prepare on a worksheet a brief list of policy statements which your group recommends to be incorporated into legislation for Udanax.

EXERCISE 1.3: *WASTE HANDLING ACTIVITIES TO BE CONTROLLED*

On a worksheet, list the unsatisfactory waste handling operations observed in Udanax which need to be controlled by legislation immediately, and those which can be controlled later.

There are numerous handling operations which, if mismanaged, can directly give rise to environmental risks.

In addition, some management actions can directly put the entire system at greater risk; for example, by allowing excessive quantities of hazardous waste to be generated and stored in the first place.

Any attempts at introducing legislation must therefore be clear about what waste handling operations are to be subject to control.

Various references (for example, Ref 1) will discuss a large number of waste handling operations. A simplified list can be found in *TABLE 3.3*, under *'Application'*.

For this exercise, the group should list the operations that it believes should be controlled in some way in Udanax.

TASK 2 A PACKAGE FOR LEGISLATION

EXERCISE 2.1: *LEGISLATIVE INSTRUMENTS*

This task examines the legal instruments that could be applied to the waste operations so as to achieve the purpose as defined in *EXERCISE 1.1*.

Legal instruments for hazardous waste control can take a variety of forms as described in *TABLE 3.3*. Some may be statutory controls; some may be fiscal measures; some may provide assistance to industry or research institutions.

A number of measures may facilitate self regulation by industry.

Be careful not to confuse statutory control measurements with more general legislative obligations and assistance measures. *List these separately.*

Also, make sure that the instruments you recommend are actually useful in resolving the environmental problems experienced in Udanax.

Do not devise bureaucratic procedures for their own sake.

Using *TABLE 3.3* as a starting point, list for each waste handling operation the legislative instruments which can be applied.

For example, for 'chemical use', appropriate instruments could include—

- notification
- certification
- licensing
- bans
- standards
- guidelines
- monitoring
- record-keeping
- release of information

Not all possible instruments will be applied in practice. Recommend a first package of instruments that should be implemented immediately in Udanax.

EXERCISE 2.2: *EXISTING REGULATIONS*

From the *COUNTRY REPORT*, identify the existing regulations that are related to hazardous waste control.

Identify which items in *TABLE 3.2* are included.

Indicate which instruments in *TABLE 3.3* apply to each regulation.

How many of the legislative instruments considered in *EXERCISE 2.1* are already in existence?

TASK 3 IMPLEMENTATION OF LEGISLATION (INSTITUTIONS)

EXERCISE 3.1: *EXISTING AGENCIES*

List the government agencies which administers pollution or waste laws in Udanax.

EXERCISE 3.2: *IMPLEMENTING AGENCIES*

For the instruments recommended in *EXERCISE 2.1*, nominate an existing (or new) agency which could implement it, and—if possible—the legislation (existing or new) to be used.

When the list is complete, review it again. Decide whether the overall implementation should stay with existing agencies and laws, or whether a new agency, and a new comprehensive hazardous waste law, is justified.

Prepare on the worksheet a final summary of agency and legislation recommendations.

Note that such a recommendation may need to be reviewed again later, after all the implications have been assessed.

EXERCISE 3.3: *PERMITTING ARRANGEMENTS*

Consider in more depth the licensing/permitting type arrangements that you consider necessary for hazardous waste operations in Udanax.

List the types of operations to be licensed.

Who should issue them? How should they be enforced? What fees should be applicable?

What type of requirement should be included in such licences?

What public review and industry appeal provisions should be allowed?

EXERCISE 3.4: *EXAMPLE OF A STORAGE SITE I*

Assume you have to *register* all hazardous waste storage sites.

What information will you ask of the owners? What will you do with the information?

Who else will be allowed to see the information? How often will you ask for an update?

How will you verify that the information you receiv e is correct?

How will you detect owners who do not register?

EXERCISE 3.5: *EXAMPLE OF A STORAGE SITE II*

Assume you are asked to *licence* a storage site.

What technical requirements—siting, design, operation, wastes, etc.—would you make before you grant the licence?

TASK 4 REVIEW OF A REGULATION PROPOSAL

EXERCISE 4.1: *REVIEW OF A PROPOSAL*

Comment on the draft regulation in *TABLE 3.4* regarding its adequacy for the Udanax situation. What do you find useful in the proposal? What changes would you suggest in order to improve it?

In order to focus the discussion, consider the following questions—

QUESTION 1

How well does the draft regulation address the environmental problems of Udanax as listed in *SECTION 3* of the *COUNTRY REPORT*, or of the problems revealed by *EXERCISE 1.1* in *SESSION 1*?

QUESTION 2

How well does the draft regulation deal with the wastes shown in—

① *TABLE 2.1B*?

② *ANNEX I* of the *Basel Convention*?

QUESTION 3

What are the enforcement implications of the proposal?

QUESTION 4

What technical annexes and schedules are required by the regulation? How easy are these to prepare?

TABLE 3.4 DRAFT REGULATION FOR THE MANAGEMENT OF HAZARDOUS WASTES

OBJECTIVES

To define hazardous wastes, establish a system for the management of hazardous wastes and to provide penalties for the improper handling and disposal of hazardous wastes.

DEFINITIONS

Best Practical Means

Refers to requirements specified in writing by the authorities for environmental and safety management drafted with regard to local circumstances, financial implications and the current state of technical knowledge.

EPSS

Refers to the Environment Protection and Safety Service of Udanax.

Hazardous Waste

Means any waste listed in Appendix 1* or any other waste considered to pose a hazard to human health or the environment.

Person

In the context of these regulations, refers to any individual responsible for hazardous wastes, any employee handling hazardous wastes or any person dealing with hazardous wastes on behalf of a company or government body.

Waste Disposer

Refers to any person transporting hazardous waste, or any person contracted to dispose of wastes.

Waste Generator

A person producing hazardous wastes by any means.

Handling and Disposal

1. Any person handling or disposing of hazardous wastes must comply with the Best Practicable Means as specified by the EPSS.

2. Any person storing more than one tonne of hazardous wastes must inform the EPSS of the site and type of wastes.

3. Any person treating or disposing of hazardous waste or storing in excess of one tonne of hazardous waste must have the written approval of the EPSS and must comply with any conditions specified.

continued ...

4. Any person disposing of hazardous wastes must do so in accordance with the procedure outlined in Appendix 2*.

5. Any person exporting hazardous wastes or seeking to import hazardous wastes must provide the prenotification specified in Appendix 3*, to the EPSS and the local authorities in the country receiving or exporting the waste and obtain the written approval of both agencies before moving the waste.

6. The EPSS may order any person, at that person's expense, to transport hazardous waste from any premises or site to a secure municipal site for storage.

Waste Minimisation

7. The EPSS may order any person to prepare a report and waste minimisation plan for any quantities of hazardous wastes under that person's control.

Inspection, Testing and Record Keeping

8. The EPSS may order any person to obtain a full analysis of any hazardous waste under that person's control and submit the result of that analysis.

9. Inspectors of the EPSS may enter premises at any time and may inspect the storage of hazardous wastes and take any necessary samples to determine the quantities or nature of hazardous wastes so stored.

10. The EPSS may direct any person to keep records of hazardous waste generation and disposal and to submit these reports annually.

Transport

11. All vehicles transporting hazardous wastes shall be in sound condition and of suitable design to permit the safe transport of these wastes.

12. Inspectors of the EPSS may direct the owner of any vehicle to undertake any repairs or modifications to permit the safe transport of hazardous wastes.

13. All vehicles or drums or other containers in which hazardous wastes are transported must be labelled with the appropriate dangerous goods class label specifying the hazards associated with the waste.

14. Hazardous wastes must be transported in a secure manner to prevent any spills or losses.

Offences

15. It shall be an offence against these regulations to dispose of hazardous waste by a means other than that outlined in Appendix 2.

16. It shall be an offence against these regulations to import or export hazardous wastes without providing prenotification information to the receiving and exporting government authorities and without mutual agreement of these parties.

17. It shall be an offence against these regulations to fail to comply with any order, direction or notice issued in accordance with the regulations.

* *Note that appendices are not attached here.*

You could try preparing some of these appendices as a supplementary exercise.

SECTION THREE: THE SESSION REPORT

A separate worksheet should be completed for each exercise. A suggested worksheet is shown on the following page. Make copies of this worksheet for all exercises.

The information in these worksheets can be used to prepare a summary report for the entire session. The Session Report on the page following the worksheet should be used for this purpose.

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● WORKSHEET ●

Session ..... Date .....

Exercise .....

Work Group Members

This sheet is for your personal use.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

Session .....

Subject .....

Tasks ..... Exercises .....

Main Conclusions

continue on reverse if necessary

Work Group Members

Return completed sheet to workshop coordinator for inclusion inthe Workshop Report.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

SECTION FOUR: REFERENCE MATERIAL

3.1 ***Safe Disposal of Hazardous Wastes:*** *The Special Needs and Problems of Developing Countries*

3 vols, World Bank/WHO/UNEP, 1989.

3.2 ***Management of Hazardous Waste,*** *WHO Regional Publications*

European Series, N° 14, 1983.

3.3 ***The Basel Convention on Control of Transboundary Movements of Hazardous Wastes and Their Disposal***

UNEP, 1989.

3.4 ***The Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes***

UNEP, 1987.

3.5 ***International Perspectives on Hazardous Waste Management***

W.S. Forester & John H. Skinner (Eds)
Academic Press, 1987.

3.6 ***Adapting Hazardous Waste Management to the Needs of Developing Countries***

A special edition of *Waste Management and Research*
Vol. 8, N° 2, March 1990.

SESSION FOUR

ADMINISTRATIVE AND ORGANISATIONAL MEASURES FOR HAZARDOUS WASTE AVOIDANCE, MINIMISATION, RECOVERY, TRANSPORT AND DISPOSAL

casework notes

INTRODUCTION

There are many administrative and organisational arrangements which can help to reduce waste quantities, or ensure their safe handling and disposal.

Such arrangements are particularly useful in the initial phase of a waste management plan when permanent facilities have not yet been built and when regulations are not yet fully developed. However, they will also be important in the final plan itself.

In some cases, legal measures may need to be taken in order to make the administrative arrangements work.

Coordination and the formal designation of a responsible agent or agency are essential if arrangements are to work in the field. In some situations, the funding sources need to be identified.

The notes for this Session have been organised into four *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION FOUR

The working group should—

Task One

Review and recommend useful administrative measures and practical arrangements for waste management in Udanax

Exercise 1.1 *Useful measures: I*

Exercise 1.2 *Useful measures: II*

Task Two

Consider several options for waste reduction and recovery

Exercise 2.1 *Waste exchange proposal*

Exercise 2.2 *Waste oil collection*

Exercise 2.3 *Waste minimisation: I*

Supplementary Exercise 2.3A *Implementing cleaner production technologies*

Exercise 2.4 *Waste minimisation: II*

Task Three

Consider field arrangements to improve treatment and disposal

Exercise 3.1 *Pesticide collection*

Exercise 3.2 *Pesticide disposal*

Task Four

Transport arrangements

Exercise 4.1 *Transport monitoring*

Exercise 4.2 *Transport safety*

Task Five

Coordination

Exercise 5.1 *Coordination*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised on a worksheet as provided.

SECTION ONE: BACKGROUND INFORMATION

TABLE 4.1 OPTION MENU FOR ORGANISATIONAL MEASURES FOR WASTE MINIMISATION, RECOVERY AND DISPOSAL

WASTE AVOIDANCE/REDUCTION

- EIA to screen industries
- Publish technical guides
- Prepare consultant roster
- Employ extension staff
- Employ PR staff
- Give incentives, publicity
- Speak at business meetings
- Work with some plants as case studies
- On-line access to ICPIC
- Publish cleaner production information

COLLECTION/TRANSPORT

- Voluntary waste manifest
- Driver training programme
- Agriculture Dept. to collect pesticides
- Health Dept. to collect medical wastes and drugs
- Storage at municipal depots
- Government vehicles for some collection

EVALUATION

- Monitor industrial waste at dumpsites
- Factory inspections
- Establish an interdepartmental group to collect data
- Start simple surveys

WASTE RECYCLING/RECOVERY

As for 'WASTE REDUCTION' plus—

- Set up a waste exchange
- Government purchase of recycled materials
- Tax reduction for recycling plant

TREATMENT/DISPOSAL

- Special treatment at sewage works or municipal depots
- Selected, supervised co-disposal
- Simple immobilisation
- Use of local cement kilns
- Extension staff

COMMUNICATION

- Print a regular waste bulletin
- Attend industry meetings
- Brief politicians on waste problems
- Publish educational features in newspapers
- Work with technical schools

NOTE *Many other initiatives can also be developed. A supplementary exercise could be to list some possible additions to this table.*

TABLE 4.2 SOME FACTORS ENCOURAGING WASTE MINIMISATION BY THE GENERATOR

TECHNICAL

- New processes available
- New chemicals available
- New plant installed
- Improved product design
- New raw materials

OPERATIONAL

- Regular maintenance of plant
- Trained operators
- Printed company directives on minimisation
- Area set aside for collection and recovery
- Avoid over-ordering
- Storage areas kept safe

DISPOSAL

- Lack of disposal sites
- Pre-treatment by generator required by authorities
- Chemical supplier obliged to accept return of surplus stock

INFORMATIONAL

- Technical information is readily available
- Discussion at business meetings
- Consulting expertise is available
- Training venues are organised

LEGISLATION/POLICY

- Bans on specified wastes or raw materials
- Limits on waste production
- Compulsory waste audits
- Waste minimisation is criterion in plant permits

MANAGEMENT

- Waste minimisation policy adopted
- Staff incentives for minimisation
- Operational directives
- Waste audit procedures
- Positive publicity
- Public scrutiny
- Regular monitoring

ECONOMIC

- High disposal fees
- High dumping fines
- High chemical costs
- Incentives for new plant

NOTE *Many other arrangements could also be developed. A supplementary exercise could be to list some possible additions to this table.*

TABLE 4.3 SOME FACTORS ENCOURAGING WASTE RECOVERY AND RECYCLING

WASTE SOURCE CONTROL

- Waste composition is known
- Source segregation to avoid mixtures and contamination
- Waste volume is regular
- Appropriate containers are used

TECHNICAL/OPERATIONAL

- Reclamation techniques exist
- Operators can be found or easily trained
- Market network for recovered materials exists

LEGISLATION/POLICY

- Mandatory recovery for certain wastes—for example, oils or batteries
- Government purchasing preference for recovered materials
- Arrangements made for a waste exchange
- Special regulations for reuse of recovered hazardous waste

ECONOMIC

- No market barriers to use of secondary (reclaimed) materials
- Incentives for use of secondary materials
- Low permit fees for recycling facilities
- Waste volume is high enough to justify facilities

SECTION TWO: THE CASEWORK TASKS

TASK 1 REVIEW AND RECOMMEND USEFUL ADMINISTRATIVE MEASURES AND PRACTICAL ARRANGEMENTS FOR WASTE MANAGEMENT IN UDANAX

EXERCISE 1.1A: *USEFUL MEASURES I*

From *TABLE 4.1*, select the two items from each subgroup that you consider the most useful for immediate application in Udanax.

From your discussions, propose at least one more item not already listed to add to each subgroup. Explain briefly in which way all of the above items selected are useful.

Or ...

EXERCISE 1.1B: *USEFUL MEASURES II*

From *TABLE 3.1*, select a total of six (6) measures that you think should be implemented immediately in Udanax.

Again, propose three (3) further useful measures that are not so far listed. Explain your choice in terms of helping to resolve the problems in Udanax.

Summarise the results on a worksheet.

TASK 2 CONSIDER SEVERAL OPTIONS FOR WASTE REDUCTION AND RECOVERY

EXERCISE 2.1: *WASTE EXCHANGE PROPOSAL*

Discuss how a waste exchange scheme could be established in Udanax.

