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Report

INTEGRATED INTERNATIONAL PROGRAMME
ON
INDUSTRIAL INCINERATION OF WASTE

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EXECUTIVE SUMMARY

The present document examines the problem of industrial incineration of waste in the perspective of the Rio Summit and the progressing industrialization of a large number of developing countries. The conclusion is that the best way to prevent large scale industrial pollution of the atmosphere, ground water and soil, is to transfer and adapt methods and technology known from pollution abatement in industrialized countries to concerned developing countries.

The programme is focussing on the need for industrial solutions in practically all developing countries and describing a series of project activities which, combined in an integrated programme, would be an efficient tool in the development of industrial incineration of waste in these countries.

Although the transfer of industrial technology is an important part of the programme, it would not be complete without including assistance to the development of legislation and the training of pollution inspectors and industrial managers. Likewise it is proposed to engage national universities, notably their science faculties and inscribed technical students in pollution surveys and case studies to increase their interest for a clean environment before they start their professional careers.

The multidisciplinary design of the programme is made on the assumption that UNEP and UNIDO in cooperation with UNESCO, WHO and ILO will all be ready to share the programme in accordance with their mandate and experience. UNEP would for instance be expected to coordinate the training of pollution inspectors and assist national authorities in the development of environment regulations. UNESCO could coordinate the mobilization of engineering and science faculties in the monitoring of waste disposal and the study of the effects of spillage and pollution.

UNIDO should mainly engage in transfer, development and adaptation of technical solutions and their promotion with the help of diagnostic studies, environment impact assessments and investment promotion activities. UNIDO and UNEP should cooperate in the organization of regional seminars, while the ensuing roving national seminars, repeating the message from the regional seminar and expanding the dialogue with local industry and national authorities, could be managed by UNIDO with occasional support from UNEP.

The proposal is describing how a first cycle of programme activities could be implemented in Asia. The host country for the first regional seminar should preferably be a large Asian country to benefit from a large national participation with multiple follow up possibilities.

The objective of the programme is to promote a sustainable industrialization process in the developing countries through collection and dissemination of information on regulation and control as implemented in the Europe and North America in relation to industrial waste incineration and through the training of government officials, pollution inspectors and managers enable updating of legislation, establish efficient control with waste disposal and facilitate a cleaner industrial environment.

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1.00 Introduction.

In 1985 "CHEMICAL ENGINEERING", a well known technical periodical, decided to find out from their professional readers what they felt about hazardous waste. They received more than 2000 answers to their questionnaire and 70 per cent of those expressing their opinion had graduated in chemical engineering. The majority of the respondents expressed the following:

- The chemical process industries, in general, do not have the problem of hazardous waste under control (In other words the environment and all of us have a problem with hazardous waste).
- No untreated hazardous waste should be disposed of by any means, and particularly not by landfill or deepwell injection.
- The preferred treatment for most hazardous waste is high-temperature incineration.
- Regulations concerning hazardous waste are adequate (in USA), but underenforced or inconsistently enforced.

Ten years have gone and the present proposal is devoted to the developing countries. Many of these had pollution problems already ten years ago and few have invested in improvements in the meantime. It is therefore anticipated that industrial pollution abatement is needed more than ever.

The dilemma with waste is its negative or very low value and the fact that practically nobody wants it. Since however society has to protect the environment, in order to protect itself, it can no longer be permitted to dump waste at the convenience of the waste producer. The know how and the experience so far developed in waste management has mainly been to the benefit of industrialized countries, where early decisions were made to invest in industrial pollution abatement.

In the developing countries the situation is somewhat different. Officials and decision makers are generally not well informed about the pollution risks accompanying the application of landfills and they see no urgent need for corrective action. Government authorities and environmentalists in developing countries are facing two problems. One is that environment legislation is often incomplete, another is the shortage of resources and experienced personnel for enforcement of regulations.

In the industry itself, many developing countries only accord low priority to preventive action in matters of technique including waste disposal. The likelihood that some waste dumps and landfills may poison soil, crops and ground water for a lifetime seem to be of limited importance as long as it does not happen.

The tragedy is unfortunately that environmental repairs are many times as expensive as well planned and executed preventive waste management. Simple landfilling and dumping is therefore expected to continue, mainly because it is easy and cheap, unless action is taken to strengthen regulations as well as to train operators and inspectors to protect the environment in accordance with the regulations. Besides the upgrading of personnel and regulations also transfer and development of technology is required.

The present document is aiming at describing some of the problems prevailing in the developing countries in regard to waste disposal and is then based on the findings formulating a programme on industrial waste incineration designed to help national authorities in promoting industrial incineration through the organization of technical meetings and the training of pollution inspectors and plant operators. In addition it is intended to expose science faculties and their students to the problem of waste disposal so coming generations of engineers and managers can use their university experience in favour of clean production and efficient management of industrial wastes. The programme is designed in the assumption of a close cooperation between UNIDO, UNEP and other UN organizations.

2.00 The Rio Commitment for Change.

The United Nations Conference on Environment and Development (UNCED) took place in Rio de Janeiro in 1992 and produced two international agreements, two statements of principles and a major action agenda on world-wide sustainable development. The five documents are:

- The Rio Declaration on Environment and Development. Its 27 principles define the rights and responsibilities of nations as they pursue human development and well-being.
- Agenda 21, a blueprint on how to make the development socially, economically and environmentally sustainable.
- A statement of principles to guide the management, conservation and sustainable development of all types of forests, which are essential to economic development and the maintenance of all forms of life.

Particularly Agenda 21 is of importance as guidance in the development of industry although its coverage is much wider. It explains that population, consumption and technology are the primary driving forces of environmental change. It lays out what needs to be done to reduce wasteful and inefficient consumption patterns and encourage sustainable development.

Chapter 19 describes the dangers occurring with toxic chemicals. Among others it says: Chemicals are used throughout the world and are necessary to meet social and economic goals, but a better job must be made of reducing their (negative) health and environmental impacts.

Some of the world's major industrial areas are so contaminated that there is damage to human health, genetic structures and reproduction. In addition, long range pollution is affecting the Earth's atmosphere and climate. The illegal traffic in toxic and dangerous products and wastes involves chemical(s) banned in one country as hazardous, being shipped to other countries.

Chemicals can be used in a cost-effective manner and with a high degree of safety, but most countries, particularly developing nations, lack the ability to manage chemicals safely. Countries need to develop and share experience in assessing and preventing chemical risks.

Chapter 20 focus on the management of hazardous waste. It says that an increasing amount of hazardous waste is affecting human health and the environment, but goes on to say that many countries are short of expertise to manage the problem. Governments further often lack information about what types of pollution are released, and what risk they pose to people and the environment.

All national environmental protection plans should include targets for hazardous waste reduction. Programmes are needed to identify wastes and their potential effects, and to minimize their occurrence through appropriate treatment. It must be a priority activity to change and develop industrial processes reducing the amount of waste released. Governments should work with industry on setting targets for reducing the amount of hazardous waste released in any form and engage in campaigns to reduce fugitive emissions and the release of hazardous waste.

Governments should immediately identify contaminated waste disposal sites and engage in the necessary remedial measures, including cleaning up of polluting sites. Governments should further:

- Require and assist in the innovation by industry of cleaner production methods and of preventive and recycling technologies.
- Encourage the phasing out of processes that produce high risks because of hazardous waste.
- Conduct environmental audits of existing industries to improve hazardous waste management.
- Hold producers responsible for the environmentally sound disposal of the hazardous waste they generate.
- Establish public information programmes and ensure that training programmes are provided for industry and government personnel on hazardous waste issues, especially waste reduction.

- Build treatment centers for hazardous wastes, either at a national or regional level. Industry should treat, recycle, re-use and dispose safely of waste as close as possible to the site where the waste occur.