What would the scheme set out to do? Who would run it? How would it be funded? How, and to whom, is information distributed and received back? How would the results be evaluated? What are the expected major benefits of the scheme? What are the costs?

Waste exchanges have been run by many authorities around the world. Some are managed by industry associations, some by government departments, some by contract services.

The normal procedure is for a central secretariat to collect information on wastes that could be reused somewhere, and to publish this by way of a regular bulletin.

The effective circulation of the bulletin is the key to a successful scheme.

Financial sponsorship or support of such a scheme is essential, as it rarely makes a profit. Accordingly, a clear appraisal of the benefits of a waste exchange is vital to maintain the sponsorship.

Record the results on a worksheet.

EXERCISE 2.2: *WASTE OIL COLLECTION*

Propose a scheme for collecting waste motor oil for re-use as boiler fuel.

The following aspects should be resolved in the final proposal—

■ responsible agent ■ financing ■
■ end-user of collected oil ■
■ guarantee of supply and demand ■
■ equipment for collection ■
■ transport and interim storage ■
■ regulations ■ pre-treatment ■
■ chemical analysis ■ record keeping ■
■ training ■
■ government surveillance and reporting ■

EXERCISE 2.3: *WASTE MINIMISATION I*

A CLEANER PRODUCTION PROGRAMME FOR INDUSTRY

Discuss in the group some ideas for encouraging industry in Udanax to produce less waste. List your ideas in order of expected effectiveness. You can use *TABLE* 4.2 as a guide, but you should also add your own ideas.

In each case, indicate who is responsible for initiating the action, and how industry will be encouraged to cooperate—i.e. what are the incentives and disincentives.

SUPPLEMENTARY EXERCISE 2.3A

IMPLEMENTING CLEANER PRODUCTION TECHNOLOGIES: *USE OF THE ICPIC DATABASE*

Use the on-line ICPIC database—or use a current demonstration version locally—to select some low-waste production alternatives for Udanax for the leather industry.

Discuss how to persuade industry to adopt these alternative technologies.

A description of ICPIC can be found in the box opposite.

For this exercise, you will first have to decide what is the most important hazardous waste, and its process source, from the leather industry in Udanax.

You should then search the database for alternative processes/chemicals.

This is best done by initially searching the abstracts, and then examining some of the promising case studies in more detail.

You will have to use your own judgement about how to persuade industry to adopt such alternatives.

EXERCISE 2.4: *WASTE MINIMISATION II*

WASTE AVOIDANCE IN THE NON-INDUSTRIAL SECTOR

By using pesticide wastes as an example, consider how hazardous residues from non-industrial sources can be reduced.

List the possible sources of pesticide residues and wastes that could occur in Udanax—but remember that there is no local manufacturing plant.

Propose measures to reduce the quantity of waste produced, identifying who is responsible for initiating and coordinating action, and also for funding the action.

NOTE: Do not try to resolve here such issues as pesticide residues in food, nor safety in spraying, etc. These are not really issues of 'waste' management. You may consider such issues only insofar as they reduce the waste quantities generated for disposal.

Report your conclusions on a worksheet.

UNITED NATIONS ENVIRONMENT PROGRAMME
INDUSTRY AND ENVIRONMENT PROGRAMME ACTIVITY CENTRE

INTERNATIONAL CLEANER PRODUCTION INFORMATION CLEARINGHOUSE [ICPIC]

ICPIC is a computer-based information exchange system which has over 600 technology and programme case studies, a calendar of training events and seminars, a directory of experts, a bibliography of over 400 frequently referenced publications, and descriptions of corporate environmental programmes. ICPIC is based on the US EPA Pollution Prevention Information Clearinghouse.

ICPIC works as a decentralised system. Information is collected and shared by users of the system. Its purpose is to act as a 'pointer' system, providing basic, descriptive information on cleaner production processes and pointing the way to sources of more specific information (companies, research and academic organisations, technical institutions, networks, individuals). Users of ICPIC can communicate with specialists and other users, privately or publicly, through ICPIC's message centre.

The system is linked to the SprintNet packet switching network to enable access to users in over 100 countries at the cost not much greather than a local telephone call.

Accessing ICPIC

EQUIPMENT You need—

- ◊ an IBM (or compatible) PC, an Apple, or a terminal;
- ◊ a modem (1200 bauds or 2400 bauds) and appropriate communications software.

CONNECTION ICPIC is accessible either through public telephone systems or any data packet switching network.

TELEPHONE

- ◊ Change your communications parameters*
  —number: 33-1-40588878;
  —no parity, 8 data bits, and 1 stop bit;
  —emulated terminal, if necessary, to VT100.
- ◊ Save the communications settings.
- ◊ Dial the number and establish connection with ICPIC.

PACKET SWITCHING NETWORK

1 ICPIC is currently (1992) connected via the Sprintnet system. The connection details used in 1992 are given below; however, in all cases, users are advised to check with IE/PAC for latest details.

continued ...

continued ...

◊ Change your communications parameters*
—number: your local Sprintnet access number**;
—no parity, 8 data bits, and 1 stop bit;
—emulated terminal, if necessary, to VT100.

◊ Save the communications settings.

◊ Dial Sprintnet
—follow Sprintnet's normal access procedures.
For 1200 baud, enter: D<Return>. For 2400 baud, enter: @D<Return>.
When Sprintnet requests a terminal identifier, enter: <Return> if you are using an IBM terminal.

◊ At the system prompt, enter ICPIC access number 7620 0604. Enter your personal Sprintnet password when requested in order to establish connection with ICPIC.

2 Connection via other PSNs is also possible.

◊ Communication settings as above, or else:
—even parity, 7 data bits, 1 stop bit.

◊ Dial PSN number, log on, and follow access procedures for connecting to another network

◊ At the PSN prompt, enter Sprintnet code 3110 7620 0604 to access ICPIC (some PSN may require a 0 before the code, and a password).

Once connection is established, you are requested to enter your first name, last name, and a password in order to log on. If you want to register as a new user, complete the registration procedure in order to add your name to the user list.

ICPIC system is a menu-driven system. Please read carefully the system prompts and answer them correctly. On-line help is available by entering 'H' in response to any prompts.

If you experience any difficulties, contact ICPIC system operator at telephone number 33 (1) 40 58 88 54, or leave your message to SYSOP before logging off.

Access to ICPIC is free of charge. There is neither a registration fee nor a monthly charge. Users pay the communication cost directly to local telephone authorities or to the packet switching network which they use to access ICPIC.

For all information related to the system, please write to—

UNEP—Industry and Environment Programme Activity Centre
Tour Mirabeau, 39-43 Quai André Citroen, 75739 Paris Cedex 15
France

Telex 204 997 F
Telefax 33 (1) 40 58 88 74

* Refer to your communications software manual for details on how to change these settings.

** ICPIC is connected to Sprintnet (US-Sprint) packet switching network. UNEP can provide you with your local Sprintnet office address.

TASK 3 CONSIDER FIELD ARRANGEMENTS TO IMPROVE TREATMENT AND DISPOSAL

EXERCISE 3.1: *PESTICIDE COLLECTION*

Consider and recommend how a scheme might be established in Udanax to collect surplus pesticides and empty containers from rural areas.

The same organisational aspects as in *EXERCISE 2.2* should be taken into consideration.

Do any other special factors apply?

EXERCISE 3.2: *PESTICIDE DISPOSAL*

For the collection scheme which was developed in *EXERCISE 3.1*, suppose that the items in *TABLE 4.4*, on the next page, have now been collected in a nationwide campaign.

Discuss the options for dealing with these items, and then prepare a practical plan of action.

Indicate who is responsible for the action, and how it will be financed. Also indicate the resources—skills, equipment, sites, etc—that will be needed.

TABLE 4.4 PESTICIDE WASTES COLLECTED IN UDANAX

Miscellaneous pesticides in small batches in diverse containers and bags. Some materials cannot be identified, due to lack of labels and so on	36t
Empty pesticide containers	20m³
Out of date DDT	5t
Surplus Malathion in usable condition	10t
Mercury fungicide *(use no longer permitted)*	2 drums
Wood preserving chemicals *(copper-chrome-arsenic)* from a government project	8t

TASK 4 TRANSPORT ARRANGEMENTS

EXERCISE 4.1: *TRANSPORT MONITORING*

A full transport manifest system is not yet feasible in Udanax. Discuss and recommend an alternative, simple system of monitoring the amount of hazardous waste currently transported.

Indicate what administrative implications are involved.

What should be the prime purpose of such a monitoring system? How will the system be enforced?

Summarise the results of your discussion on a worksheet.

EXERCISE 4.2: *TRANSPORT SAFETY*

What arrangements do you recommend for ensuring the safe transport of hazardous waste? Safety is for whom, or to what?

How will these arrangements be integrated with—or kept separate from, if you prefer—other controls on safety in chemicals transport?

Summarise your discussions on a worksheet.

TASK 5 COORDINATION

EXERCISE 5.1: *COORDINATION*

Most of the measures discussed in the exercises above—or those shown, for example, in *TABLE 3.1*—will require a certain level of cooperation between various ministries, municipalities, and industry organisations.

Discuss in the group how you propose to initiate, and subsequently maintain, the necessary coordination to allow the arrangements to work effectively.

What are some of the obstacles to effective cooperation?

Summarise the results on a worksheet.

SECTION THREE: THE SESSION REPORT

A separate worksheet should be completed for each exercise. A suggested worksheet is shown on the following page. Make copies of this worksheet for all exercises.

The information in these worksheets can be used to prepare a summary report for the entire session. The Session Report on the page following the worksheet should be used for this purpose.

As well as showing conclusions and results, any *missing information*, and *additional work* which may be needed, should be indicated.

Tables and *charts* can be attached to the report.

There is no set format or content, but the report should be intelligible to non-specialists such as a minister or a journalist.

A worksheet such as the one shown below can be conveniently used to summarise the results of each exercise. Make copies of this sheet for as many exercises as are attempted.

● WORKSHEET ●

Session ..... Date .....

Exercise .....

Work Group Members

This sheet is for your personal use.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

Session .....

Subject .....

Tasks ..... Exercises .....

Main Conclusions

continue on following page if necessary

Work Group Members

Return completed sheet to workshop coordinator for inclusion inthe Workshop Report.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

SECTION FOUR: REFERENCE MATERIAL

4.1 ***Safe Disposal of Hazardous Wastes:*** *The Special Needs and Problems of Developing Countries*

3 vols, World Bank/WHO/UNEP, 1989.

4.2 ***Treatment and Disposal Methods for Waste Chemicals***

IRPTC, 1985.

4.3 ***Management of Hazardous Waste,*** *WHO Regional Publications*

European Series, N° 14, 1983.

4.4 ***The Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes***

UNEP, 1987.

4.5 ***Guidelines for Establishing Policies and Strategies for Hazardous Waste Management***

ASEAN/UNEP/CDG, 1986.

4.6 ***'Industry and Environment'*** *Special editions on—*

Hazardous Waste Management March 1988.
Waste Minimization March 1989.

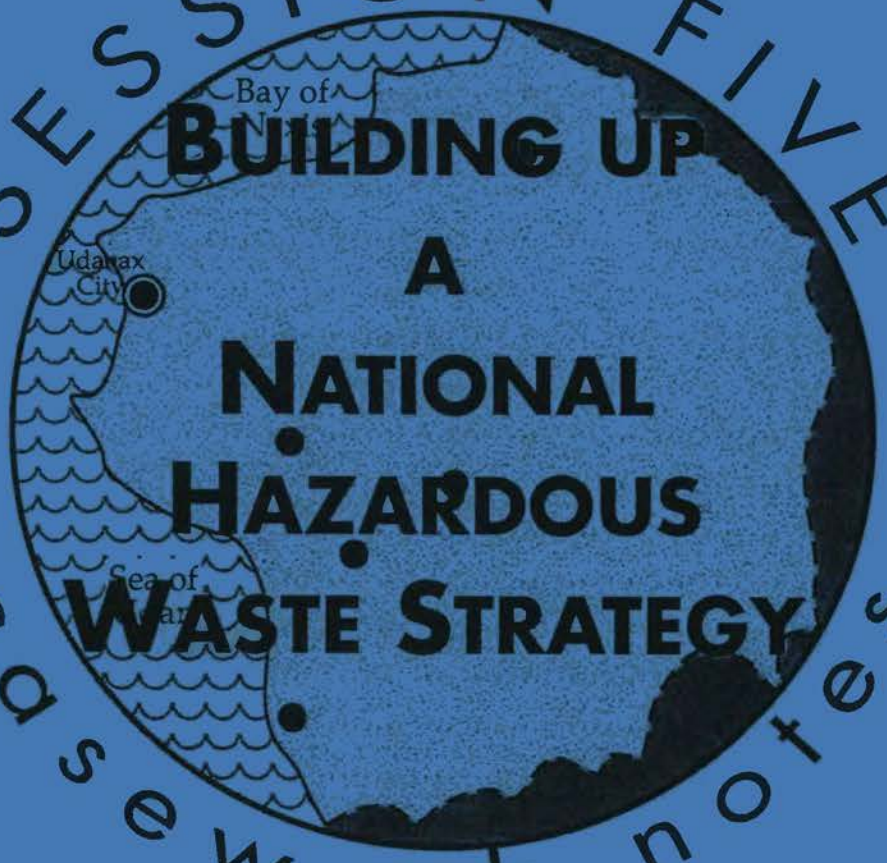
4.7 ***Adapting Hazardous Waste Management to the Needs of Developing Countries***

A special edition of *Waste Management and Research*
Vol. 8, N° 2, March 1990.

4.8 ***Audit and Reduction Manual for Industrial Emissions and Wastes***

UNEP/IEO and UNIDO, 1991.

SESSION FIVE



BUILDING UP A NATIONAL HAZARDOUS WASTE STRATEGY

casework notes

INTRODUCTION

It is not always clear what is meant by a 'strategy'. In general, it refers to an overall systematic group of measures, initiatives, controls, incentives and actions.

Such a systematic approach avoids the messy and uncoordinated application of individual measures that have occurred in the past. These have often shown costly internal conflicts that reduced their effectiveness in the long term.

There are many ways of describing waste management strategies. *TABLE 4.1* and *4.2*, and *FIGURE 4.1*, present a strategy as **groups of elements that are designed to be compatible with each other**. *FIGURE 4.2* particularly displays the stages in a cradle-to-grave system that must be taken into account. The CAIRO GUIDELINES *(TABLE 4.3)* presented the strategic approach as a list of action points.

The preceding working sessions will have summarised much of the background information needed to build a strategy, as well as recommendations in several technical areas. It remains to determine the overall goals and objectives of a management strategy, and the particular combination of instruments, actions and responsibilities needed to achieve the objectives.

It also remains to identify the external facts of life and constraints, including economics, within which a strategy must operate. These can be drawn from participants' own experience and common sense, perhaps summarised here for the benefit of outside readers.

It is most unlikely that a full strategy can be implemented as a single step in the form of a complete master plan. The working group therefore needs to consider how the various measures will be introduced—i.e. the sequence and timing. Interim measures may also be considered to provide some temporary relief until the final measures are in place. This consideration leads to the preparation of a timetable of action.

The Minister is unlikely to adopt the Task Force report at face value. Prior consultation with various affected parties is useful to gain support in principle for the strategy, and ensure they each know their future roles. The process of this consultation should be discussed by the group. A recommended consultation procedure should accompany the strategy (in fact, a part of the strategy may be a consultation process).

As the information necessary to prepare a strategy may be incomplete, further investigation work may need to be identified. The preliminary questionnaire shown in this Session will give you a feel for how ready you are to prepare a convincing strategy.

The notes for this Session have been organised into four *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION FIVE

The working group should—

Task One

Environmental objectives

Exercise 1.1 *Issues to be addressed*

Exercise 1.2 *Goals*

Task Two

Identify external constraints and influences

Exercise 2.1 *External factors*

Task Three

Strategy elements: *policies, instruments, actions, responsibilities*

Exercise 3.1 *Strategy elements*

Exercise 3.2 *Implication of regulatory actions*

Exercise 3.3 *Coordination*

Task Four

Interim measures

Exercise 4.1 *Interim measures*

Exercise 4.2 *New strategy elements*

Task Five

A timetable for implementation

Exercise 5.1 *Implementation*

Exercise 5.2 *Consultation*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised on the worksheets provided.

PRELIMINARY QUESTIONNAIRE

ARE YOU READY TO FORMULATE A HAZARDOUS WASTE STRATEGY?

① WASTE BACKGROUND

Is sufficient information available, or can it be inferred?

	YES	SOME ONLY	NO
Health problems due to hazardous waste	☐	☐	☐
Ecological problems	☐	☐	☐
Waste classification system	☐	☐	☐
Waste hazard identification system	☐	☐	☐
Waste analysis protocols	☐	☐	☐

SYNTHESIS

	YES	NO
Do you have or can you quickly build a solid methodological basis to proceed with management controls?	☐	☐
Is the need for action on hazardous waste convincing?	☐	☐

② WASTE SOURCES

Is sufficient information available, or can it be inferred?

	YES	SOME ONLY	NO
Hazardous waste produced within Udanax	☐	☐	☐
Waste from previously contaminated sites	☐	☐	☐
Proportion of waste that can be avoided	☐	☐	☐
Proportion of waste that can be recycled	☐	☐	☐
Waste imported	☐	☐	☐

SYNTHESIS

	YES	NO
Do you have sufficient knowledge of hazardous waste sources and quantities to start on a management plan?	☐	☐

③ WASTE AVOIDANCE

Is sufficient information available, or can it be inferred?

	YES	SOME ONLY	NO
Waste production?	☐	☐	☐
Waste avoidance?	☐	☐	☐
Are recycling volumes accurately known?	☐	☐	☐
Have by-product uses been studied?	☐	☐	☐
Are secondary raw materials markets well established?	☐	☐	☐
Government policies	☐	☐	☐

SYNTHESIS

	YES	NO
Have the possibilities for waste avoidance been properly documented?	☐	☐

④ DISPOSAL NEEDS

Is sufficient information available, or can it be inferred?

	YES	SOME ONLY	NO
Waste that could be treated on-site	☐	☐	☐
Waste that should not be treated on-site	☐	☐	☐
Waste that could be exported in the short term	☐	☐	☐
Waste that could be treated by existing installations	☐	☐	☐
Acceptable/unacceptable disposal methods defined	☐	☐	☐
Additional facilities needed	☐	☐	☐
Interim facilities to be put into use in the meantime	☐	☐	☐
Policy constraints identified on development of disposal facilities	☐	☐	☐

SYNTHESIS

	YES	NO
Are you in a position to define the additional facilities needed?	☐	☐

continued ...

continued ...

	Is sufficient information available, or can it be inferred?		
⑤ REGULATORY	YES	SOME ONLY	NO
Existing regulatory framework	☐	☐	☐
Basic pollution control and solid waste regulations	☐	☐	☐
Scope of new legislation	☐	☐	☐
Enforcement agency and resources	☐	☐	☐
Economic implications	☐	☐	☐

SYNTHESIS	YES	NO
Are you ready to explain and justify new hazardous waste legislation?	☐	☐

	Is sufficient information available, or can it be inferred?		
⑥ INFRASTRUCTURE	YES	SOME ONLY	NO
Laboratory services and protocol	☐	☐	☐
Training facilities for technicians and operators	☐	☐	☐
Communication links (media, inter-agency)	☐	☐	☐
Data processing facilities and skills	☐	☐	☐
Information centres and consultants	☐	☐	☐

SYNTHESIS	YES	NO
Are there enough known back-up services to allow operators to comply with any new regulations?	☐	☐

	Is sufficient information available, or can it be inferred?		
⑦ FINANCIAL	YES	SOME ONLY	NO
Ability/willingness of public expenditure	☐	☐	☐
Ability of industry to absorb extra costs	☐	☐	☐
Options for raising revenue to pay for control measures	☐	☐	☐
Damage costs from present waste disposal	☐	☐	☐

SYNTHESIS	YES	NO
Do you feel able to recommend how new measures should be paid for?	☐	☐

	Is sufficient information available, or can it be inferred?		
⑧ COMMUNICATION	YES	SOME ONLY	NO
Good understanding/support by public	☐	☐	☐
Awareness of various authorities	☐	☐	☐
Industry awareness	☐	☐	☐

SYNTHESIS	YES	NO
Will you have public understanding of, and support for, new control measures?	☐	☐

SECTION ONE: BACKGROUND INFORMATION

There are no firm rules for either the format or the process of a strategy. The following tables are only intended to stimulate—not constrain—discussion. They are examples, not rules.

TABLE 5.1 SOME HAZARDOUS WASTE STRATEGY ELEMENTS

WASTE REDUCTION	WASTE CONTROL
Waste avoidance and minimization— ■ cleaner technologies ■ cleaner operation ■ low impact raw materials and products	Discharge limits Disposal controls
Recycling and recovery	Treatment plants
Plant safety	Disposal facilities
	Transport control
	Clean-up of spills

TABLE 5.2 SOME WASTE CONTROL ELEMENTS

ADMINISTRATIVE	TECHNOLOGY	INFRASTRUCTURE
Standards	Cleaner production	Identification
Licences	Recycling	Packaging
Permits	Storage	Hazard classification
Enforcement	Treatment	Transport
Databases	Transport	Spill clean-up
Education	Disposal	Laboratories
Legal and policy	Site clean-up	Design
	Analysis	Research
		Consulting
		Training
		Databases

Some Functional Links to be kept in mind

Close links exist with—

- chemical products
- emergency services
- factory approvals
- EIA
- public health
- urban waste services
- agriculture (pesticides) and air/water pollution control

TABLE 5.3 MAIN POINTS OF THE CAIRO GUIDELINES AND PRINCIPLES FOR THE ENVIRONMENTALLY SOUND MANAGEMENT OF HAZARDOUS WASTE

INTRODUCTION

I GENERAL PROVISIONS

1 Definitions
2 General principles
3 Non-discriminatory control of hazardous wastes
4 International cooperation
5 Transfer of technology
6 Transfer or transformation of pollution

II GENERATION AND MANAGEMENT OF HAZARDOUS WASTES

7 Preventive measures
8 Establishment of competent authorities

III CONTROL OVER DISPOSAL OF HAZARDOUS WASTES

9 Disposal plans for hazardous wastes
10 Separation of hazardous wastes
11 Collection of hazardous wastes
12 Duty to ensure safe disposal
13 Use of best practicable means
14 Approved sites and facilities
15 International listing of approved sites and facilities
16 Transfrontier effects of approved sites and facilities—*pre-authorisation information*
17 Transfrontier effects—*consultation*
18 Transfrontier effects—*equal access and treatment*

IV MONITORING, REMEDIAL ACTION AND RECORD KEEPING

19 Monitoring
20 Public access to information

V SAFETY AND CONTINGENCY PLANNING

21 Instruction of workers
22 Contingency plans
23 Contingency plans—*transfrontier effects*

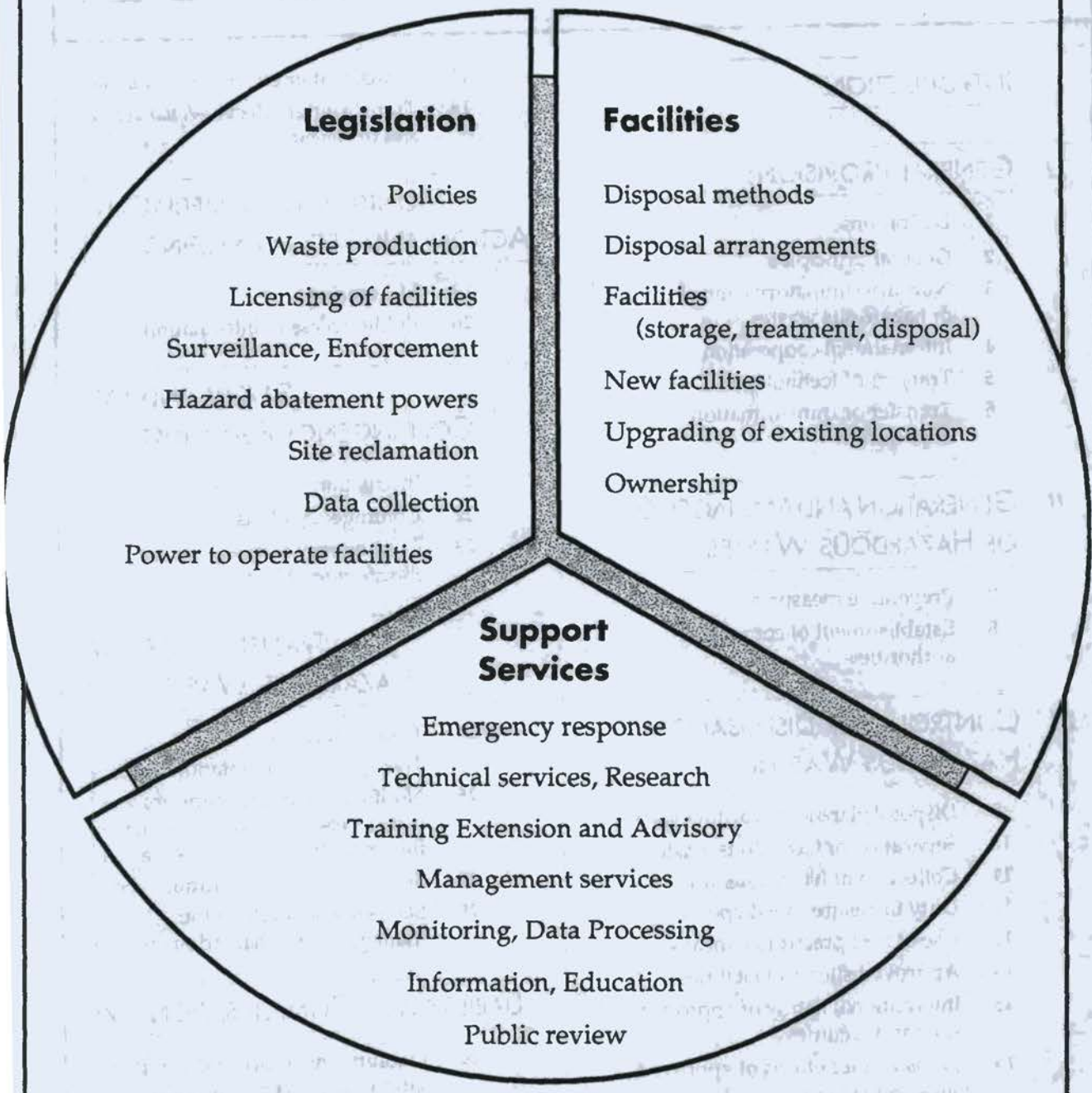
VI TRANSPORT OF HAZARDOUS WASTES

24 Transport rules
25 Transport documentation
26 Notification and consent procedure in respect of transfrontier movements of hazardous wastes
27 States of export to readmit exports
28 States to cooperate in the management of hazardous wastes

VII LIABILITY AND COMPENSATION

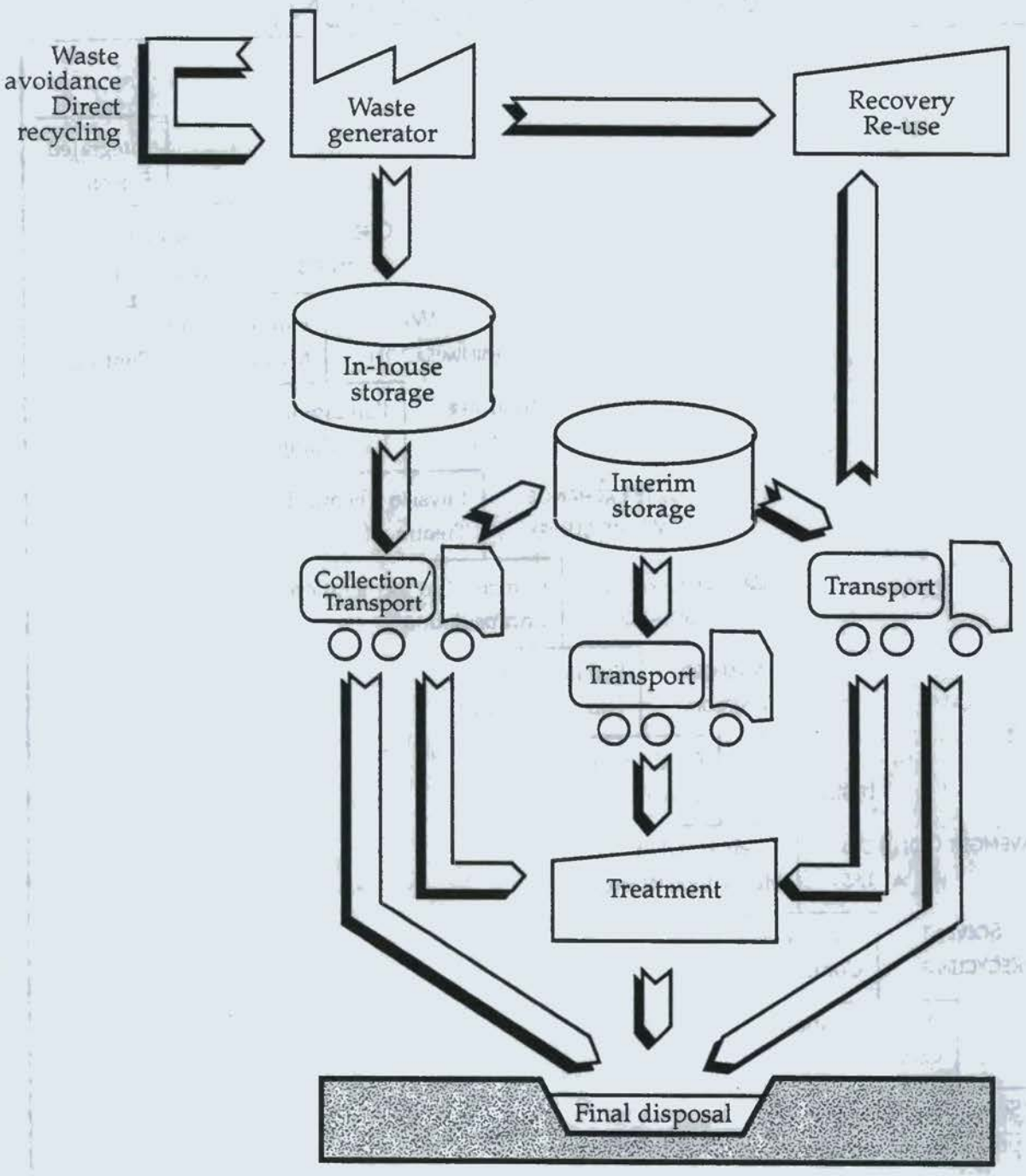
29 Liability, insurance and compensation for damage caused by hazardous wastes