Governments should further ensure that the military conforms to national environmental norms for hazardous waste treatment and disposal. Developed countries should promote the transfer of environmentally sound technologies on know how on clean and low waste production methods to developing countries.

Part of the international movement of hazardous waste involve illegal shipments, often to developing countries. Government should ban the export of hazardous waste to countries which are not equipped to deal with those wastes in an environmentally sound way. They should see that hazardous waste shipments destined for recovery are handled by environmentally sound recycling systems. Countries should create an alert system to detect illegal disposal and traffic in hazardous waste.

3.00 General Information

3.01 Problems faced in the disposal of waste

Clean air, potable water and non-contaminated land are becoming increasingly important as environment pollution is increasing. Yet population growth, industrial development and increasing living standards, although not available to all, invariably lead to an expanding output of waste. Some waste has little or no impact on the environment and may as such be rated harmless. Other types of waste are hazardous and their handling and disposal is accompanied with the risk of damaging the environment. The same or similar dangers also apply to a number of industrial chemicals and intermediates, the pollution potential of which is only noted when something goes wrong.

The main problem in the disposal of waste is insufficient knowledge about the handling of risk materials and what to do when something goes wrong. The old wisdom that prevention is better than cure also applies to the environment. In industrial waste management the sentence could read "precaution is better (for the environment) than remedy".

Efficient pollution abatement however call for continuing development and application of industrial know how for cleaner production in combination with efficient waste management. One of the keys to the implementation of such a pollution abatement programme is transfer of know how and training, but also applied research in combination with dissemination of information is of immense importance for being at the forefront in the design of efficient engineering solutions for treatment, recycling and containment of waste.

Another key to active protection of the environment in the developing countries is to engage local universities and managers in pollution abatement activities commensurate with their role in society. Without the active participation of local professionals in preventing pollution and in mobilizing the public awareness for the same, no lasting improvements can be expected.

The biggest problem faced in the disposal of waste is presumably that it's too easy to circumvent rules. Most repair and treatment work is costly and the decision to take appropriate action is a conflict between cleanliness and economic incentives. This entry point make the development of public awareness one of the cornerstones in a waste management programme.

3.02 Categories and types of hazardous and non-hazardous waste commonly produced in developing countries

The waste occurring in the developing countries is a consequence of import, local manufacture and the use of chemical products and industrial equipment. Technical installations (factories) may for instance have transformers which are cooled with PCB's and when such installations are damaged few people think about the need for collecting the coolant before disposal or cannibalization. The same apply for cooling installations in air conditioners and refrigerators.

Manufacture of metallurgical products, organic and inorganic chemicals, pesticides and fertilizers are all accompanied by the generation of waste. Every repair shop and vehicle depend on lubricants, sealants, cutting oils and paints, and while their application is increasing, so is the disposal of used materials.

OECD is listing hazardous waste in three categories:

I: RED LIST

Wastes containing PCB's, polychlorinated terphenyl, polybrominated biphenyl, chlorinated dioxin, asbestos, leaded anti-knock compound sludge.

II: AMBER LIST

Ash from iron and steel manufacture, petrol coke and bitumen, lead acid batteries, waste oils and oil/water mixtures, phenols, thallium compounds, hydrogen peroxide solutions.

III: GREEN LIST (Recyclable waste)

Scrap metals: gold, platinum, silver, iron and steel, copper, nickel, lead, cadmium, indium, gallium, thallium.

Plastics: PVC, polythene, polypropylene, styrene polymers, polyamides, Teflon, phenol-formaldehyde resins.

Other: Ceramics, mining waste, glass, rubber waste, textile and tannery wastes, gypsum, and certain ashes from coal fired power stations.

Environment groups are not satisfied with recyclability rating of the materials on the green list. Their claim is that recycling may still produce hazardous waste. Ferrous scrap may for instance be contaminated with cutting oils, plastics and other impurities which could generate chlorinated and carcinogenic products like dioxin, chlorobenzene and polycyclic aromatic hydrocarbons during the smelting process. In other words when a developing country is using imported steel scrap in order to save energy, they may at the same time generate hazardous waste.

The waste output however depend immensely on local conditions and the development situation. Low and middle income countries for instance have less paper and more vegetable refuse in their garbage than industrialized countries. The composition of the waste compare as follows for low, middle and high income countries:

Environment survey THE ECONOMIST	High Income countries	Middle Income countries	Low Income countries
Glass	10 %	2 %	4 %
Plastics	8 %	11 %	2 %
Metals	8 %	2 %	2 %
Rubber, leather, wood, textiles	5 %	14 %	7 %
Paper	31 %	14 %	2 %
Vegetable	25 %	47 %	60 %
Other	13 %	10 %	22 %

The waste presented in the above table looks more harmless than it really is because the last line "Other" does not mention the possible presence of hazardous materials frequently occurring in city wastes. City dumps may for instance contain used solvents, paint residues, used lubrication oil, used batteries, halogenated carbon components from refrigerators and air conditioners or any residue left in a bottle or a can that city dwellers might decide to throw away without considering pollution risks. Sewage sludge is another problem waste, because it may be rich in heavy metals and therefore unsuitable for use in agriculture whether composted or not.

Industrial waste is in some way both easier and more difficult to manage. Easier because it usually occurs in uniform and known quality at the place of origin; difficult because the waste may be both hazardous and occur in large quantities. In all cases disposal costs play an important role in the choice of the disposal method.

3.03 Disposal costs for hazardous waste

Although dumping at sea is no longer regarded as a feasible solution and many nations have legislated against it, it is, in the short term perspective, still one of the least costly solutions. The long term impact of such disposal depend on the quality and the quantity of the material dumped and it is generally recognized that the pollution risks in sea dumping by far outweigh the economic advantages. Never the less such pollution will continue until a total ban can be enforced. Illegal dumping at sea of small quantities of waste, otherwise very costly to neutralize, will be very difficult to prevent unless a practically faultless control and tracking system can be established.

Among the inexpensive solutions, landfilling come close to dumping at sea. Considering however the growing hostility against land based waste deposits, dumping costs may very well increase with the increased demand for containment (and control) and in the end make incineration or waste digestion, for instance in the cement making process, more attractive than landfilling. Attempts to manage sealed deposits with collection and treatment of the percolate, have, after several cases of polluted ground water, lost some credibility. Dumping costs are in Europe estimated to be 20 - 50 US\$ per ton depending on local conditions. Dumping costs in the developing countries are gquestimated to be 10 - 25 US\$ per ton.

Incineration of waste has for many years been an important alternative to landfilling. At first it was mainly a question of reducing the amount of waste, later the environmental performance of the incinerators gained importance and both the efficiency of filters and the quality of ash residues, filter sludge (or dust) are now important performance parameters. Traditional incineration is under European conditions estimated to be 50 - 100 US\$ per ton.

Population growth and increasing industrial production are accompanied with increasing occurrence of both municipal and industrial waste. This has led to the establishment of waste traders that collect and blend different types of industrial waste into tailor made and well defined waste fuels which can replace some of the traditional fuels used in specific industries. The waste traders are by nature of their business not interested in all types of waste and the majority of the rejects are disposed of through landfilling and incineration.

Waste traders are paid for receiving selected waste from industry. The waste traders blend the waste they receive into waste fuels with a calorific value similar to conventional fuel and deliver it to fuel consuming industry at attractive conditions. Such waste fuels are among other applied in the cement industry, where it helps to save primary fuel.

Managers of incinerator plants therefore claim that cement plants are running away with some of the best combustible waste thus forcing operators of incinerators to procure and apply primary fuel to enable a full burn out of their waste mix at the correct temperature. The incinerator lobby also claim that the cement kiln is not as efficient in its destruction of waste as the incinerator and yet cement plants have frequently less regulation and control to deal with than traditional incinerators.