FIGURE 5.1 OBJECTIVES AND SCOPE OF A NATIONAL INDUSTRIAL WASTE STRATEGY



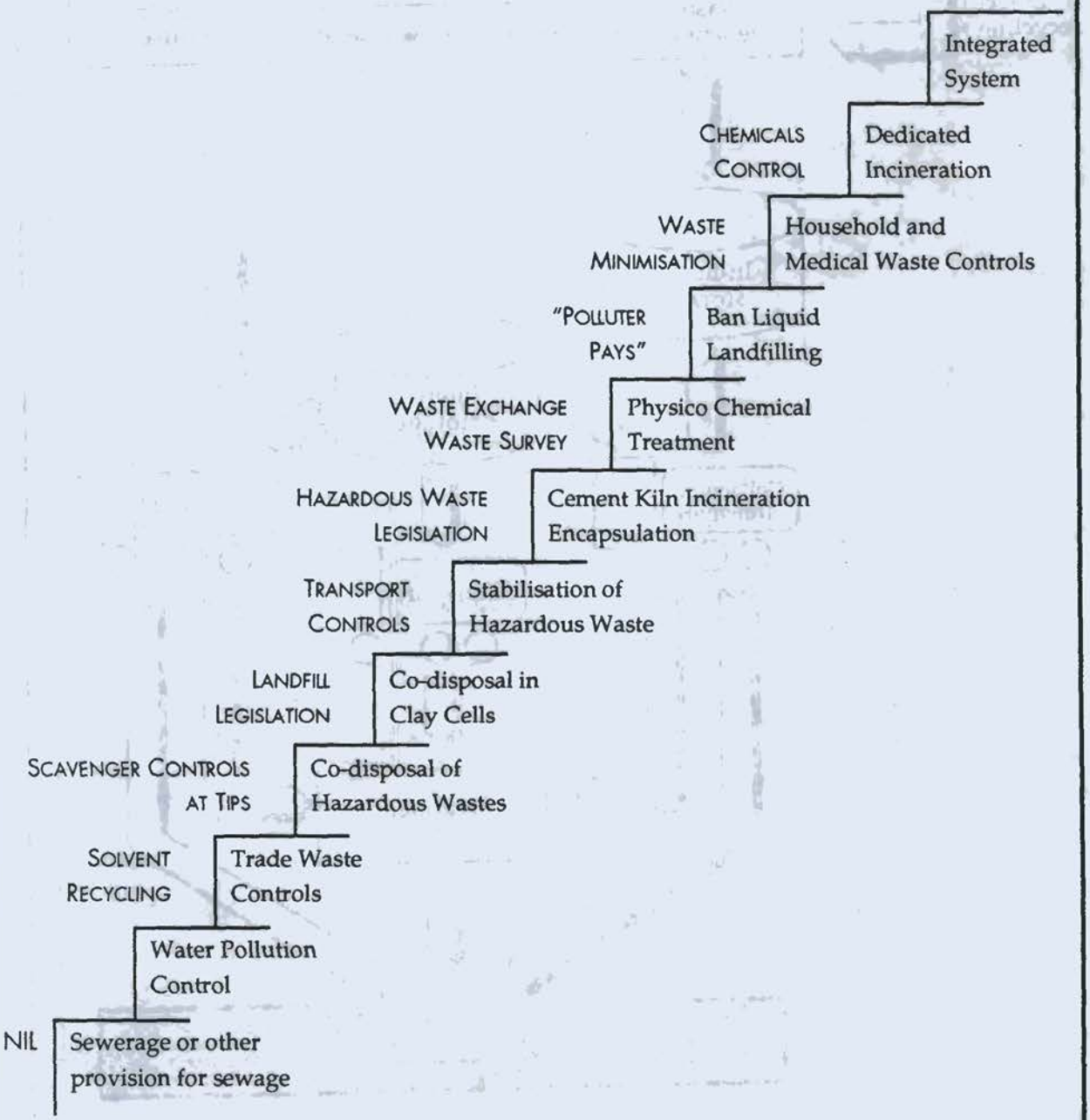
Source: *State of Victoria, Australia*, 1985

FIGURE 5.2 COMPONENTS OF A HAZARDOUS WASTE SYSTEM



Source: *Technical Paper Nº 93, World Bank, 1989*

FIGURE 5.3 AN EXAMPLE OF AN EVOLUTIONARY APPROACH TO HAZARDOUS WASTE MANAGEMENT



Source: *Waste Management and Research*, March 1990

SECTION TWO: THE CASEWORK TASKS

TASK 1 ENVIRONMENTAL OBJECTIVES

EXERCISE 1.1: *ISSUES TO BE ADDRESSED*

Summarize again the environmental issues in Udanax that need to be addressed. Choose the top three (3) priority issues.

This task is really a repetition of earlier information. It is as well, though, to be clear about the goals of a strategy by briefly listing again the issues to be addressed, and the objectives to be achieved.

EXERCISE 1.2: *GOALS*

From earlier exercises, recall the goals—or objectives—of a hazardous waste strategy.

Either from this, or from your discussion, develop a short statement that could be adopted by the government.

An example may help to focus discussion.

A waste strategy developed in 1985 in Australia had two principal objectives—

① to protect the public and the environment from the effects of pollution

and

① to ensure the establishment and operation of effective disposal services (irrespective of immediate environmental risks).

This strategy is concerned with the **management** of industrial waste, not just its disposal. Accordingly, waste avoidance and minimisation, waste generation, recovery, storage and transport are all addressed in the recommendations. This is sometimes termed *"cradle-to-grave"* control.

The strategy defined the roles and responsibilities of all interested parties, in particular government, industry and the general public.

TASK 2 EXTERNAL CONSTRAINTS AND INFLUENCES

EXERCISE 2.1: *EXTERNAL FACTORS*

Identify important external, non-technical constraints and influences in Udanax which the strategy must accommodate.

By 'external', we mean outside the area of waste management.

The government will have more on its mind than just hazardous waste management.

Other societal goals will be important constraints on waste control.

These include—

- economics
- industry development policy
- public sector investment policy
- official secrecy laws
- public controversy

Assignment of ministerial and institutional responsibility may also be an important factor.

Economics will include two aspects—

① ability of government to pay for disposal and

② willingness of industry to pay.

Such other goals may constrain the technical options of a waste management plan.

The working group should identify any social or political constraints that are likely in a country such as Udanax.

Obstacles to new legal measures, particularly institutional resistance to new powers being given to environmental departments, may also be strong.

Is this likely to be important in Udanax?

Use a worksheet to summarise your results.

TASK 3 STRATEGY ELEMENTS: *POLICIES, INSTRUMENTS, ACTIONS, RESPONSIBILITIES*

EXERCISE 3.1: *STRATEGY ELEMENTS*

Strategy 'elements' are the many separate measures or instruments that must be combined into a coherent, coordinated master plan.

The present task is to list all the elements needed, grouped in such a way as to give a simple overview.

The idea behind *FIGURE 5.1* can be used here, perhaps.

Three main groups of elements were considered in previous Sessions—

① disposal facilities and operations

② legislation

and

③ administrative and organisational arrangements.

Other elements may also be considered here, at this stage.

A simple approach for the working group is to first consider what other factors are needed to allow disposal facilities to function properly ...

... For example, laboratories for analysis; training of staff; reliable transport operators, and so on.

These could be listed under the heading of 'INFRASTRUCTURE'.

EXERCISE 3.2: *IMPLICATION OF REGULATORY ACTIONS*

Some implications of the legislation could be explored.

How is the legislation to be made known to those affected?

How will enforcement be organised?

How will waste manifest infringements be detected?

What will happen if enforcement never occurs?

EXERCISE 3.3: *COORDINATION*

Finally, a list of some important actions which require coordination should be prepared. Actions that can be put into place by a central agency without coordination and without consultation should be listed separately.

For example, coordination is required on hazardous waste transport regulations (with whom?), over waste landfill (with which agencies?), and over hospital wastes. List four (4) other coordination areas.

Summarise the results on a worksheet.

TASK 4 INTERIM MEASURES

EXERCISE 4.1: *INTERIM MEASURES*

The group should consider realistically how long it will take to put a strategy into place, and make it work.

What interim disposal measures should be put into place so as to immediately reduce the environmental impact of waste dumping?

Who should do it? Who should pay?

How can it be ensured that the interim measures do not become permanent?

Use a worksheet to—

① list the proposed interim measures and

② discuss their management and operation.

EXERCISE 4.2: *NEW STRATEGY ELEMENTS*

Go back to *TASK 3*, and add any new strategy elements arising from interim measures.

Include consideration of technology, legislation and coordination measures.

TASK 5 A TIMETABLE FOR IMPLEMENTATION

EXERCISE 5.1: *IMPLEMENTATION*

The development of a formal strategy plan has considerable value in showing how individual actions are linked.

However, it is unlikely that the strategy can be implemented all at once.

Waste management measures in industrialised countries have always evolved over a period of time.

The next task for the group is to link the strategy concept and the interim measures, by developing a progression of actions that can be implemented over a period of time.

An example of such an evolutionary ladder was shown in *FIGURE 5.3.*

The group should draw up a comparable ladder for Udanax.

EXERCISE 5.2: *CONSULTATION*

Discuss the consultation mechanisms that you feel need to be set up immediately with—

① official levels

② within government

and

③ the public and industry

—so as to help implement the strategy.

SECTION THREE: THE SESSION REPORT

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Tables and *charts* can be attached to the report.

There is no set format or content, but the report should be intelligible to non-specialists such as a minister or a journalist.

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● WORKSHEET ●

Session ..... Date .....

Exercise .....

Work Group Members

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HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

Session .....

Subject .....

Tasks ..... Exercises .....

Main Conclusions

continue on following page if necessary

Work Group Members

Return completed sheet to workshop coordinator for inclusion inthe Workshop Report.

HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

SECTION FOUR: REFERENCE MATERIAL

5.1 ***Safe Disposal of Hazardous Wastes:*** *The Special Needs and Problems of Developing Countries*

3 vols, World Bank/WHO/UNEP, 1989.

5.2 ***The Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes***

UNEP, 1987.

5.3 ***Management of Hazardous Waste***

WHO Regional Publications, European Series, N° 14, 1983.

5.4 ***Industrial Waste Management***

CEFIC, 1989.

and ***Guidelines on Waste Minimisation***

CEFIC, 1990.

5.5 ***Adopting Hazardous Waste Management to the Needs of Developing Countries***

A special edition of *Waste Management and Research*
Vol. 8, N° 2, March 1990.

5.6 ***Guidelines for Establishing Policies and Strategies for Hazardous Waste Management***

ASEAN/UNEP/CDG, 1986.

SESSION SIX

IMPLEMENTING THE BASEL CONVENTION

casework notes

INTRODUCTION

Many members of the cabinet—and most members of the public—may not have heard of the *Basel Convention*.

Much of industry will not understand its implications very well.

There may be a suspicion of externally imposed obligations.

The Task Force needs to familiarise itself thoroughly with the Convention so as to be able to discuss it without causing further confusion.

The Task Force may also need to initiate an information programme about the implications of the Convention.

This Session will explore a few of the many implications of the Convention to Udanax.

The notes for this Session have been organised into four *Sections*—

SECTION ONE
Background Information

SECTION TWO
The Casework Tasks

SECTION THREE
The Session Report

SECTION FOUR
Reference Material

THE TASKS YOU WILL UNDERTAKE IN SESSION SIX

Preliminary Exercise

Application of the Basel Convention

The Task Force should pursue three lines of investigation—

Task One

Review the current situation of trade of hazardous waste

Exercise 1.1 *Current export/import*

Task Two

Consider the administrative implications of the Basel Convention

Exercise 2.1 *Reporting sheet*

Exercise 2.2 *National surveillance programme*

Exercise 2.3 *Information management*

Exercise 2.4 *Transport regulations*

Exercise 2.5 *Other regulations*

Task Three

Consider the regional implications

Exercise 3.1 *Regional disposal options*

Exercise 3.2 *Regional agreements*

Further information and references needed to carry out the tasks are included in each exercise where necessary.

The results of the discussion on each exercise should be summarised on the worksheets provided.

SECTION ONE: BACKGROUND INFORMATION

MAIN POINTS OF THE BASEL CONVENTION

The full text of the Basel Convention is found by consulting the references. Some key points are summarised below.

1 A signatory State cannot send any hazardous waste to another signatory State that bans imports of it or to any country that has not signed the treaty.

2 No signatory country may ship hazardous waste to another signatory State if the importing country does not have the facilities to dispose of the waste in an environmentally sound manner.

3 Every country has the sovereign right to refuse to accept a shipment of hazardous waste.

4 Before an exporting country can start a shipment on its way, it must have the importing country's consent in writing. The exporting country must first provide detailed information on the intended export to the importing country to allow it to assess the risks.

5 The treaty asks that less hazardous waste be generated, and what is generated to be disposed of as close to its source as possible.

6 Where an importing country is unable to dispose of legally imported waste in an environmentally acceptable way, then the exporting State has a duty either to take it back or to find some other way of safely disposing of it.

7 The treaty states that "illegal traffic in hazardous waste is criminal".

8 Shipments of hazardous waste must be packaged, labelled, and transported in conformity with generally accepted and recognised international rules and standards.

9 Bilateral agreements may be made by signatory States with each other and with a non-signatory country, but these agreements must conform to the terms of the Basel treaty and be no less environmentally sound.

10 As authorities in many countries frequently do not have trained specialists and technical know-how about hazardous waste and how to handle it efficiently, the treaty calls for international cooperation on the training of technicians, the exchange of information, and the transfer of technology.

11 The treaty sets up a secretariat to supervise and facilitate its implementation.

12 Signatory parties will report annually information about transboundary movements of hazardous wastes in which they have been involved.

BASEL CONVENTION: ARTICLE 13

Transmission of Information

1 ...

2 ...

3 The Parties, consistent with national laws and regulations, shall transmit, through the Secretariat, to the Conference of the Parties established under Article 15, before the end of each calendar year, a report on the previous calendar year, containing the following information:

(a) ...

(b) Information regarding transboundary movements of hazardous wastes or other wastes in which they have been involved, including:

(i) The amount of hazardous wastes and other wastes exported, their category, characteristics, destination, any transit country and disposal method as stated on the response to notification;

(ii) The amount of hazardous wastes and other wastes imported, their category, characteristics, origin, and disposal method;

(iii) Disposals which did not proceed as intended;

(iv) Efforts to achieve a reduction of the amount of hazardous wastes or other wastes subject to transboundary movement;

(c) ...

(d) ...

(e) ...

(f) ...

(g) ...

(h) ...

(i) ...

4 ...

SECTION TWO: THE CASEWORK TASKS

PRELIMINARY EXERCISE: *APPLICATION OF THE BASEL CONVENTION*

From the *Main Points of the Basel Convention* (OPTIONAL EXERCISE—use the full text of the Convention) identify the main waste management elements that are called for in the Convention.

How many of the elements that you have selected are necessary for—

① wastes management ***within*** Udanax?

and

② wastes subject to ***import/export***?

As an aide memoire, you can use *TABLES 5.1, 5.2,* and *5.3,* and *FIGURES 5.1, 5.2* and *5.3* to identify possible waste management elements.

TASK 1 REVIEW THE CURRENT SITUATION OF TRADE OF HAZARDOUS WASTE

EXERCISE 1.1: *CURRENT EXPORT/IMPORT*

Prepare a short report to the Basel Convention secretariat of the current known situation regarding export/import of hazardous waste in Udanax.

From the country report, a number of facts emerge about the export/import situation. Few of these seem to be well substantiated.

First, comment how likely it is that clandestine import and dumping operations could be detected.

Then discuss some possibilities for detecting such operations.

What official monitoring programmes exist to monitor waste export and import?

Prepare a short summary of the above on a worksheet.

TASK 2 CONSIDER THE ADMINISTRATIVE IMPLICATIONS OF THE BASEL CONVENTION

EXERCISE 2.1: *REPORTING SHEET*

How do you suggest that a national agency in Udanax should collect information on international hazardous waste movements?

From your response to this question, prepare a proposal for a reporting sheet that will be a national submission to the Secretariat of the Basel Convention, based on the results of *EXERCISE 1.1*.

Attach the report sheet and the submission to the worksheet.

Use a worksheet to make any comments you may have about this exercise.

EXERCISE 2.2: *NATIONAL SURVEILLANCE PROGRAMME*

Discuss a possible national surveillance programme in Udanax for—

A import

and

B export of hazardous waste

Who should do it? How? And what would they look for?