The cement lobby is defending itself by claiming that they are not burning waste. The (waste) fuel they apply is just another type of fuel (not waste) matching their needs and comparing well to their traditional fuels in terms of trace elements, heat value and process efficiency. The fact that incinerator plants increasingly need primary fuels to make up for diverted high calorific waste is by the cement lobby seen as an incentive for waste producing industry in general to develop cleaner technology.

The explanation for this incentive is that procurement of primary fuel for the incineration process invariably lead to higher waste treatment fees, which in turn should make it more attractive to produce less waste. Managers of (waste) fuel consuming cement factories are in the meantime concentrating on clean production and quality cement in order to protect their business.

Facts and figures indicate no remarkable difference between the waste treatment efficiency of incinerators and cement kilns. The most important difference is that cement factories may be more selective in their acceptance of "waste" because they are first of all interested in (waste) fuels which are economically attractive and efficiently digested in the cement making process. The difference between the efficiency of cement kilns and incinerators is of little interest to the developing countries. They are dumping their waste in landfills with the risk of imminent pollution of ground water and soil. What they need is advice and assistance to find better and affordable solutions.

The building of traditional incinerator plants may by some be seen as the ideal technical solution, but capital requirements, economy of scale and incineration fees make it economically unattractive in many developing countries. What is needed is a comprehensive development activity through which managers in the developing countries can convince themselves about the necessity to engage in pollution abatement, at the same time as their knowledge to equipment and operational routines in waste management is expanded through technology meetings, study tours and training.

3.04 Methodologies used in disposal of waste

The disposal of hazardous waste takes its beginning where the waste occurs. At this point it must be decided how the waste can be transported and which type of containers would be required for safe transport to its destination. The choice of containers and transport are influenced by the quantity of waste to manage, the physical nature of the waste, its declared chemical composition, the treatment envisaged and the transport options available.

Expired products from pharmacies is often packed in cardboard boxes, hospital waste in plastic or steel drums, larger quantities of used liquid materials, like used solvents and lubrication oil, may be transported in bulk tankers, while smaller quantities of mixed waste may go in plastic or steel barrels.

At the plant level receiving the waste both safe storage and safe unwrapping facilities must be available. Some containers are only opened in closed systems under neutralized atmospheric conditions with less than 8 per cent oxygen. Depending on the nature of the waste, the first station in the treatment might be a blending facility converting different types of waste into acceptable cocktails matching the downstream process requirements.

The treatment facility itself may be a traditional incinerator with a boiler installation so it besides the conversion of the waste into an incinerator slag, also produce electricity, hot water and a filter cake. Both the filter cake and the incinerator slag is regarded as hazardous waste and must be further treated or dumped in a controlled deposit. Waste with a high content of heavy metals can be incinerated in special installations, so the heavy metals are solidified into an amorphous and insoluble glass matrix based on silicates.

Another efficient treatment facility is a cement plant equipped for receiving and using combustible waste as fuel. The classical example is used tires which in the early days were rolled into the kiln from the back end. Later other feeding devices and the use of shredded tires and numerous other waste fuels became common routine under the watchful eye of the surrounding community and the authorities.

While the cement manufactured during the digestion of waste is a saleable product satisfying all specifications, the factory operation is also resulting in the production of limited quantities of filter dust, which is normally dumped in landfill(s) in consultation with the local authorities.

3.05 Reasons for digesting hazardous waste in cement kilns

Modern incinerators are as efficient as cement kilns in the destruction of hazardous waste. The main difference between the two reactors is that the classical incinerator is built only for the incineration process. It therefore depend on being paid for receiving the waste, and build the entire economy on waste treatment fees.

In this connection it should be considered that not all waste is able to burn and yet the waste still require a high processing temperature in order to ensure total destruction. It is therefore common that combustible waste is burned together with waste of no or low calorific value in order to facilitate both thermal cracking and total incineration. In case an incinerator plant does not receive sufficient quantities of high calorific waste, it simply has to supplement with primary fuels.

In a cement plant digesting waste, the situation is somewhat different. The plant is from the beginning built with the main purpose of making profit by producing and selling cement. In order to do so the factory use primary fuels like oil, gas or coal depending on availability and costs. The use of combustible waste as fuel is a secondary activity through which the company can replace a part of the primary fuel with less costly fuels for the benefit of economic improvements.

The exploitation of inferior materials is not new to the cement industry. Especially the increasing application of low quality fuel, low in calorific value and high in sulphur, and the use of low quality raw materials, contaminated with alkalis and chlorine, has been a useful learning process for cement makers interested in burning waste. The application of waste fuels is more of the same kind of problems with added precautions and control to ensure clean operation and to protect the environment.

The special advantage of the cement making process in the digestion of waste is that the burning zone has flame temperatures up to around 2000 degree centigrade and material temperatures in the region of 1400 °C. The counter current movement of the exhaust gasses versus the calcareous raw materials are ideal for the retention of SO_x, NO_x and chlorides. All dust generated during the processing is caught in filters and recycled or disposed of in accordance with local regulations.

The cement kiln is in other words a reasonably efficient installation for the digestion of selected waste. Some claim that the cement kiln, with appropriate process control, is able to digest all types of waste not contaminated with mercury. Such waste digestion require careful analysis and proportioning of the waste combined with a calculated dosage matching the process requirements.

The most important argument for the use of cement kilns for the digestion of waste in some developing countries is simply that commercial incinerators are expensive and not (yet) available while they often have cement factories, which, with supplementary installations and appropriate improvements, could be used in the disposal of hazardous waste in stead of dumping it in landfills.

3.06 Indication of types of hazardous waste found in developing countries that can be classified as secondary fuels

Secondary fuels are different kind of industrial rejects with such a calorific value that they compare reasonable well with traditional types of fuels. Examples of such waste fuels also occurring in developing countries are:

- Waste lubrication oil.
- Oil residues from tank cleaning.
- Halogenated and non-halogenated solvents.
- Waste from paint, varnish, glue and printing colors.
- Bottom stills and tar residues.
- Waste from production of pesticides.
- PCB oils and other organic matters.

Considering that nearly all developing countries have different economic strength and success in their industrialization, it is obvious that they all have different waste profiles and only few have such a wide variety of waste that it includes all the above mentioned items. The main problem is that practically all developing countries produce waste that may pollute the environment, unless the waste is neutralized through appropriate treatment or isolated from the environment by containment.

Neutralization of waste and residues is therefore gaining increasing importance in the developing countries. In the past attention was mainly given to economic development, while the protection of the environment only appeared as second or third priority. The result is that environment pollution at present is worse in many developing countries than in most industrialized countries. Typical examples of pollutants are hazardous waste from the production of pesticides, fertilizers, dyes, pigments and organic chemicals.

Pollution problems are however, despite the environmental risks, still neglected in many countries for political or economic reasons. When the lack of knowledge, about how hazardous and toxic materials should be handled, is added to the negligence, then pollution disasters are nearly pre-programmed.

3.07 Specific comments on likely effects of hazardous waste digestion in cement kilns on the quality of the Portland clinker produced.

The processing of clinker in a rotary kiln offer several substitution possibilities in terms of raw materials and fuel. In this connection it is important to differentiate between two major types of clinker, namely Portland clinker as required for the production of Portland cement and artificial aggregate clinker used as medium for glass phase storage of immobilized pollutants like heavy metals and alkali rich waste.

In the production of Portland clinker, various limits for the acceptance of waste residues in the raw materials and in the fuel exist. The cement kiln is however a proven reactor for the thermal cracking and neutralization of many types of waste, difficult to dispose of elsewhere. It is therefore possible in the cement making process to substitute a part of the primary fuel with combustible waste, like used tires, waste oil, plastic and paper etc. It is also possible to digest more complicated types of waste as for instance chlorinated organic compounds and different types of sludge, pharmaceutical industry waste, chemical industry waste, paints and paint thinners etc in limited and carefully controlled quantities.

Some cement plants have used household waste as a supplementary fuel, but the economic suitability of this substitution depend heavily on the composition, the heat value and the handling costs involved. Household waste is, depending on the local possibilities, usually dumped in landfills or incinerated, while composting is less frequent.

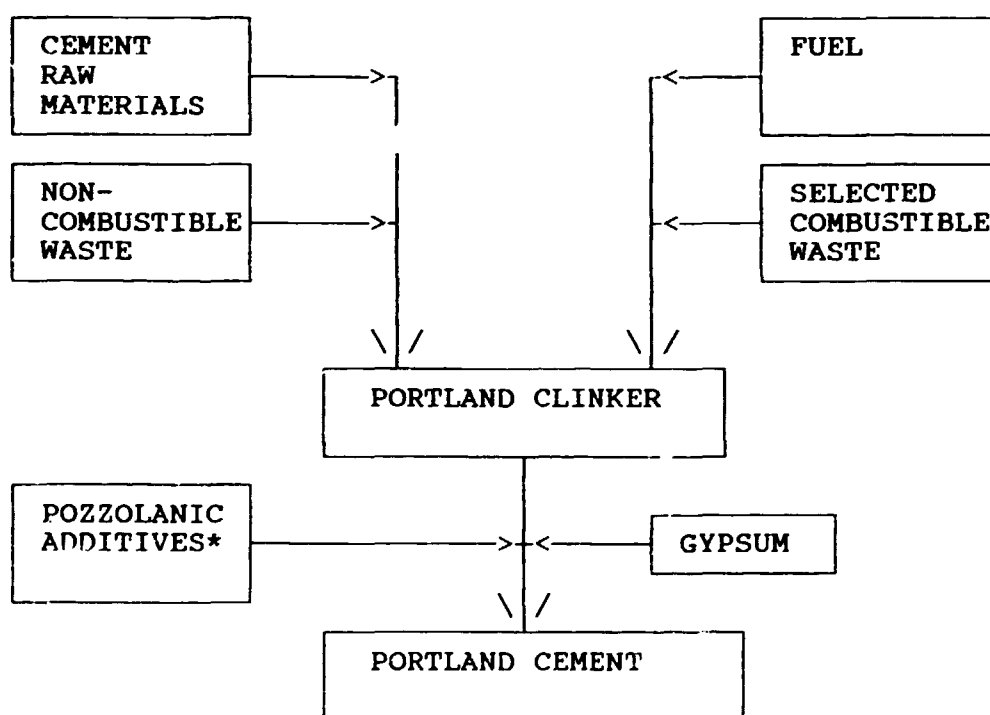
Dumped household waste may be both hazardous and toxic, because the disposers frequently neglect the environmental dangers and throw away, in the same waste deposit, a mixture of used batteries, paint residues, lacquers, solvents and scrap of unknown origin making landfills into time bombs, which sooner or later may poison ground water and create problems.

Incineration ash is also a hazardous waste calling for safe storage or treatment, like for instance its digestion in the cement making process.

The situation now materializing in the developing countries with increasing quantities of waste call for industrial solutions for processing potentially hazardous and toxic waste into chemically stable products, like for instance the above mentioned Portland clinker or artificial aggregate materials, for use in commercial cement and concrete. This might reduce the need for waste deposits and waste dumping and help to save primary fuel and raw materials in the production of cement and concrete.

The potential application of combustible and non-combustible waste in the cement making process could be presented with the following graph:

INDUSTRIAL DIGESTION OF WASTE IN THE CEMENT PROCESS



* (fly ash, steel slag or volcanic ash)

The chemically controlled processing of waste into harmless components and materials with the help of the cement industry is well established in the

industrialized countries, but the developing countries are anticipated to be in need of assistance for the full application of this technology. First and foremost to upgrade their cement industry to cleaner production, but also to manage the waste from occurrence to destruction with all necessary precautions and control.

In this connection it should be noted that cement production, in terms of pollution, is a low risk industry and that well managed factories avoid pollution by collecting or recycling all rejects. Actually very efficient filter installations for the cleaning of all exhaust gasses are part of up to date cement factories.

3.08 Pros and cons of using cement kilns for digestion of waste.

Although cement is produced in large quantities, the total waste digestion capacity of the entire cement industry remain limited. Considering further that cement plants aim at producing a saleable product, according to certain specifications, it is obvious that operators are quite selective about the type and the quantities of waste they are ready to accept. The most important selection criteria for the acceptance of waste fuels in the cement industry is the savings materialized when a part of the conventional fuel is replaced by waste fuels.

In this connection it is worth noting that the experience in building and operating incinerator plants have helped to estimate the often negative value of different types of waste. The starting point here is that waste producers normally have to pay a fee when they deliver their waste to an incinerator plant, so that plant operators can amortize and operate their waste treatment facilities without economic losses. Some operators of incineration plants are fortunate in receiving a mixture of combustible and non-combustible waste in such proportions that the waste fuel cover their fuel needs.

Other may be less favored. Imagine for instance the existence of a cement plant in the same area as an incineration plant. The cement plant needs fuel and it may happen that producers of combustible waste get a better deal with the cement plant than with the incinerator.

The result could be that the cement plant make savings by substituting a part of their primary fuel with waste fuel, while the incinerator has to increase treatment costs in order to meet the additional costs occurring in the procurement of primary fuel at market costs.

The advantage of the cement plant is that it does not depend on earnings from waste digestion. It does not make much difference for the cement plant whether its capacity for waste digestion is fully utilized or not, whereas a fifty per cent utilized incinerator may have to double the treatment fees to secure its survival. This economic reality illustrates the problems involved in the establishment and the operation of incinerator plants in the developing countries. Such plants are only economically feasible when their capacity is fully exploited unless they are further subsidized from waste producers or other interest groups.

From the above it is obvious that it is less complicated to start selected waste digestion in an existing cement plant than to engage in the building of an incinerator. In the long term perspectives both incinerator plants and cement factories as well as other treatment facilities will be needed to cope with both old and new waste problems.

4.00 Special considerations.

4.01 Policies and legislation to be enacted for disposal of waste through cement kilns.

Hazardous and toxic materials, including waste, are produced, stored, transported and converted into other materials in such quantities in modern societies that special precautions are required for protecting the environment. The ideal solution would be a cradle to grave control that could ensure that the environment is not exposed to contamination. Experience however shows that 100 per cent safety is non-existing and it is therefore important to reduce the risk of environmental pollution with the help of legislation.

The simplest approach could be to make the declaration of hazardous materials, wherever they occur, compulsory in combination with follow up declarations whenever such materials are moved or converted into other materials. Each consignment would require an initial registered declaration (a birth

certificate) which should follow the material until a release certificate is warranted. It could further be prescribed that all storage, transport and use of hazardous materials should apply the best available technology, not later than maybe 10 years after the proven availability of such technology, while the general acceptance of its necessity could be manifested in pollution limits.

Such an approach would require that hazardous materials are clearly defined and classified in different groups according to their reactivity and toxicity. Each group could then be accompanied by a history of recommendations for their storage, transport and use (in the case of hazardous waste rather neutralization). Until the latest recommendations for the best available technology mature, the previous would continue to apply. For instance could conventional landfills, considering their possible time bomb nature, be regarded as temporary storage or (biological) treatment sites, and be monitored until the deposits are proven neutralized or dug up for final treatment according to the latest matured technology.

The main pollution problem occurring in and around cement factories is the emission of dust. Regulations are therefore primarily focussing on bringing the local air pollution under control in the vicinity of the factory and within the plant area. The combustion of fuel, including waste fuels, takes place under such conditions (flame temperature and retention time) that all hazardous components are thermally cracked and oxidized into elementary and harmless components provided the cement kiln is in stable operation. Since further all exhaust gasses, by the nature of the process design, are filtered through the incoming calcareous cement raw mix and cleaned as through scrubbing with lime, there is no noticeable difference between the stack emission when conventional fuels and when waste fuels are applied.