How can illegal activities be detected?

The group should suggest who would coordinate this programme, and how the results will be collated.

Comment

As only a part of export/import operations may be 'honest', a proportion of this trade will seek to hide from official surveillance. Accordingly, surveillance should be of clandestine activities as well as those which are officially sanctioned.

Report on this exercise on a worksheet.

EXERCISE 2.3: *INFORMATION MANAGEMENT*

From the Main Points of the Basel Convention, identify those for which there is an obligation for the national authorities in Udanax to collect or disseminate information.

How will this information be stored?

Who should be responsible for collecting and distributing the information in Udanax, if the Convention is ratified in six months?

OPTIONAL EXERCISE

Repeat this exercise using the complete text of the Basel Convention.

Report on your discussion on the worksheet.

EXERCISE 2.4: *TRANSPORT REGULATIONS*

Make a proposal for a national regulation to implement the 'transboundary transport' sections of the Basel Convention. What should such regulations contain in Udanax?

Who should implement the regulation?

What resources would be needed for enforcement?

A complete regulation would encompass concepts of approval (or not) for export/import, monitoring, reporting, nomenclature and labelling, conditions of transport (if any), and verification of treatment, among others.

For this exercise, you should keep the proposal simple. Initially, just add a further short section to *TABLE 3.4* in *SESSION 3*. You will need to indicate any new annexes that are required to implement the clauses.

Report on this exercise on a worksheet.

EXERCISE 2.5: *OTHER REGULATIONS*

Look again at the Main Points of the Convention. Identify other regulations (in addition to *EXERCISE 2.4*) that are needed to implement the Convention.

To what extent are these regulations already included in *TABLE 3.4*?

Suggest some additions to this table.

Do you consider that the clauses of *TABLE 3.4* are sufficient to implement the relevant export/import clauses of the Convention?

TASK 3 CONSIDER THE REGIONAL IMPLICATIONS

EXERCISE 3.1: *REGIONAL DISPOSAL OPTIONS*

Which wastes produced in Udanax could conceivably be considered as forming part of a hypothetical future international regional disposal plan?

Report on this exercise on a worksheet.

Comment

Regional disposal plans usually refer to shared disposal facilities such as incinerators, to emergency response teams, to ship generated wastes, and to specialised recycling and chemical destruction, among others.

However, other elements could be considered if necessary.

EXERCISE 3.2: *REGIONAL AGREEMENTS*

What regional or bilateral agreements do you recommend for Udanax? What should such agreements cover?

Refer to *SECTION ONE* for possible framework ideas.

SECTION THREE: THE SESSION REPORT

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HAZARDOUS WASTE POLICIES AND STRATEGIES

Work group .....

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Main Conclusions

continue on reverse if necessary

Work Group Members

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HAZARDOUS WASTE POLICIES AND STRATEGIES

Main Conclusions—*ctd*

SECTION FOUR: REFERENCE MATERIAL

6.1 *The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*

UNEP, 1989.

6.2 *Greenpeace Information Dossier*

Greenpeace.

RESOURCE SECTION

1 WASTE SITUATION QUESTIONNAIRE

2 MODEL WORKSHOP PROGRAMME

3 BACKGROUND ON MANAGEMENT AND CONTROL SYSTEMS FOR HAZARDOUS WASTE

1 WASTE SITUATION QUESTIONNAIRE

HAZARDOUS WASTE SITUATION QUESTIONNAIRE

UNEP: Industry and Environment Programme Activity Centre (IE/PAC)

Country/Region:

Period/Year:

Prepared by: Date:

INFORMATION NOTE TO USERS

This questionnaire seeks to collect basic, country-specific information in order to give an overview of hazardous waste generation rates and disposal needs. This information will allow an appraisal of the environmental problems, the sources of hazardous waste, and the management elements already in place.

The first part of this document consists of a simple two-page overview questionnaire that can be used alone or in conjunction with a second, more detailed survey. When used alone, it can be widely distributed in order to quickly obtain an appreciation of the general situation in a country. This overview questionnaire can be completed by country personnel without requiring a great deal of research. They will rely on their own knowledge and experience, and perhaps on easily accessible documentation.

The second part consists of a more detailed questionnaire for in-depth investigation of the factors important to the management of hazardous waste. It is designed for use by consultants or experienced national experts. It is not suitable for mail-out.

Both parts can be used in actual country studies. They are also useful in preparing trainees for a forthcoming course by collecting information in advance that can then be used in association with this manual.

In order to complete all the information asked for, it will often be necessary to contact special information directories handbooks and annual reports, and to contact information sources in various government departments. These sources should be indicated in appropriate places in the tables to allow follow-up later.

National Hazardous Waste Situation Overview

Depending on the question, mark the appropriate box, write the correct answer or provide key words in the space provided.

National Profile

Population: GDP: .....

Main Economic Activity:

Main Industries:

Waste Generation

Main problem wastes: .....

Major industrial waste sources: identified/not identified

Other hazardous waste sources: known/not known

Waste Surveys: done/in process/none

Survey Agency (s): .....

Waste import: not known/unconfirmed/confirmed

Checklist of Problems

- ☐ water pollution
- ☐ toxic air emissions
- ☐ landfill problems
- ☐ contaminated sites
- ☐ fires, spills of chemicals
- ☐ waste dumping
- ☐ waste import
- ☐ transport problems
- ☐ safety risks/poisoning
- ☐ animal/fish kills

Mark (1) if the problem is minor, (2) if it is serious.

Waste Transport/Disposal

Specialized transport operators: exist/not exist

Specialized disposal facilities exist for : .....

Industrial waste recycling exists for : .....

.....

Garbage dumps receive: much/some/no industrial hazardous waste

Regulations/Standards

Legislation* is in force on:

hazardous waste disposal:	☐ Yes	☐ No
hazardous waste transport:	☐ Yes	☐ No
water pollution:	☐ Yes	☐ No
solid waste disposal:	☐ Yes	☐ No
EIA:	☐ Yes	☐ No
Export/Import of wastes:	☐ Yes	☐ No
Waste Classification system exists? :	☐ Yes	☐ No

*If answer is yes, attach details.

Administration

Environmental agency/Ministry:

Agency responsible for hazardous waste management:

Enforcement agency(s):

Agency for Industrial Development:

Contact agency for Basel Convention:

Waste Generation Overview

List below the main types of waste known by you to be generated. Use the common classification in use in your country	List the number and location of Treatment/Disposal Facilites known to you
Waste ..... Quantity	Oil recovery plants ..... Solvent Recovery ..... Non-ferrous metal recovery ..... Cyanide Treatment ..... Other Physical/Chemical Tmt. ..... Incineration ..... Co-incineration ..... Special landfill ..... Co-disposal landfill ..... Solidification/Encapsulation ..... Stockpiling ..... Export of Wastes ..... Discharge to : sewer ☐ river ☐ sea ☐
If known, list the quantities of wastes shown below.	Contact Names for further information on waste surveys, and disposal facilities
Waste ..... Quantity Acids/Alkalis ..... Heavy Metal Wastes ..... Toxic Inorganics ..... Reactive/Corrosive ..... Solvents Wastes ..... Oil Wastes ..... Organic Chemicals ..... Pesticide Residues ..... PCB's, Chlorinated hydrocarbons ..... Contaminated Soil or Equipment	1. 2. 3.

HAZARDOUS WASTE QUESTIONNAIRE

table of contents

Background Information

National Profile

Give a very brief description of your country under the headings below:

1. Geographical (area, terrain, climate, population)

2. Resources

3. Urban Services (transport, water, sewerage, electricity)

4. (a) Economic Activity and Industries

   (b) GDP

5. Political Structure

6. Administration

7. Technical Services Available

8. Environmental Quality (major issues)

Attach names of relevant Yearbooks, Statistical Digests, Country Profiles, and Environmental Reviews which have been published.

Background on Industry

Indicate below the main types of industry found in your country with: none/some/many

Textile	Specialty chemicals
Leather/Tanning	Petro chemicals
Wood products	Aluminium
Wood preserving	Iron and Steel
Pulp and Paper	Base Metals
Printing	Battery manufacture
Chemicals (list)	Metal fabrication
Plastics (PVC)	Vehicle manufacture
Plastics (others)	Electrical machinery
Chlorine	Electronic components
Sulphuric acid	Cement
Nitrogen fertilizer	Ship building/repair
Phosphate fertilizer	Others ... (indicate)

Which Ministry or Department is responsible for keeping employement statistics ? .....
If available, attach employment and production output for each of the above industries.

Background on Specific Activities

The following sections deal with some activities that may under some circumstances give rise to hazardous wastes. Please list the information requested in the space indicated, using available handbooks and reports to provide the data.

1) Agriculture

Main crops grown:

Main crops exported:

Irrigated crops:

Pesticides used:

Number of pesticide production/formulation plants: .....

2) Mining and Minerals

Minerals mined:

Minerals processed:

Minerals smelted:

Metals fabricated:

3) Energy

Type of fossil fuel produced:

Number of refineries:

Number of storage/distribution centres:

Number of service stations:

4) Transport

Number of registred: Trucks: Buses: Cars:

Shipping: N°. of ports: Total tonnage handled: N°. of bulk terminals: Tonnage:

5) Cement

Number of plants: Total output:

6) Medical

Number of major hospitals: Number of private clinics:

Number of medical laboratories:

List information sources consulted:

Background on Employment

As employment rates can give an approximate indication of waste generation, please show employment in the sectors below.

Industry Sector ISIC Code	Description	Employees (x 1000)
31	Food	.....
	Beverage	.....
	Tobacco	.....
32	Textile	.....
	Footwear	.....
	Leather	.....
33	Wood	.....
	Wood Production	.....
	Processing	.....
34	Paper, Paper Products	.....
	Printing	.....
35	Chemicals	.....
	Petroleum	.....
36	Non-metallic Mineral Products	.....
37	Basic Metal Production	.....
38	Metal Fabrication Products	.....
	Machinery	.....
39	Other Manufacturing	.....
D	Services Utilities	.....
	Total:	.....

Source: specify whether (i) Industry Ministry or (ii) other.

Background on Environmental Problems

It is important to know the types of environmental problems being caused by hazardous wastes. Please complete the questionnaire form on the next page as indicated.

Initially try to complete the form using your own knowledge. Subsequently, copies of pages 13, 14, 15 should be sent for reply to ministries, departments or other organizations competent in the sectors shown in the table below. The table allows you to keep a record of your contact with these organizations.

Sector/Organization	*Date sent out*	*Date of reply*
• *water and sewerage*		
• *waste disposal*		
• *pollution control*		
• *health*		
• *agriculture*		
• *fisheries*		
• *fire services*		
• *factory inspectorates*		
• *shipping*		
• *transport*		
• *NGO's*		
• *environmental research institutes*		
• *state of environment units*		
• *industry federations*		
• *municipalities in industrial regions*		

Environmental Problems due to Hazardous Wastes

Problem Group	Severity		
	None	Some	Much
1. Pollution			
Toxic effluents are affecting marine or river life?			
Oils and chemicals are burnt under uncontrolled conditions?			
Toxic discharges are affecting sewers or sewage treatment?			
Leachate has been detected escaping from landfill?			
Excessive chemical residues are detected in fish, or in crops?			
Vehicles sometimes discharge wastes to land or to water?			
Odour are detected from factories?			
Toxic emissions escape to air from factories?			
2. Landfill			
No control exists at landfill sites?			
Drums of chemicals sometimes found at the site?			
Liquids being discharged to landfill?			
Fires from chemicals occur at landfills?			
Leachate is escaping from some landfills?			
Serious odour problems occur at landfills?			
It is common for people to scavenge on landfill sites?			
3. Export/Import			
Confirmed export/import operations?			
Unsubstantiated claims?			
Wastes are shipped overseas for treatment/disposal?			

Problem Group	Severity		
	None	Some	Much
4. Dumping			
Dumping of wastes is detected along roadsides?			
Drums have washed up on the beach?			
Wastes are known to be dumped at sea?			
Wastes are dumped on factory premises?			
Old contaminated factory sites are known to exist?			
5. Unsafe Operations			
Some people have been injured/killed by industrial wastes?			
The handling of industrial wastes is unsafe?			
The transport of industrial wastes is unsafe?			
Waste material are often not labelled, and in poor quality containers?			
6. Storage			
Surplus pesticides are known to be stockpiled?			
Chemicals are often stored under unsafe conditions?			
Waste chemicals are accumulating in storage?			
PCB's are stored by some companies?			
Treatment sludges are being stored?			
Abandonned waste storages exist?			

Problem Group	Severity		
	None	Some	Much
7. Soil contamination			
Contaminated industrial land identified?			
Other contaminated land is known?			
River or harbour sediments are polluted?			
Surveys are carried out before industrial land is re-developped?			
8. Transport			
Accidents involving hazardous wastes?			
Spills of industrial chemicals?			
Vehicles well maintained?			
Containers in good condition?			
9. Cost			
The cost of treatment is high?			
The cost of clean-up is high?			
There is no good market for recovered material?			
10. Publicity			
There has been adverse publicity about hazardous wastes?			
There have been reports about injuries and damage to the environment?			
Public concern about wastes?			
Public opposition to new treatment plants?			
Are certain public groups active on waste issues?			
Have newspaper or media reports been frequent?			

Background on Environmental Sensivity

Estimate below as far as you are able the information requested as: None/Some/Much

1. Sensitive Environments

Enclosed harbours/bays

Estuaries

Coral Reefs

Rivers used for: drinking/fishing
agriculture

Inland Lakes

Groundwater used for drinking/agriculture

Groundwater is shallow

Stable air/air inversions
over towns and industry areas

Important national parks or nature reserves

Flooding/inundation

2. Human Environments

Urban habitation close to industry?

River water used for drinking supply?

Subsistence fishing is common?

Tourism is important?

Scavenging on landfills/dumpsites?

Human habitation adjacent to dumpsites?

Agriculture close to industrial estates?

Re-use of empty containers is common?

Background on Waste Classification

Show below (or in attached documents) the method of classification of hazardous wastes and chemical residues in your country. If no official system exists, write down the names of those hazardous waste types that are of greatest concern to you.

Waste Types	Code N° (if any)	Quantity produced (if known)

Table 1 – Hazardous Waste Generation

The Tables in the following pages ask for data on hazardous waste generation from a number of sources, and also for details of non-hazardous waste, as far as is known.

As data on waste generation is collected differently in various countries, you may not be able to respond to all the tables shown. In that case, please provide whatever data is available on the most appropriate tables.

Indicate any source documents from which data was taken.

Table 1 (a) – Hazardous Wastes Generation Rates

Estimate the total amount of the following waste types produced.

Waste Type	Quantity (give units)
Washwaters (if hazardous constituents)	
Acids/alkalis	
Metallic residues sludges, salts	
Cyanides	
Inorganic Chemicals, Salts, Residues	
Corrosive, Oxidizing, Reducing Wastes	
Solvents	
Oils (non-PCB)	
Organic Sludges, Resins, Paints	
Organic Chemicals	
Pesticides	
PCB's, Chlorinated hydrocarbons	
Contaminated Soils & Equipment	
	Total

Source:

Table 1 (b) – Hazardous Wastes from other Sources

If you have any data on the following items, please show in the table below, or attach a list.

	Waste type	Source	Quantity (give units)
1.	Lubricating Oil Other Oils	Public and Private Transport Machinery Ships	
2.	Pesticides	Agriculture, Municipalities Public Health Programmes	
3.	Solvents, paints Chemicals (misc.) Oxidizing agents Cleaners, Disinfectants	Domestic Households	
4.	Solvents, Pharmaceuticals, Drugs, Chemicals	Hospitals, Laboratories, Schools	
5.	Medical Wastes	Hospitals, Laboratories, Schools	
6.	Others (specify)	(specify)	

Source:

Table 1 (c) – Other Waste from Industrial Sources

Please give any available details on the following general non-toxic waste sources, as far as known.

	Waste Type	Source	Quantity (give units)
1.	High strength liquid wastes		
2.	Untreated effluents, Dilute washwaters, Effluent discharged to sewers or rivers		
3.	Agricultural residues		
4.	Inert solid wastes Factory rubbish		
5.	Mining spoil, Mineral processing waste, excavation and demolition waste		
6.	Dredging spoil and sediments		

If no figures are available, please provide a short description in writing of any relevant information, and attach to this table.

Source:

Table 1 (d) – Hazardous Wastes as specified by the Basel Convention

This table looks at wastes classified in the Basel Convention. Provide to the extend possible, information on the wastes listed below.

	(i) Wastes Streams	Quantity* (give units in each case)
Y1	Clinical wastes from medical care in hospitals, medical centers and clinics	
Y2	Wastes from the production and preparation of pharmaceutical products	
Y3	Waste pharmaceuticals, drugs and medicines	
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals	
Y5	Wastes from the manufacture, formulation and use of wood preserving chemicals	
Y6	Wastes from the production, formulation and use of organic solvents	
Y7	Wastes from heat treatment and tempering operations containing cyanides	
Y8	Waste mineral oils unfit for their originally intended use	
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions	
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)	
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment	
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish	
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives	
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known	
Y15	Wastes of an explosive nature not subject to other legislation	
Y16	Wastes from production, formulation and use of photographic chemicals and processing materials	
Y17	Wastes resulting from surface treatment of metals and plastics	
Y18	Residues arising from industrial waste disposal operations	

* If not known, write NOT KNOWN. If not quantified, write NOT QUANTIFIED

Source :

	(ii) Wastes having as constituants:	Quantity* (give units in each case)
Y19	Metal Carbonyls	
Y20	Beryllium; beryllium compounds	
Y21	Hexavalent chromium compounds	
Y22	Copper compounds	
Y23	Zinc compounds	
Y24	Arsenic; arsenic compounds	
Y25	Selenium; selenium compounds	
Y26	Cadmium; cadmium compounds	
Y27	Antimony; antimony compounds	
Y28	Tellurium; tellurium compounds	
Y29	Mercury; mercury compounds	
Y30	Thallium; thallium compounds	
Y31	Lead; lead compounds	
Y32	Inorganic fluorine compounds excluding calcium fluoride	
Y33	Inorganic cyanides	
Y34	Acidic solutions or acids in solid form	
Y35	Basic solutions or bases in solid form	
Y36	Asbestos (dust and fibres)	
Y37	Organic phosphorous compounds	
Y38	Organic cyanides	
Y39	Phenols; phenol compounds including chlorophenols	
Y40	Ethers	
Y41	Halogenated organic solvents	
Y42	Organic solvents excluding halogenated solvents	
Y43	Any congenor of polychlorinated dibenzo-furan	
Y44	Any congenor of polychlorinated dibenzo-p-dioxin	
Y45	Organohalogen compounds other than substances referred to in this table (eg. Y39, Y41, Y42, Y43, Y44)	

*If not known, write NOT KNOWN. If not quantified, write NOT QUANTIFIED

Source :

Table 1 (e) – Wastes as listed by the London Dumping Convention

Waste Type	Quantity* (give units in each case)

*If not known, write NOT KNOWN. If not quantified, write NOT QUANTIFIED

Table 1 (f) – Other Waste Types

List information as appropriate

(i) Wastes Quantities as Available from Local Information

(ii) Waste Quantities involved in:

a) Export:

b) Import:

Sources :

Table 2 – Hazardous Wastes Treatment and Disposal

The Tables in the following pages ask for data on current hazardous waste treatment and disposal practices, and on infrastructure.
Different tables may ask for the same information several times, and in different ways. Complete all the tables as far as you can.

Table 2 (a) – Types of Waste Treated and Disposed of by Industry on its own Premises

Please show the most common forms of **ON-SITE** treatment given to the wastes listed in column 1., and also show the industries which most commonly use such treatment.

Waste Type	Industry Sector/Source treating this waste	Type of Treatment/Disposal/Storage On-site
1. Effluents, Washwaters		
2. Acids, alkalis,		
3. Heavy-metal bearing wastes		
4. (a) Inorganic chemicals (b) Inorganic sludges		
5. Cyanides		
6. Solvents		
7. Oils		
8. Paints, Resins		
9. (a) Organic chemicals (b) Organic sludges		
10. High BOD wastes		
11. Other (describe)		

Table 2 (b) – Fate of Common Industrial and Other Residues

Describe the disposal methods currently used for the following residues or wastes as far as you know:

1. Waste lubricating oils
2. Unwanted or surplus pesticides
3. Scrap tyres
4. Scrap metal
5. Old batteries
6. Treatment plant sludges
7. Empty containers for chemicals
8. Refinery sludges
9. Ship cleaning wastes, slops contaminated balast water
10. Incinerator ash or dust
11. Hospital Wastes

Table 2 (c) – Fate of Waste Listed in the Basel Convention

	Waste Stream	Current Disposal Method*
Y1	Clinical wastes from medical care in hospitals, medical centers and clinics	
Y2	Wastes from the production and preparation of pharmaceutical products	
Y3	Waste pharmaceuticals, drugs and medicines	
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals	
Y5	Wastes from the manufacture, formulation and use of wood preserving chemicals	
Y6	Wastes from the production, formulation and use of organic solvents	
Y7	Wastes from heat treatment and tempering operations containing cyanides	
Y8	Waste mineral oils unfit for their originally intended use	
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions	
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)	
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment	
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish	
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives	
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known	
Y15	Wastes of an explosive nature not subject to other legislation	
Y16	Wastes from production, formulation and use of photographic chemicals and processing materials	
Y17	Wastes resulting from surface treatment of metals and plastics	
Y18	Residues arising from industrial waste disposal operations	

* If disposal method is not known, write NOT KNOWN. If the waste is not produced, write NO WASTE.

Table 2 (d) – Disposal Facilities Available

Please list any facilities which are available to treat waste off-site, ie. away from the place of generation. Include both commercial and public authority facilities. Indicate throughput if known. If no facilities of a particular type exist, show "none".

Facility Type	Capacity/Throughput (give units)
1. Incinerators for industrial wastes	
2. Co-incineration eq. cement kiln, industrial boilers	
3. Treatment of cyanide wastes	
4. Storage site for wastes requiring incineration or treatment	
5. Arrangements for high temperature incineration of waste in Europe or elsewhere.	
6. Special industrial waste landfill	
7. Municipal landfill accepting industrial waste (number .....)	
8. Ship cleaning facility or slop storage	
9. Any other (specify)	

Table 2 (e) – Waste Minimization and Recycling

Show below any initiatives in waste reduction, exchange, reclamation and recycling.

Facility Type	Capacity/Throughput (give units)
1. Oil recovery plants accepting lubricating and industrial oils for reclamation and resale	
2. Co-incineration facilities	
3. Solvent recovery plants	
4. Non-ferrous metal recovery	
5. Battery recycling/recovery	
6. Other (specify)	

Management Initiatives	Details
1. Waste reduction	
2. Recycling/recovery incentives	
3. Waste Exchange service or operator	
4. Other (specify)	

Table 2 (f) – Disposal Facilities Available (as per Basel Convention – Annex IV)

This uses a different format for listing disposal facilities. Again indicate throughput if known

Disposal Facility		Capacity/Throughput (give units)
D1	Deposit into or onto land, (e.g., landfill, etc.)	
D2	Land treatment, (e.g., biodegradation of liquid or sludgy discards in soils, etc.)	
D3	Deep injection, (e.g., injection of pumpable discards into wells, salt domes or naturally occuring repositories, etc.)	
D4	Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons, etc.)	
D5	Specially engineered landfill, (e.g., placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)	
D6	Release into a water body except seas/oceans	
D7	Release into seas/oceans including sea-bed insertion	
D8	Biological treatment not specified elsewhere in this Table which results in final compounds or mixtures which are discarded	
D9	Physico chemical treatment not specified elsewhere in this Table which results in final compounds or mixture which are discarded	
D10	Incineration on land	
D11	Incineration at sea	
D12	Permanent storage (e.g., emplacement of containers in a mine, etc.)	
D13	Blending or mixing prior to any disposal operations	
D14	Repackaging prior to any disposal operations	
D15	Storage pending any disposal operations	

Disposal Facility	Capacity/Throughput (give units)
R1	Use as a fuel (other than in direct incineration) or other means to generate energy
R2	Solvent reclamation/regeneration
R3	Recycling/reclamation of organic substances which are not used as solvents
R4	Recycling/reclamation of metals and metal compounds
R5	Recycling/reclamation of other inorganic materials
R6	Regeneration of acids or bases
R7	Recovery of components for pollution abatement
R8	Recovery of components from catalysts
R9	Used oil re-refining or other reuses of previously used oil
R10	Land treatment resulting in benefit to agriculture or ecological improvement
R11	Uses of residual materials obtained from any of the operations numbered R1–R10
R12	Exchange of wastes for submission to any of the operations numbered R1–R10
R13	Accumulation of material intended for any recycling or recovery operation

Table 2 (g) – Waste Management Services Available

Please indicate the level of service, i.e. None/Some/Much in each of the categories below.

1. Sewers accepting industrial effluents? – accepts all wastes
   – pretreatment required
2. Special chemical transport services
   Hazardous waste transport services?
   Other waste contractors
3. Chemical laboratories capable of analyzing wastes?
4. Consultants for waste treatment?
   Consultants for environment, EIA?
5. Emergency response team for chemical fires and spills?
6. Programme of community awareness and preparedness (APELL)
7. Chemical or environmental engineering department exists at university?
8. Professional associations exist for:
   - waste management professionals (eg. ISWA)?
   - chemical engineers?
   - scientists?
   - environmental professionals?
9. Technical training institutes exist?
   For professionals? Drivers? Emergency Services?
10. A pollution complaint service exists for the public?
11. A waste exchange service?
12. A technical information service/library?
13. Industry associations, Productivity Councils?
14. Citizen-based advice bureaux? NGOs?

Table 2 (h) – Hazardous Waste Transport

1. Are there transport services which specialize in transport of:
   - hazardous industrial chemicals ? Y ❑ N ❑
   - flammable liquids ? Y ❑ N ❑
   - hazardous wastes ? Y ❑ N ❑
2. Is a special permit required to transport such materials ? Y ❑ N ❑
3. Is a load manifest or other special documentation necessary ? Y ❑ N ❑
4. Are transport vehicles identified with:
   - UN hazard symbols ? Y ❑ N ❑
   - other warning placards ? Y ❑ N ❑
5. Are special containers used for hazardous wastes ? Y ❑ N ❑
6. Are there special training courses for drivers of such vehicles ? Y ❑ N ❑
7. Which authorities are notified in case of a spill or accident ?.....
   Is such notification mandatory ? Y ❑ N ❑
8. Is there :
   - an association of transport operators ? Y ❑ N ❑
   - a special union for drivers ? Y ❑ N ❑

Table 3 – Regulations and Discharge Standards

The Tables on the following pages summarize the environmental and health standards applying to hazardous waste treatment facilities, as well as to industry generally.

Table 3 (a) – Principal Laws and Regulations

Please list current laws applying to or which include mention of the following items. Note for each the government agency* responsible for administration.

1. Environment Protection generally, including EIA.
2. Water Pollution, including marine pollution and oil spills
3. Air Pollution
4. Management of Industrial Waste
5. Solid Waste Disposal, including dredge spoil and mining spoil
6. (a) Transport and Storage of Dangerous Goods
   (b) Transport of Hazardous Waste
7. Export/Import of Hazardous Waste
8. Chemicals, and Chemical Wastes
9. Soil Contamination, Clean-up of Sites
10. Pesticides
11. Occupational Health

* If more than one agency is involved, indicate the role of each.

Table 3 (b) – Standards Applying to Environmental Media

	(1) Discharge to water* (mg/l)	(2) Discharge to sewer* (mg/l)	(3) Discharge to air* (mg/m^3)	(4) Occupational* Exposure
Cadmium				
Chromium				
Mercury				
Copper				
Lead				
Zinc				
Nickel				
Cyanide				
Phenols				
Oil				
Solvents				
Suspended Matter				
COD				
pH range				
Dust/Particulates				
Any other (specify or attach)				
Name of regulations applying to:				
(1) above				
(2) above				
(3) above				
(4) above				
(5) above				

* If more than one set of standards applies, attach further details.

Table 3 (c) – Controls Applying to Solid Waste Disposal

Specify below the requirements and standards currently applying to landfill and other solid waste disposal.

Include domestic garbage, industrial waste, mining spoil, dredge spoil.

Name of legislation which applies the controls above

Table 3 (d) – Standards Applying to Treatment and Disposal of Specific Wastes

Please attach details of any special environmental standards or requirements that are in force for disposal of the following:

PCB's

Dioxins/Furans

Oils

Solvents

Cadmium

Mercury

Surplus Pesticides

Surplus Drugs, Pharmaceuticals

Any other (specify)

Name of regulations applicable:

Table 3 (e) – Controls Applying to Specific Treatment and Disposal Operations

Indicate the types of permits, approvals, restrictions and other controls that apply to the operations below:

Operation	(i) Type of Control or Approval required (ii) Name of regulation which applies	Issuing Agency
Hazardous waste generation		
Factory emissions to air		
Factory discharges to water		
Factory discharges to sewers		
Transporter		
Transport Manifest		
Disposal facilities – landfill – others		

Table 3 (f) – Standards or Controls Applying to Specific Industries

Type of industry Agency	Types of Emissions, Discharges or Operations controlled or banned	Implementing

Give names of regulation(s) which applies:

Table 3 (g) – Important Policy Considerations

List any official policies which apply to the following:

1. Waste export
   Waste import

2. Offshore dumping

3. PCB's

4. Ownership of facilities

5. Treatment preference

6. Source of financing of treatment facilities

7. Permit and approval fees

Table 4 – Implementation

The Tables below cover a number of aspects of administration, inspection, monitoring and surveillance concerning hazardous waste.

Table 4 (a) – Administrative and Operational Responsibilities

Please indicate which ministries, departments, agencies and other organizations have designated responsibilities for the following:

1. Environmental Impact Assessment

2. a) Setting environmental standards (air, water, land)
   b) Enforcement of standards

3. Standards for discharge to sewers

4. Approval or permits for (a) industrial sites
   (b) hazardous waste facilities

5. Environmental monitoring
   Hazardous waste monitoring

6. Control over toxic chemicals
   and pesticides

7. Import of chemicals, wastes

8. Disposal of urban wastes
   Managing/supervising landfill sites

9. Policy for pollution and hazardous wastes

10. Treatment, disposal of hazardous wastes

11. Clean-up of dumpsites and chemical spills

12. Oil spills

13. Transport of (a) hazardous wastes and
(b) dangerous goods

14. Export/import checking of wastes

15. Focal Point for Basel Convention

16. Focal Point for IRPTC

17. Chemical exposure in the workplace

18. R & D in environment

19. Government Laboratories

20. State of Environment reporting

21. Conservation Strategy

Table 4 (b) – Inspection Services

Please indicate below details as requested about environmental inspectorate.

1. Agency/department responsible for inspection/enforcement of: No. of Personnel
   - water pollution:
   - solid waste:
   - chemical wastes:
   - air pollution:
   - pesticides:
   - transport of hazardous materials:
   - chemical storage:
   - waste storage (if different from above):
   - site clean-up:

2. Co-ordination of inspections above, and any inter-agency co-operative arrangements

3. Training/qualifications generally required for inspection personnel:

4. Training facilities available in the country for inspection personnel:

5. Do inspection personnel have the power to initiate prosecution against offenders?

Table 4 (c) – Monitoring and Surveillance

Please indicate the monitoring operations carried out in your country, and the names of the agencies responsible.