Extensive testing has been implemented during the introduction period for waste burning in cement plants in Europe and North America and practically all tests have proven the digestion efficiency of the cement making process. Considering further that the present paper focus on promoting industrial incineration in the developing countries it seem advisable within this programme to engage in the training of pollution inspectors, plant managers and engineers to promote the adherence to regulations and discourage illicit disposal.

What is needed is a balanced program of assistance helping national authorities in creating popular understanding for the necessity of pollution abatement and at the same time helping operators to perform in accordance with national rules and regulations. In this connection it should be considered that many developing countries both need assistance in enforcing existing regulations as well as in updating national legislation to cover the management of hazardous materials and the disposal of wastes including industrial rejects.

The subject of waste management and environment protection has alerted both national authorities and the United Nations Environment Programme (UNEP) notably their Industry and Environment Office in Paris, which has been instrumental in promoting several initiatives for the protection of the environment. The most remarkable result in relation to waste management is the work done under the Basel Convention on the control of transboundary movements of waste and their disposal.

Of special interest for national authorities and the international community is the "Model National Legislation on the Management of Hazardous Wastes as well as on the Control of Transboundary Movements of Hazardous Wastes and Other Wastes and Their Disposal", which at present is available as a revised draft¹. The document is a very useful reference for national authorities contemplating to update their environment legislation .

4.02 Logistics and operational procedures, classification, transport, delivery and handling of waste, etc.

The basic problem in the industrial management of waste from its occurrence to its destruction is that treatment facilities are not started overnight and even when facilities are ready they are not activated before such quantities of waste are available that the processing pays off. In addition it should be considered that only few types of waste are suitable for direct transfer from their place of origin to their destruction in a waste treatment facility.

¹: UNEP/SBC/94/2

The first action required is therefore to examine in which quantities the different types of waste occur so the available transport, storage and treatment possibilities can be considered. Only when sufficient quantities of waste are available can blending, processing and transport be initiated. In some locations storage and blending facilities may be established as part of a waste treatment plant in other places the intermediate storage and blending may be handled by waste traders.

A typical intermediate storage and blending station, able to receive hazardous waste, would normally have a large storage area for steel and plastic barrels, a tanker fleet for collecting liquid waste and at least one storage tank for each type of liquid bulk waste to be in transit storage. All storage areas must be protected so a leakage, even of a big storage tank, can be fully contained without damage to the environment. All waste containers must carry a number or another code giving access to a full identification of the content.

The blending station would usually have the legal responsibility for the waste from the moment it is declared, packed and loaded on vehicles, according to the blenders instructions. The delivery of waste for destruction follow similar procedures. A cement factory engaging in the digestion of waste can simplify its handling procedures by accepting only ready made (waste) fuels or easy to handle combustible waste. Later, when the authorities have recognized the clean performance of the plant and the waste digestion start to pay off, more complicated and profitable lines of business may be taken up in consultation with the authorities.

The guiding principle in all transport and handling of hazardous materials is, or should be, to eliminate the risk of personal and environmental damage. It is therefore compulsory in most developed societies that hazardous and toxic materials are classified in accordance with their nature and all loading, transport, storage, reloading, transfers and treatment is managed and controlled by specialists under strict observance of regulations in regard to limitations in route selection and mode of transport including prescribed containerization.

The handling of hazardous waste is subject to the same guiding principles as hazardous materials, but it is supplemented with special recommendations for the disposal of waste in such a manner that the risk of personal or environmental damage is reduced. Since however the waste disposal follow many routes in accordance with the nature of the waste, it has become part and parcel of the recommendations that the performance of the waste receptors is thoroughly regulated and controlled so inadequate disposal methods and work routines can be identified and improved.

4.03 Needs for strengthening capacity, infrastructure, of developing countries to use cement kilns for digestion of hazardous waste

The burning of Portland clinker is a well defined process taking place at such temperatures that a complete thermal cracking of waste components are practically guaranteed. The main problem for digesting waste in a cement plant is to obtain the consent of the local authorities and neighbors to do it. Such an approval is mainly related to the factory performance of the past as it is known to the local community. If the plant as a routine has been letting out far more dust than the community find reasonable, irrespective of the regulations, and the plant area looks like a scrap yard, one should not anticipate understanding and acceptance for the burning of waste of any kind.

If therefore a cement plant is interested in improving its economy by burning waste or waste fuels, the first basic requirement is to strengthen the ability to operate the plant with minimum pollution and to keep the factory area clean. Emission from the stack may in a developing country be permitted up to 300 or 150 mg/Nm³, but it is advisable to get it below 100 mg/Nm³ similar to the latest requirements in industrialized countries.

The next is to strengthen the skills of the personnel expected to handle the waste. Motivated and trained manpower is however not enough, because the cement plant will need special facilities in accordance with nature of the waste considered for digestion. The most uncomplicated solution is to replace a part of the primary fuel with ready made (waste) fuel or secondary fuel of known and uniform quality.

The factory would for this purpose only need safe and containable storage space, facilities for the reception of the secondary fuel, as well as a closed system for the drainage of storm water. The waste fuel itself could be delivered from waste recycling centers producing secondary fuels in accordance with agreed specifications.

The opening of waste burning activities in a cement factory usually call for a total review of the entire plant, including an environment impact assessment, so the existing installations can be appropriately supplemented and upgraded for safe handling and processing of the secondary fuels considered for acceptance in the cement making process. In this connection it is important that both laboratory facilities and monitoring equipment is supplemented so the performance of the factory can be scientifically documented in continuity whether it is burning waste fuel or not.

It should also be agreed with the authorities which kind of monitoring and control should apply for the daily operation of the factory and pollution inspectors should have access to take samples in cooperation with the factory manager in order to be able to verify the findings of the operators.

- 4.04 How industrial incineration could be promoted in the developing countries through regional meetings to discuss technical issues and the need for guidance to be given to government officials

The collection and disposal of waste through recycling, landfilling, waste dumping, biodegradation, composting, incineration and reformulation is in Europe and North America developed into an industrial activity with its own resources in know how and technology like any other industry found in the same part of the world. The experience gained and used represent an important step towards the promotion of a sustainable development building on industrial methods to conserve primary resources for coming generations and for protecting the biosphere against environmental pollution.

The know how and the experience so far available has mainly been to the benefit of industrialized countries, where decisions were made to invest in industrial pollution abatement.

Officials and decision makers in many developing countries are not well informed about the pollution risks accompanying the wide-spread application of waste dumping and they see no urgent need at present for corrective action because they have not experienced or taken notice of the negative impact of pollution in their own environment.

Most developing countries therefore have a long way to go, first in understanding how important it is to prevent pollution and secondly to transfer the necessary technology and experience for the promotion of industrial waste management.

One fundamental difficulty is also that preventive action in matters of technique has a low priority in many developing countries. The prospect that some waste dumps and landfills may poison soil, crops and ground water for a lifetime is of no importance as long as it does not happen. The tragedy is that environmental repairs are many times as expensive as well planned and executed preventive waste management. Landfilling and dumping is therefore expected to continue as before simply because it is easy and cheap.

The long term impact of such ignorance is unpredictable and it appears a necessity to select typical pollution risk cases which can be monitored and studied for long periods so that the experience gained can be used as a foundation for future waste management decisions. At the same time it is a necessity that developing countries are informed about the technology available for the incineration of hazardous waste and that government officials and managers are invited to participate in technical meetings and training in industrial incineration.

The above described activities may be combined in a multilevel and multi-disciplinary programme of activities for the promotion of industrial incineration of hazardous waste, for instance organized in a network including government authorities, universities, UN organizations like UNIDO and UNEP, equipment suppliers and consulting companies. The awareness creation activities should focus on involving professionals and managers in developing countries in applied research and case studies focussing on the long term impact of incorrect waste disposal on the environment. Likewise the innocence of correctly neutralized and immobilized waste should be studied.

The transfer of technology should be promoted through a combination of technology seminars, study tours, fellowship training, techno-economic studies for the promotion of safe disposal of waste through industrial incineration and technical assistance for establishment and operation of appropriate installations.

The proposed programme should take into consideration that the use of incinerators and cement plants in the disposal and immobilization of hazardous waste is still a relatively young industrial activity and that only few developing countries have made commitments for industrial treatment of their waste.

Most developing countries however have cement plants which could help in making a shortcut to the incineration of waste by digesting a part of it in the cement making process and by storing, at least on a temporary basis, the rest, for instance in the limestone quarry under full environment control. When the totality of the available and the incoming waste, in combination with the treatment fees received, justify the establishment of additional installations for the incineration of the waste, then such facilities could be promoted. Prospective techno-economic studies for the feasibility of such waste disposal methods should be elaborated and carefully studied in different scenarios for possible implementation.

5.00 Support activities required for activating, guiding and supporting developing countries in the application of industrial incineration in the disposal of hazardous waste.

5.01 Diagnostic surveys

Any new cycle of activities for the disposal of hazardous waste in the developing countries would naturally start with diagnostic surveys executed by local professionals. As result of such diagnostic surveys, country reports, with a first inventory of acute and possible pollution problems like contaminated areas and deposit risk areas, would be put together and used as data base for the initiation of remedial action and as background documents for technical meetings and promotion of industrial incineration. Follow up action may include one or several of the following activities.

5.02 Regional technology meetings

Partly as preparation for the transfer of technology on industrial incineration and partly as a forum for discussion of pollution problems and treatment options, it is important that regional technology meetings like seminars and workshops are organized from time to time. During such technology meetings, invited participants from developing countries would be expected to present country papers describing the situation in their respective countries in regard to the occurrence of hazardous waste and pollution. In the same presentations also a description of ongoing and planned waste treatment, or the absence of it, should be made in order to give the broadest possible foundation for meaningful discussions and promotion of realistic follow up activities.

Another important input to the technology meetings would be to present and examine different kind of waste treatment installations as used in the Europe and North America and explain the environmental regulations governing the operation of such installations. This part of the technology meeting(s) could cover technical and managerial aspects of transport and incineration of hazardous waste. Other subjects could be to disseminate operational experience in manufacture and use of waste fuels, in high and low temperature incineration, in the digestion of waste in cement kilns as well as in the application of small incinerators for special and/or lightly contaminated residues.

Consulting companies in the field of waste management and disposal should be invited to present their experience in development and/or management of industrial installations for incineration of hazardous waste, notably describing storage and disposal methods applied for specific types of hazardous and toxic waste and the efficiency achieved with different incinerators. Further it would be appropriate to invite equipment suppliers to describe the equipment they deliver for storage, transport, treatment, recycling and containment of waste and the kind of end products coming out of the processing.

The experience available from managers of existing industrial installations used for the incineration of hazardous waste is imperative for a realistic discussions about the efficiency of the waste treatment and the possibilities for making further improvements in waste management. Plant managers should therefore be invited to present their experience and to contribute to the discussion with their know how and experience.

Also the experience of legislating and controlling authorities, should be presented and examined, for instance by inviting government officials and pollution inspectors to present their experience and invite them to explain how efficient the pollution abatement, they know about, works to the benefit of environment protection.

In total such technology meetings would aim at bringing together, from developing and developed countries, government officials, decision makers, managers, equipment suppliers, laboratory specialists, representatives and advisers from consulting companies together with UN experts and experienced pollution inspectors.

The overall aim of the technology meetings is to lay the foundation for the development of industrial incineration of locally occurring hazardous waste in the developing countries through the transfer of know how and experience in combination with an initial exposure to the problem of industrial waste disposal. The elaboration of a comprehensive meeting report would further give both participants and non-participants to the meeting(s) a good starting point for further local action in terms of updating legislation and facilitating contacts with equipment suppliers, consulting companies and international organizations like UNEP and UNIDO.

A technology meeting could for instance help to disseminate knowledge about the established role of consulting companies in Europe and North America in the design of solutions for industrial incineration of hazardous waste and their contribution to efficient pollution control, for instance through the training of plant operators and pollution inspectors.

Information about equipment suppliers and their role in the construction and commissioning of waste treatment installations should be explained and clarified through their own presentation of equipment applied in transport, storage, recycling, containment, treatment, disposal and waste processing as well as in emission control etc,. Attention should in time be given to review all aspects of industrial waste management and encourage the promotion of follow up activities as mentioned in the succeeding chapters.

5.03 Roving technology seminars.

While the regional technical meetings are instrumental in collecting, presenting and disseminating comprehensive information about industrial waste management, it has to be accepted that it may be difficult for the few participants from each of the participating countries to initiate local industrial pollution abatement activities upon their return from regional meetings.

It is therefore suggested to design roving seminars, in cooperation with participants from selected developing countries, so the information and experience, made available at the regional meeting, can be efficiently transferred to interested developing countries, where many local professionals including government officials, university professors, decision makers, managers and engineers can join forces in local follow up action.

The content of such roving seminars would be selected subjects from the regional meeting focussing on pollution risks and how to reduce such risks through legislation, control and the promotion of industrial incineration. The roving seminars should in the fundamental agenda cover all subjects agreed with the respective national participants to the regional meeting. Particularly the roving seminars should be initiated with studies of local waste problems and the elaboration of proposals for improvements. Such studies should be implemented with the help of local professionals preferably in cooperation with university professors and students in order to increase the awareness regarding pollution risks and raise popular support for environment protection through industrial incineration of waste.

5.04 Study tours and fellowship training.

Having identified specific problem areas in participating countries with the help of diagnostic surveys, country reports and specific studies as mentioned above, and having the aim that local professionals should be in charge of all improvements activities, when required with assistance from UNIDO consultants, it is essential that training and study tours are organized for government officials (legislators), managers (decision makers), operators, pollution inspectors and laboratory personnel so they can examine how legislation, operational efficiency and performance inspections can contribute to environment protection and thus prepare local professionals for the diversity of problems they will meet in the development of industrial incineration of waste.

5.05 Promotional and technical studies.

Having examined, during the above mentioned technical meetings, roving seminars and study tours how specific pollution problems are dealt with in developed countries and further studied specific pollution problems and/or risks in participating countries, the next is to formulate work plans and terms of references for the transfer and establishment of the technology deemed necessary for industrial incineration of waste in the participating countries.

Work plans and terms of references may in accordance with requirements be elaborated by local professionals in consultation with UNIDO. Project promotion activities like environment impact assessments and techno-economic feasibility studies would normally be implemented by consultants in collaboration with local managers and UNIDO experts to ensure objectivity. Both improvement of existing installations and establishment of new facilities may be considered.

5.06 Investment promotion

The establishment of industrial facilities for the storage and incineration of waste in the developing countries is handicapped by a general lack of understanding for having the waste producer to pay for the waste treatment. It is therefore of utmost importance that such industrial projects are appropriately supported with soft loans and donations so the burden of fixed costs will not prevent a successful start of efficient waste management.

In this connection it should be noted that the capacity utilization during the first years may be quite modest and totally insufficient for a gainful operation, particularly for an incineration plant. Taking however into account that pollution does not stop at national borders if insufficiently arrested and controlled, one may expect both regional and international support for efficient industrial solutions.

5.07 Case studies and monitoring activities.

The detailed study of specific pollution problems or treatment technique is an important entry point for further improvements in waste treatment and management. For this purpose and for the fostering of increasing interest in pollution abatement it is important to engage local universities and professionals in case studies regarding the efficiency of different disposal methods in regard to the protection of natural resources and public health.