Item	Regular Monitoring and Surveillance		Agency
	Yes (give interval)	No – Spot checks	
1. Raw Materials Monitoring			
– chemicals imported			
– chemicals manufactured			
– lubricating oil contamination			
2. Facility and Plant Inspections			
– hazardous installations			
– waste treatment plants			
– major waste generators			
– other (specify)			
3. Waste Generation			
– registered waste generators only			
– waste import/export			
– other (specify)			

4. **Waste Discharge Monitoring**
   - sewer discharges
   - effluents
   - air emissions
   - wastes at landfill
   - waste transport
5. **Environmental Monitoring**
   - water quality (list no. station)
   - air quality
   - groundwater quality
   - food residues: pesticides/metals
6. **Health Monitoring (chemicals/poisoning)**
   - public health
   - occupational health

Table 4 (d) –Studies and Research

1. List below the names (and publishers) of any official reports dealing with environment pollution or waste disposal that have been published in the last five years.

2. List below the names of any research institute or official enquiries dealing with environment, pollution or wastes.

Table 4 (d) – Support Services

Please indicate **None/Few/Many** regarding the following support services.

1. **Laboratories able to analyse chemical constituents of waste**
   - commercial:
   - government:
   - university/institutions:
   - private company:
   - pesticide labs:
2. **Consulting services**
   - water treatment:
   - air emission control:
   - waste disposal:
   - environmental engineering/science:
   - public relations, media, communication
3. **Emergency Services**
   - fire services:
   - chemical spills:
   - oil spills:
4. **Training/Education (specify institutions or courses)**
   - environmental:
   - waste disposal:
   - public health:
   - industrial safety:
   - occupational health:
   - transport safety:
   - emergency services:
5. **Technical Documentation Services**
   - public technical library:
   - IRPTC contact:
6. **Professional Associations**
   - municipal services:
   - engineer:
   - chemists:
   - environmental:
7. **Trade Associations (give names)**
   - chemical:
   - manufacturing:
   - transport:
   - waste management:
   - productivity council:
8. **Environmental groups (give names)**
   - professional:
   - public:
   - industry:
9. **Recycling/Waste Exchange (give names)**
10. **R. & D.**
    - research departments:
    - consulting:

Table 4 (f) – Key Player Analysis

Indicate below names, title and organization of some key players in environmental and waste management affairs.

1. Political figures who have made important pronouncements in favour of environmental issues.

2. Key citizens campaigning on environment and pollution control, or who are known to have strong views.

3. Key NGO's.

4. Influential Business persons interested in environment, pollution and wastes.

5. Prominent researchers, scientists and educators.

6. Media persons, journalists and writers.

7. Union leaders concerned about health and safety.

8. Important administrators in environment, chairmen of environment committees or enquiries.

9. Key consultants, designers.

2 MODEL WORKSHOP PROGRAMME

EXAMPLE OF A WORKSHOP PROGRAMME

UNEP/IMO/ISWA Regional Workshop on

HAZARDOUS WASTE MANAGEMENT POLICIES AND STRATEGIES

for East African Countries

Mauritius; 3–7 June 1991

INFORMATION NOTE TO USERS

The following pages show the programme used by UNEP in 1991 for a five-day regional workshop in Mauritius on 'Hazardous Waste Management Policies and Strategies'. The workshop was organised jointly with the International Maritime Organisation (IMO) and the International Solid Waste and Public Cleansing Association (ISWA).

The programme shows how the manual can be used for a short course by selection of relevant background material and exercises. When other issues—for example, marine pollution—are included in the programme, further background material must be added to the manual, and the UDANAX country report modified with respect to these issues.

For the Mauritius workshop, a shorter manual was prepared for each trainee as a 'workbook'. This included Parts I and II of this manual, as well as selected exercises from Part III. Exercises were carried out by groups of trainees who reported back to plenary session on the Session Report forms shown in this manual.

The Overview Questionnaire was sent to trainees before the workshop, together with the Country Report form (page 17). Trainees were requested to prepare a written country report along the lines of the Udanax report, and to give an oral summary of their country situation.

Full details of this and other workshops are available from IE/PAC in the form of detailed workshop reports.

It should be noted that the manual can be used for courses as short as one day. Only a limited number of simple exercises can be done; however, even at this level, they are very stimulating for trainees.

DAY 1 - Monday, June 3

8:00 - 9:30 Registration of participants

9:30 - 10:30 Opening of the workshop

Minister of Environment and Land Use
UNEP
IMO

10:30 - 11:00 Coffee break

11:00 - 11:30 Review of hazardous waste issues in the region. Marine pollution. International agreements, national actions. Management principles. (UNEP; IMO; ISWA)

11:30 - 11:45 Review of case study scenario and exercises (UNEP)

11.45 - 12:00 Introduction to groupwork exercises. (UNEP)

12:00 - 13:30 Lunch in work groups. Groups to select their respective presidents and rapporteurs.

13:30 - 14:15 Presentation on technical theme 1: "Assessment of land-based and marine sources of waste and pollution". (UNEP; IMO)
Demonstration of INVENT

14:15 - 15:30 Case study groupwork on theme 1: "Assessment of land-based and marine sources".

Summary of prior background exercise
Exercise 1: Rapid assessment of industrial waste
Exercise 2: Organization of a waste survey
Exercise 3: Assessment of ship- generated waste
Preparation of first groupwork report.

16:00 - 17:00 Country reports (includes land- and maritime situation)

DAY 2 - Tuesday, June 4

8:30 - 9:00 Interim groupwork reports from theme 1.

9:00 - 10:00 Presentation and discussion on technical theme 2: "Technology for incineration, treatment and disposal of wastes on land and at sea". (UNEP; IMO;)
Explanation of case study work on theme 2.

10:30 - 12:00 Case study groupwork on theme 2:"Disposal technology".

Exercise 2.1: Disposal options for selected wastes
Exercise 2.3: Immediate disposal actions

12:00 - 13:30 Lunch

13:30 - 14:30 Presentation and discussion on technical theme 3: "Infrastructure, technical and support measures". (UNEP; IMO). Short film of a treatment centre

14:30 - 15:30 Continuation of groupwork on theme 2:"Disposal technology".

Exercise 2.5: Marine disposal options

16:00 - 17:00 Country reports

Chair: Kenya(Kiai)
Countries: Lesotho, Malawi, Swaziland, Uganda, Zambia

Film.

DAY 3 - Wednesday, June 5

8:30 - 9:00 Interim groupwork reports from theme 2.

9:00 - 10:00 International conventions on waste and marine pollution (UNEP, IMO)

10:00 - 10:30 Film on international waste trade

11:00 Introduction to the field visit - landfill, port of Port Louis.

Depart for field visit

Sandwich lunch

13:30 Depart for WED ceremony

14:00 - 14:30 World Environment Day ceremony - Port Louis

14:30 - 17:00 Free time in Port Louis

17:00 Depart by bus for Sandy Bay Hotel

18:30 WED cocktail hosted by the Minister for Environment and Land Use.

DAY 4 - Thursday, June 6

8:30 - 9:00 Review of field visit. Review of hazardous waste practices and facilities around the world (audio-visual presentation).

9:00 - 10:00 Presentation on technical theme 5: "National pollution- and waste control policies, regulations and administration". (Land-based and marine). (UNEP; IMO)

10:30 - 12:00 Case study groupwork on theme 5: "Policy/legislation/administration options"

Exercise 4.1: Legislative control instruments for waste operations
Exercise 4.2, Question 2, part (ii): Review of a draft waste regulation from the point of view of the Basel Convention.
Exercise 4.3: Marine dumping control strategy.

12:00 - 13:30 Lunch

13:30 - 14:30 Presentation on technical theme 4: "Waste avoidance, reduction, recycling. (Land & marine). Cleaner production". (UNEP; IMO; ISWA).

14:30 - 16:00 Case study groupwork on technical theme 4:"Waste avoidance, cleaner production".

Exercise 3.2: Options for waste avoidance
Exercise 3.1: Waste minimization in Udanax
Exercise 3.3: Offshore disposal

16:00 - 17:00 Country reports

Chair: Seychelles
Countries: Comoros, Ethiopia, Gambia, Kenya, Madagasscar, Sierra Leone.

DAY 5 - Friday, June 7

8:30 - 9:00 Interim groupwork reports

9:00 - 10:00 Presentation on technical theme 6: "Waste control strategy; first steps; interim measures". (UNEP; IMO; ISWA)

10:30 - 11:30 Case study groupwork on theme 6:"Developing a waste control programme".

Exercise 5.1: Public infrastructure for disposal
Exercise 5.2: Interim measures for disposal
Exercise 5.3: Marine aspect of waste policies

11:30 - 12:00 Preparation of groupwork report for Session 5.

12:00 - 13:30 Working lunch to finalize the summary of all groupwork results for presentation in the afternoon.

13:30 - 14:30 Workshop synthesis and appreciation of country reports - F.Balkau, R.Coenen (UNEP/IMO)

Presentation of groupwork results by working group rapporteurs.

Comments on workshop by group chairmen.

15:00 Evaluation

Final address by:

- Mr.R.Prayag (Mauritius)
- Mr.D.Brown (IMO)
- Mr.F.Balkau (UNEP)

Close workshop

3 BACKGROUND ON MANAGEMENT AND CONTROL SYSTEMS FOR HAZARDOUS WASTE

BACKGROUND PAPER ON HAZARDOUS WASTE MANAGEMENT

MANAGEMENT AND CONTROL SYSTEMS FOR HAZARDOUS WASTE

The following paper gives an overview of some of the key considerations in building up an action plan for the management of hazardous waste. For detailed information on specific issues, the references listed at the end of the paper or in the manual should be consulted.

UNEP IE/PAC
Dec 1991

Management and Control Systems for Hazardous Waste

United Nations Environment Programme,
Industry and Environment Programme Activity Centre

39-43 Quai Andre Citroen
75739 Paris Cedex 15
France

November 1991

Management and Control Systems for Hazardous Waste

1. Introduction

Deteriorating environmental conditions in several parts of Europe have more than ever before focussed the attention of governments and the public on hazardous industrial wastes. Previously such wastes were disposed of without particular care. In some cases wastes have been exported to countries that lack effective control systems.

The response of governments has been to attempt to quickly put into place national control systems over industrial wastes. Recent international agreements such as the Basel Convention themselves rely on effective national systems for their implementation. However limited national experience with hazardous waste management often means that such new control systems are less effective than had been hoped. Most countries are therefore anxious to learn from the collected experience of others so as to reduce the time taken to put effective programmes into place.

This paper briefly examines the elements of an effective management strategy for hazardous waste, as well as outlining the contributions that some international organizations are making in putting such strategies into place.

2. What is Hazardous Waste Management?

Which wastes are hazardous? What do we mean by management? More fundamentally, what are "wastes"?

It is often tiresome to begin a discussion with definitions of terms. However in the case of hazardous waste management it is important that we all speak the same language. Hazardous waste comes from many sources, and many organizations will be involved in control actions. A variety of specialists from disciplines such as law, engineering, education and public relations are needed to contribute to action programmes. We must also remember that regulations and administrative control systems depend on clear and unambiguous definitions and classifications.

The definition of those wastes to be managed is crucial. Commonly, *hazardous waste* includes all wastes that are listed in a schedule, or that have hazardous properties such as toxicity, flammability, corrosivity, or ecotoxicity. Most of these wastes come from industry, however agriculture, transport services, hospitals and research laboratories, and even households, will also generate such wastes.

Management means different things to different people. In general it refers to the rational control over all aspects of the life-cycle of a waste, in line with a well-defined set of objectives. It is important to define the management responsibilities of all partners in such life-cycle control, from the generator through to the final disposal operator. Even the public has an important role in some strategies.

Each country must adopt its own definitions of terms and classification system for wastes. As a guide, some working definitions used by UNEP/IEO are shown in Annex 1. The classification of wastes used in the Basel Convention is shown in Annex 2.

A controversial issue at the moment is whether wastes intended for recycling should be exempted from hazardous waste controls. Industry would prefer such an exemption so as to improve the economics of recycling, however government agencies remember the pollution that has been caused by sham recycling schemes in the past, and are therefore reluctant to agree to exemption. The Basel Convention included wastes intended for recycling within its management system, and many national systems do likewise.

3. Assessment of the Waste Situation

Before we can devise sensible solutions we must first have a good idea of what the problem is, both in nature and in extent. Surprisingly this is often overlooked by many national authorities who are in a hurry to get on with building a control system. However without firm evidence that there is indeed a problem we are unlikely to convince policy-makers to pass regulations and to commit money to build facilities. And without a good estimate of the waste sources we are in any case unable to design and build the disposal facilities that are needed.

Surprisingly, good data on environmental impact are often difficult to find. This is particularly so in respect of the cost of health and other damage, the number of people affected, the value of natural resources destroyed, etc. A specific activity has usually had to be launched to collect such information, and such data as exist should be put into an assessment report in order to document the size of the problem. Such a report needs to keep its audience in mind. It should be simple, persuasive, must include cost estimates of damage, and draw some conclusions about immediate and future risks.

Assessment of waste sources is also more complex than it first appears. Neither the types nor the quantities of waste are always immediately obvious, waste generators are frequently ignorant of what they actually produce, and will in any case be secretive about their operations. Past waste surveys have been remarkably inaccurate. While direct measurements are more accurate, they are also more expensive. Waste assessment has thus become a highly skilled exercise that requires time, patience, training and a high level of interagency and intersectorial co-operation.

In countries where comprehensive data on waste sources do not exist, rapid assessment methods can be used to give a first estimate, and to provide a starting point for further more detailed examination. Such rapid assessment methods include both manual and computer based calculation programmes. Direct monitoring and surveys can then follow, and subsequently the results of several methods are combined so as to increase reliability.

Once the problem (environmental impact) and its origin (waste sources) have been identified, we can start to consider the options for action. It is however useful to first identify the administrative context in which the waste problem finds itself. This context includes those regulations that may already exist, the government agencies with responsibility for health and safety, and the technical infrastructure and support services available. An important aspect is what is sometimes called a 'key player analysis', ie. identification of those key individuals and agencies who may help or hinder in the eventual control of hazardous wastes.

The entire set of assessment steps above has recently been put by UNEP IE/PAC into the form of a *Situation Questionnaire*. This questionnaire is intended to be used by waste managers or consultants to identify the most relevant features of a country situation as it concerns the management of hazardous wastes. The table of contents of this questionnaire is shown in Annex 3.

4. Preparing a Hazardous Waste Action Plan

Experience in countries that have implemented hazardous waste management programmes in the past shows that it is necessary to act on several different fronts simultaneously. In particular the following are indispensable:

- establishment of waste treatment and disposal facilities,
- legislation to set acceptable standards for waste handling facilities, and to require monitoring and reporting of waste operations,
- an administration to enforce the legislation, to monitor wastes and to undertake some practical disposal operations,
- adequate infrastructure and technical support services such as waste transport contractors, analytical laboratories, consulting and design services, training institutions, information services, data banks to monitor waste data, and so on.

These elements are mutually interdependent, and have to be matched to the demands of each other. Accordingly one often talks of the need to prepare a *waste management strategy*. Figure 1 shows the elements that were included in a waste strategy in Australia in 1985. Figure 2 shows the waste handling operations that need to be considered when assembling such a set of control elements.

In view of the ease with which wastes can now cross borders, it is necessary for national strategies to pay regard to international developments in waste management, particularly concerning control over export/import of wastes and of trade in secondary raw materials (wastes sent for recycling or recovery).

The process of preparing a strategy will be as important as the contents. Many good proposals around the world have had to be abandoned because the ground had not been adequately prepared. Early public consultation on proposals is essential, discussions with co-operating agencies and regular briefing of politicians are indispensable. Industry must clearly understand what it is expected to do, and why.

Even with such a consultative process success is not guaranteed. However the absence of such a process has negated whatever chance of success there might have been for many programmes which were technically sound. It is no longer true that engineers and politicians can 'persuade' the public of the merits of proposals on which the public has had no prior input.