Special attention should be devoted to uncover malpractice and possible erroneous theories about waste treatment and disposal possibilities. For instance the impact of old waste deposits on soil and ground water deserve attention to pave the way for safer storage methods. Similar the need for neutralizing incineration ash from commercial or municipal incinerators should be examined together with the disposal methods used at present for the disposal of such waste materials.

Case studies reporting on pollution problems are generally expected to create interest for improvements and anticipating some improvements materialized it appear logical to monitor how the modifications influence the local situation. Oppositely also selected monitoring activities, over and above the routines established in connection with ongoing waste disposal, could be an interesting entry point for promoting further improvements in industrial waste management as well as it would serve as a foundation for new case studies.

6.00 Objectives, outputs and activities proposed for integrated interregional programme on industrial incineration of waste.

6.01 Programme objectives

The objective of the programme is to promote a sustainable industrialization process in the developing countries through collection and dissemination of information on regulation and control as implemented in Europe and North America in relation to industrial incineration of waste and through the training of government officials, pollution inspectors and managers enable updating of legislation, establish efficient control with waste disposal and facilitate cleaner production.

6.02 Programme outputs

The output of the programme is the following multilevel instruments for environment protection:

- b1: a data base for environment legislation and updated environment regulations in developing countries.
- b2: a data base on pollution inspection routines including testing methods and proposed pollution limits for the monitoring of factories using or producing waste.
- b3: trained personnel with experience in environmentally safe storage, transport and industrial incineration of waste.

- b4: trained operators and managers with experience in clean and efficient operation of industrial installation, notably for the industrial incineration of waste, and for monitoring and reporting on such installations and their performance.
- b5: trained personnel (pollution inspectors) with established experience from study tours and practical training in inspection of factories and their storage, transport and disposal of waste in accordance with regulations.

6.03 Programme activities

A programme of activities for the development of industrial incineration of waste in the developing countries must take into consideration that client countries have different waste and pollution problems and are at different points in their development of regulations. It is next to impossible to formulate a detailed and integrated programme of this kind, with costs estimates, covering all programme activities required over the next five years, because not all activities are foreseeable at the present time.

The activities listed are consequently an inventory of proposed programme activities presented in a sequence, which at the time of the drafting appears logical. The proposed activities are interconnected by belonging to the same programme and occasionally by being a follow up component to previous activities. The following programme activities are subsequently proposed:

- c01: Formulation of aide memoire for generation of country reports on industrial pollution and local engagement in waste management and control.

The creation of an initial data base on the situation in the developing countries, interested in participating in the present programme, depend on receiving information in such a form that it is suitable for comparison and accumulation. The first programme activity would therefore be to formulate an aide memoire explaining the general idea about the programme and guiding authorities and professionals in reporting on production and disposal of waste.

The country reports should be as explicit as possible on the occurrence of airborne and general pollution at the background of existing national pollution regulations. Finally the aide memoire should include a questionnaire which if filled could facilitate computerization of the of the collected information.

- c02: Distribution of aide memoire to selected developing countries and communication with authorities in the selection of participants ready to report to UNIDO in accordance with the aide memoire and in principle being available for succeeding programme activities.
- c03: Execution of diagnostic surveys by local professionals in accordance with aide memoire and submission of country reports to UNIDO.
- c04: Establishment of data base or summary report and evaluation of received country reports on industrial pollution and waste management with special emphasis on the formulation of specific support and technical assistance activities which might be considered by UNIDO for negotiations with potential donors and development partners.
- c05: Elaboration of aide memoire for Regional Seminar on Industrial Incineration of Waste.

The organization of regional technical meetings specially organized for promoting industrial incineration of waste in developing countries is an important pace maker and eye opener activity for industrial pollution abatement wherever industry cause pollution. It is therefore advisable that technical meetings, like the one described here, are used both as starting point and as a recurring booster for the promotion of industrial pollution abatement and the development of appropriate regulations for protecting the environment. The formulation of an aide memoire is only one of the preparatory activities for this kind of technical meetings helping organizers and officials involved in the development process to join forces in the design of the proposed meeting.

c06: Elaboration of technical assistance project document on Regional Seminar on Industrial Incineration of Waste.

As preparation for the transfer of technology and as platform for discussion of pollution problems and treatment efficiency, it is important that technology meetings like seminars and workshops are organized from time to time. During such technology meetings, invited participants from developing countries would be expected to present country papers describing the situation in their respective countries in regard to the occurrence of hazardous waste and pollution.

Similar would experts and consulting companies active in waste management present their experience in the development and management of incineration plants and systems. Further equipment suppliers would present their technology and describe how it is applied in storage, transport, treatment, recycling and containment of waste. Also of importance for the transfer of know how is the experience available from managers of existing waste treatment installations. In total such technology meetings would bring together government officials and managers from the developing countries, specialists from equipment suppliers and consulting companies, managers, experts and laboratory supervisors from enterprises engaged in storage and industrial incineration of waste.

The overall aim of the technology meetings would be transfer of technology and know how for the promotion of industrial incineration of waste. Attention should be given to review all angles of industrial incineration and create interest for the follow up activities described above opening for a full cycle of programme activities beginning and ending with technology seminars, where the last seminar among others will be used to report on and review the activities of the past and to evaluate the need for further technical assistance and support activities.

- c07: Verify the interest of selected developing countries in the technology meeting proposed and in the affirmative mobilize donor support, organize the meeting and engage in follow up activities as agreed during the meeting.
- c08: Elaboration of aide memoire for Roving Seminar(s) on Industrial Incineration of Waste.

While the regional technical meetings are instrumental in collecting, presenting and disseminating comprehensive information about industrial incineration of waste, it has to be accepted that it may be difficult for the few participants from each country to initiate industrial pollution abatement activities upon their return from such regional meetings.

It is therefore proposed to design roving seminars, in cooperation with participants from selected developing countries, so the information and experience made available at the regional meeting can be efficiently transferred to interested developing countries, where many local professionals including government officials, university professors, decision makers, managers and engineers can join forces for appropriate follow up action.

The content of the roving seminar would be selected subjects from the regional meeting focussing on pollution risks and how to reduce such risks through legislation, control and the establishment of industrial waste management. The roving seminars should in the fundamental agenda cover all subjects agreed with national participants to the regional meeting. Particularly the roving seminars should be initiated with studies of local waste problems and the elaboration of proposals for improvements. Such studies should be implemented with the help of local professionals preferably in cooperation with university professors and students in order to increase the awareness regarding pollution problems and risks and raise popular support for environment protection through industrial waste management.

The organization of roving seminars promoting industrial incineration of waste in the developing countries is seen as an important starting point for the promotion of local initiatives for industrial pollution abatement and the for the development of national regulations for the industrial disposal of waste.

c09: Elaboration of technical assistance project document on Roving Seminar(s) on Industrial Incineration of Waste.

As support for the transfer of technology on industrial incineration of waste and as platform for discussion of pollution problems and treatment efficiency, it is important that roving seminars are organized in the client countries. During such seminars, invited national participants would be expected to present the local situation in regard to the occurrence of hazardous waste and pollution.

At the same occasion should managers of existing waste treatment installations and consulting companies active in industrial incineration and training of personnel present their experience in with special reference to the situation in the host countries. Similar should selected equipment suppliers be invited to present their technology and describe how it is applied in storage, transport, treatment, recycling and containment of waste. The roving seminars should in addition function as investment promotion meetings bringing suppliers and clients together and opening for both confidential and plenary discussion of investments requirements and the economy of industrial incineration as it relate to the host country.