This is true even in developing countries, some of which also have found that public opposition can cause delay or even abandonnement of projects that are inadequately presented. Projects that have been successful have tended to include the elements shown in the box below.

Some Elements of Successful Waste Strategies

. Early discussions with the public
. Openness to public views and suggestions
. Strong emphasis on waste reduction actions
. Safe management of existing facilities
. Safe design of new facilities
. A facility operator who has public confidence

A number of references have been prepared to help guide the preparation of a waste management strategy, including the consultation process. In particular a regional workshop held by UNEP in 1986 gave clear and succinct guidance on this issue in its final report (Reference 10). The *Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes*, UNEP, 1987 (Reference 7), subsequently summarized the major considerations of a strategy, which were ultimately incorporated in the 3-volume manual on safe disposal prepared by UNEP, the World Bank and WHO in 1989 (Reference 1). The main points of the Cairo Guidelines are shown in Annex 4.

The implementation of a waste management strategy takes time. Many countries have taken over a decade to assemble their programmes, and most are still not complete. It is therefore important to consider how to phase in the various measures, and what temporary measures to put into place in the meantime. The adoption of interim measures was considered at an ISWA workshop in Honolulu in 1989 (Reference 16), and is summarized in Section 7 of this paper. Interim landfill arrangements will be among the immediate temporary measures adopted, as will options for co-incineration, recycling and perhaps long-term storage. A strong waste avoidance and reduction programme can also do much at this stage to deal with some waste streams which are generated in excessive quantity, or which are difficult to dispose of.

We go on now to look briefly at the major components of a waste strategy.

5. The Components of a Waste Strategy

The main components were earlier listed as: technology; regulations; administration; infrastructure. We will examine each briefly in turn to see how they contribute to an overall waste management strategy.

5.1 Technology for Treatment and Disposal

Contrary to common opinion, safe and efficient technology is already available to deal with most industrial wastes. In fact information on technologies is the easiest waste management information to find in references and journals. Additional R&D helps to further reduce costs, to improve operating efficiencies and performance, and to develop variations such as mobile plants, etc.

Table 1. shows some of the main disposal technologies which are commonly applied around the world. Reference 1 gives a more complete discussion of the various options and their application.

The actual choice of treatment technology will depend on government policy as well as on scientific principles, and therefore it is important to clearly identify such policies at the outset. Examples of policies applied in some countries include:

- acceptance (or not) of co-disposal and co-incineration of industrial and other waste,
- non-acceptance of liquids in landfills,
- requirement of pre-treatment and stabilization of all toxic waste prior to landfill,
- ban on disposal of certain wastes that can be recovered,
- use only of proven technologies.

These policies are often incorporated into a broader approach that promotes a hierarchy of waste priorities such as: (i) waste avoidance, (ii) recovery and recycling, (iii) treatment, (iv) disposal.

In choosing technologies, factors such as safe disposal of residues must be taken into account as well as treatment efficiency. Considerations of infrastructure, trained manpower for operation, and whether or not the plants are to be run for single waste streams or for a collective facility, are among the additional constraints.

Some countries have prepared guidelines and tables to guide in the choice of acceptable technologies. Table 2. is taken from an Australian strategy in 1986. A more comprehensive set of tables can be found in Reference 1 as well as in other literature.

5.2 Legislation for Waste Management

The framing of effective regulations is a difficult task. A multitude of waste sources and handling operations have to be covered, and yet the regulations have to be practical to enforce. New regulations on hazardous waste have to fit into an existing framework of laws on municipal waste, on chemicals and pesticides, on public health and safety, on industrial permits, on public sewer systems, on the management of air and water pollution, and on transport safety. Many of these have already developed their own classification and permit systems. In addition, regulations and classifications now need to pay regard to the Basel Convention so as to be as compatible with the regulations in other countries.

The following are common elements of national legislation on hazardous waste:

Some Common Elements of Hazardous Waste Legislation
. Defining objectives of the legislation . Defining responsibilities of generators, operators . Classification of wastes and sources . Permits for operators and facilities . Standards for discharges to water, air, land . Standards for waste transport . Bans on certain operations . Monitoring of generation, transport, disposal . Clean-up of contaminated sites . Penalties for non-observance of requirements . Incentives for R&D and installation of plant

Each country has so far developed its own approach to regulation, however there are a number of guidance documents and case studies that can be consulted. In particular, the Cairo Guidelines outline the main considerations.

5.3 Operation and Administration

Many countries now prefer that waste disposal is carried out by the private sector (perhaps under government licence), while standard setting and monitoring rests with the government. Establishment of control legislation is of course also a government function.

Legislation is worthless unless there is effective enforcement. This is particularly true for hazardous waste legislation. Enforcement requires an inspectorate that is trained to recognize the special aspects of industrial waste, while continuing to deal with more traditional

pollution problems. The creation of a separate waste inspectorate has proven to be less effective than this integration with pollution enforcement.
In addition to enforcement there needs to be a special unit that has responsibility for policy development, for monitoring and data collection, and for making special arrangements for certain wastes that are difficult to dispose of. The unit must also take an active role in minimizing the generation of waste production.

5.4 Infrastructure and Technical Services

This area is unfortunately sometimes overlooked when waste strategies are prepared. Some examples are shown in the box below.

Examples of Infrastructure and Technical Services

. Safe landfill facilities for treatment residues, incinerator ash, soil and residues from site clean-up, and those wastes that cannot be avoided or treated
. Safe interim storage facilities for abandoned wastes and wastes collected from small generators
. Analytical laboratories capable of handling the complex samples from a waste control programme
. Training institutions for drivers, operators, inspectors, and site clean-up personnel
. Educators and trainers to handle sensitive communications programmes with the public, with NGO's, and with local politicians
. Monitoring and data collection facilities

6. Waste Minimization/Cleaner Production

It is now generally conceded that a proactive approach to waste minimization has to be taken if a management programme is to be successful. This has been incorporated into the cradle-to-grave policy adopted by many countries, however practical action has been slower to follow.

Waste minimization sidesteps many of the problems with treatment and disposal. An effective programme incorporates both a tightening up of standards applying to waste operations, as well as incentive and information programmes to demonstrate that practical programmes of waste avoidance do work, are economic, and can be implemented in most industries. For example a recent report from the Netherlands indicated that of 40 industry case studies, waste minimization measures had an economic payback or were cost-neutral in 38. Only in two cases was there a long-term cost penalty to the industry concerned.

Waste minimization within the industry requires first an assessment of the waste sources, and then a systematic examination of reduction options. A number of references are available to guide such a process (References 12, 19 and 20).

A number of governments have recently taken a more proactive approach to waste reduction. The Netherlands has adopted reduction targets for many industrial (and domestic) wastes, and is backing this up with strong action programmes. The State of Victoria in Australia has adopted an integrated programme of regulation, advice, enforcement and incentives. Various states in the USA have done likewise, and the US EPA has created a special Office of Pollution Prevention to oversee its national programme.

A part of the US EPA programme is a computer-based clearinghouse on pollution prevention information. This clearinghouse has recently been made available to UNEP IE/PAC as the basis of its International Cleaner Production Information Clearinghouse (ICPIC). ICPIC can provide examples of company and government programmes, as well as case studies of low-waste production technologies. Access to ICPIC is available free of charge to users around the world. It is one component of IE/PAC's Cleaner Production programme (see Annex 6) which aims to assist countries and companies in implementing pollution prevention programmes around the world. Likewise ISWA has been active in publicizing waste minimization through special conferences and publications.

7. Country Experiences

A number of countries around the world have been gradually developing their hazardous waste management systems in recent years. While the longest experience has been in industrialized countries (where the problem has been the most acute), some developing countries have also moved in recent years to put control measures into place. The ISWA workshop in Honolulu in 1989 reviewed a number of country case studies which are described in Reference 16. Very briefly, the experience can be summarized as follows:

- effective waste management relies on a combination of measures rather than a single technical or regulatory initiative,
- the building of support for waste control measures among the public and government officials is critical to success,
- co-operation with and between government, industry and public bodies is necessary if practical minimization and disposal measures are to be effective,
- a gradual building up of control measures is easier than the implementation of grandiose master plans. A waste management strategy should include short-term actions for immediate implementation, and a phased approach to longer-term actions. An example of such a phased approach is shown in Figure 3.

8. Transport of Hazardous Waste - the Basel Convention

Following a series of well-publicized incidents of waste export and attempted dumping, the world community moved to prevent such trade as far as possible. In May 1989, 116 countries signed the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, and this Convention came into force during 1992. Annex 5 shows the main features of this Convention, which in addition to regulating the transport of wastes, requires that less waste be produced and that any remaining residues be disposed of as close to the place of production as possible. A secretariat based in Geneva has the responsibility of monitoring the implementation, and of advising countries about the practical measures they can take.

9. Training in Hazardous Waste Management

Training of national personnel is an important aspect of the implementation of the Basel Convention. UNEP IE/PAC together with other organizations such as ISWA commenced a series of training workshops in countries around the world. Workshop themes range from policies and strategies to technical themes of landfill, treatment and disposal. In order to extend training opportunities to the largest audience possible, a training manual on *Hazardous Waste Policies and Strategies* has been prepared for use by other institutions. The manual

consists of a country case study, followed by over 80 practical exercises on a range of technical subjects.

A second manual on *Landfill of Hazardous Waste* is under preparation.

Training is also important for waste prevention. Here it is particularly the waste generators who must be influenced, so the target audience is much broader than just waste managers. It is important to include the strategic areas of industrial planning, product design, etc. Professional awareness and undergraduate education are two key areas to be addressed. Specific prevention skills must also be developed, for example through waste reduction auditing (see Reference 12).

10. Summary

A number of interrelated measures are needed for effective control of hazardous waste. These measures can be combined into a strategy which is implemented in an evolutionary manner. Prior assessment of environmental impacts and of waste sources is essential for such a strategy to be correctly focussed on the major environmental problems. Waste minimization through the concept of cleaner production is an essential element of a strategy. A number of international organizations such as UNEP and ISWA have prepared information and training material to help national authorities pursue effective action programmes. International aspects of such programmes includes the control of transfrontier transport of wastes.

REFERENCES AND INFORMATION SOURCES ON HAZARDOUS WASTE

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    - Hazardous Waste Management, March 1988.
    - Waste Minimization, March 1989.
12. *"Audit and Reduction Manual for Industrial Emissions and Wastes"* UNEP/IEO and UNIDO, 1991.
13. *"Storage of Hazardous Material: A Technical Guide to the Safe Warehousing of Hazardous Materials"*, UNEP/IEO, 1990.
14. Many UNEP/IEO technical guides include recommendations on waste minimization and management.

References from other sources:

15. *International Perspectives on Hazardous Waste Management*, W.S. Forrester and John H. Skinner (Eds), Academic Press, 1987.
16. *Adapting Hazardous Waste Management to the Needs of Developing Countries*, a special edition of *Waste Management and Research*, Vol. 8, No 2, March 1990.
17. *Management of Hazardous Waste - Treatment/Storage/Disposal Facilities* - John R. Cahman, Technomic, 1986.
18. *Hazardous Waste Management*, G.W. Danson and B.W Mercer, Wiley Interscience, 1986.
19. *Waste Audit Manual*, Ontario Waste Management Corporation, 1989.
20. *Waste Minimization Opportunities Manual*, US EPA, 1988.

ANNEXURES

The figures and tables referred to in the text of the paper are actually reproduced in the body of the manual. They can be found in the following places:

Figure 1. Example of a Hazardous Waste Strategy. Page 164.

Figure 2. Hazardous Waste Handling Operations. Page 165.

Figure 3. Example of the Evolution of a Waste Management Strategy. Page 166.

Table 1. Hazardous Waste Treatment and Disposal Technologies. Page 97.

Table 2. Waste Disposal Technologies for Industrial Wastes. Page 99.

Table 3. Aspects of Hazardous Waste Legislation. Page 121.

Annex 1. Working Definitions of Common Terms. Page 11.

Annex 2. Categories of Waste to be Controlled under the Basel Convention. Page 14.

Annex 3. UNEP hazardous waste situation questionnaire. Resource Section of Manual.

Annex 4. Main Points of the Cairo Guidelines. Page 163.

Annex 5. Main Points of the Basel Convention. Page 181.

Annex 6. IE/PAC Cleaner Production Programme. Attached.

Annex 6

THE CLEANER PRODUCTION PROGRAMME

The Programme was launched in response to a decision from the UNEP Governing Council, on the need to reduce global industrial pollution and waste. The objectives of the programme are to increase worldwide awareness of the cleaner production concept, help governments and industry develop cleaner production programmes, foster the adoption of cleaner production, and facilitate the transfer of cleaner production technologies.

To meet these objectives, the programme focuses on the collection and dissemination of information on cleaner production that explains the concept, illustrates technical applications, and helps people develop cleaner production programmes. These efforts, initiated through a number of different activities, have cultivated an ever expanding informal network of cleaner production experts, both in the public and private sectors.

The programme contains five major elements:

- **ICPIC** - The International Cleaner Production Information Clearinghouse (ICPIC) is an on-line system that contains a message center, bulletins of the latest news, a calendar of events, case studies, a bibliography of document abstracts and a listing of experts worldwide.

- **Working Groups** collect and disseminate information on cleaner production and help the programme with its awareness efforts. Specific industry working groups are: leather-tanning, textiles, solvents, metal finishing, pulp and paper, petroleum, and biotechnology. Other working groups are: data networking, education, and policies, strategies, and instruments to promote cleaner production.

- **Publications** include the Cleaner Production Newsletter, a biannual outreach and educational publication that provides information on cleaner technologies and products and on steps taken by governments and organizations to promote cleaner production around the world. Other documents include: Audit and Reduction Manual for Industrial Emissions and Wastes; Climate Change and Energy Efficiency in Industry; Packaging and the Environment; and the Report on the Workshop on Country-Specific Activities to Promote Cleaner Production.

- **Training Activities** for government, industry, and academia aim to increase awareness, educate people, prompt action, and help develop cleaner production programmes.

- **Technical Assistance** for groups or individuals especially in developing countries, includes fostering links with experts and launching demonstration projects.

What is Cleaner Production?

Cleaner Production means the continuous application of an integrated *preventive* environmental strategy to processes and products to reduce risks to humans and the environment.

For production processes cleaner production includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes before they leave a process.

For products the strategy focuses on reducing impacts along the entire life cycle of the product, from raw material extraction to the ultimate disposal of the product.

Cleaner Production is achieved by applying know-how, by improving technology, and/or by changing attitudes.

How is Cleaner Production Different?... Much of the current thinking about environmental impacts focuses on what to do with wastes and emissions after they have been created. The goal of cleaner production is to not generate waste in the first place.

Why is Cleaner Production Important?... In the long run, cleaner production is the most cost-effective way to operate processes and to develop and produce products. The costs of wastes and emissions in addition to negative environmental and health impacts can be avoided by applying the cleaner production concept from the beginning.

What Can You Do to Promote Cleaner Production?

*If you work for a government...*Educate fellow workers, your ministry, and industry about the benefits of cleaner production; promote industry demonstration projects; start a cleaner production programme

*If you work for industry...*evaluate your company's current product design and production processes; develop cleaner production options; apply the options to your product design and production processes; tell your customers, other industries, government entities and the public know about your efforts; start a cleaner production programme

*As an individual you can...*Apply cleaner production principles in your professional and daily life.

In all cases, you can ask UNEP-IE/PAC for help at the address on the other side.

Financial support for the Cleaner Production Programme has come from the governments of Australia, Austria, Denmark, Finland, France, The Netherlands, The United Kingdom, and The United States, and from the European Commission and IPIECA. Cooperating organizations include: UNCSTD, UNIDO, IMO, OECD, UNECE, and ICC/IEB.