In total such roving seminars should bring together officials and managers from the host country, specialists from equipment suppliers and consulting companies, managers, experts and laboratory supervisors from enterprises engaged in industrial incineration of waste, so all angles of waste management can be reviewed in relation to the host country and create interest for industrial pollution abatement and cleaner production.

- c10: Verify the interest of selected developing countries in the hosting of roving seminars on industrial incineration of waste and in the affirmative mobilize donor support, organize the seminars and engage in follow up activities as agreed during the meeting.
- c11: Evaluate or verify the need for industrial pollution inspectors in selected developing countries and in the affirmative establish contact with potential training partners and formulate a technical assistance project specially designed for the training of industrial pollution inspectors. Project proposals should include both practical and theoretical training as well as coaching support to start national inspection and reporting activities.
- c12: Verify the interest of selected developing countries in the proposed training of industrial pollution inspectors and in the affirmative mobilize donor support and organize the required training.
- c13: Evaluate and verify the need for the prevention of pollution during loading, transport, reloading and storage of waste and in the affirmative establish contact with potential training partners in logistics and forwarding and formulate an appropriate training course which might be considered by concerned authorities for promotion as part of the present programme activities in cooperation with suitable UN partner organizations.
- c14: Verify the interest among selected developing countries in the training of authorized forwarding agents and in the affirmative contribute to the formulation of an appropriate technical assistance project specially designed for the training in logistics and forwarding with special emphasis prevention of pollution during loading, transport, reloading and storage of waste.
- c15: Verify the interest of selected developing countries in the proposed training in logistics and forwarding and in the affirmative mobilize donor support and organize the required training.

- c16: Evaluate and verify the need for study tours and fellowship training for government officials (legislators), managers (decision makers), operators, pollution inspectors and laboratory personnel to examine how legislation, operational efficiency and performance inspections contribute to environment protection and in the affirmative establish contact with potential training partners and formulate a technical assistance project specially designed for the required training.
- c17: Verify the interest of selected developing countries in the training of government officials (legislators), managers (decision makers), operators, pollution inspectors and laboratory personnel and in the affirmative mobilize donor support and organize the required training.
- c18: Evaluate and verify the need for development of installations for industrial incineration of hazardous waste in selected developing countries and in the affirmative elaborate work plans and terms of references for environment impact assessments and techno-economic feasibility studies covering transfer and establishment of the technology deemed necessary for an efficient storage and treatment of waste.
- c19: Verify the interest of selected developing countries in the pollution abatement schemes described with the above mentioned work plans and terms of references for the industrial incineration of hazardous waste and in the affirmative elaborate technical assistance documents specially designed for the implementation of the necessary environment impact assessments and pre-investment studies.
- c20: Verify the interest of selected developing countries in the pre-investment studies and in the affirmative mobilize donor support and implement the requested technical assistance project activities including appropriate environment impact assessment studies.

ANNEX I

PROJECT CONCEPTS

The following presentation of project concepts is only describing a first cycle of programme activities for the promotion of industrial incineration of waste and it should be considered that the programme should consist of several such cycles in the developing regions to serve as an efficient tool for the transfer of know how and technology for industrial waste management. Practically all project activities of the proposed programme are anticipated to be implemented in a cooperation between selected UN organizations.

Diagnostic surveys: UNIDO/UNEP	US\$ 120,000
Regional seminar: UNIDO/UNEP	US\$ 148,000
Roving seminars: UNIDO/UNEP	US\$ 420,000
Training: UNIDO/UNEP	US\$ 140,000
Promotional studies: UNIDO/Regional banks	US\$ 750,000
Investment promotion: UNIDO/Bilateral donors and Regional banks.	US\$ 280,000
Monitoring actives: UNIDO/UNEP and UNESCO	US\$ 100,000
Total Programme costs:	US\$ 1,958,000 ²

²: Agency costs not included !

Project Concept 1

Title: Diagnostic surveys of the industrial environment in selected developing countries.

Background Information:

The development of industry depend on the ability to manufacture industrial products which can be gainfully sold on the market. The profit margin is usually determined by labor costs, the cost of raw materials, the cost of the necessary capital, the costs of energy and the transport costs as well as the price of competitive products. These parameters have changed drastically over the last 20 years and made it interesting to establish industry in the developing countries. Transport has been containerized and made less dependent of labor costs with the result that economy of scale factories can be built where stability and the costs of labor, energy and raw materials make it attractive.

The outcome has been a migration of industry to developing countries where regulations were much less of a burden than in most industrialized countries. Some developing countries have also made a profit from the import of waste and practically no information is available about the pollution situation and which threats the populations are facing. When in addition both old and new factories continue established malpractice, it becomes obvious that corrective action is urgently required. In order therefore to be able to discuss corrective action and to initiate the design of possible solutions it is essential that quality and magnitude of the polluting elements in cooperating developing countries are known. Consequently it is proposed to execute environmental diagnostic surveys in selected developing countries with the help of local professionals under guidance from UNIDO and UNEP.

Objective:

The objective of the environmental diagnostic surveys in selected developing countries is to enable national government officials, local experts and UN organizations like UNIDO and UNEP to quantify and understand the pollution problem in participating developing countries and promote action to correct the situation.

Counterpart Organization:

To be decided by the national host authorities.

Target Beneficiaries:

National authorities and experts.

Description:

Mobilization of local universities and experts to execute country-wide diagnostic surveys on the industrial environment and to report on typical industrial waste streams and deposits with special reference to their present and possible future impact on soil, ground water and air.

Project Budget: US\$ 120,000

Anticipating that the first round of diagnostic surveys should cover 20 developing countries and that the national work effort in each participating country can be limited to 4 man/month of US\$ 1500 per man/month, the total project costs would amount to US\$ 120,000 excluding agency costs.

NB: The first diagnostic survey(s) could be optional considering that nominees to the first regional seminar would be expected, as entry criteria, to prepare a country paper giving a reasonable overview of local pollution problems and disposal routines before they qualify for participation. The elimination of the first diagnostic surveys would facilitate a soft start and help participants to learn more about waste and pollution abatement before they have to analyze and report on local problems and methods.

Project Concept 2

Title: Regional Seminar(s) on Industrial Incineration of Hazardous Waste.

Background Information:

The know how and the experience so far developed in waste management has mainly been to the benefit of industrialized countries, where decisions were made to invest in industrial pollution abatement. In the developing countries the situation is somewhat different. Officials and decision makers are often not well informed about the pollution risks accompanying the application of landfills and they see no urgent need for corrective action. Government authorities and environmentalists in developing countries are facing two problems. One is that environment legislation is often incomplete, another is the shortage of resources and experienced personnel for enforcement of regulations and for pollution inspection activities.

In the industry itself, many developing countries only accord low priority to preventive action in matters of technique including waste disposal. The likelihood that some waste dumps and landfills may poison soil, crops and ground water for a lifetime seem to be of limited importance as long as it does not happen. The tragedy is unfortunately that environmental repairs are many times as expensive as well planned and executed preventive waste management. Simple landfilling and dumping is therefore expected to continue, mainly because it is easy and cheap, unless action is taken to strengthen regulations as well as to train operators and inspectors to protect the environment in accordance with the regulations. Besides the upgrading of personnel and regulations also transfer and development of technology is required.

Objective:

The objective of the present project is to enable government authorities in developing countries to set in motion development and improvement of national pollution regulations and to lay the foundation for the establishment of industrial pollution inspection and generate support for specific training activities for industrial pollution inspectors. It is further the objective to enable government officials and managers

of industry in developing countries to be informed about equipment and technology applied in the high-temperature incineration of hazardous waste

Counterpart Organization:

To be decided by the host government

Target Beneficiaries:

Participants to the regional seminar and the developing countries delegating their experts to the meeting.

Description:

The organization of a regional seminar start with the elaboration of an aide-memoire which can help organizers and host authorities in negotiating cooperative conditions with national authorities and international experts expected to contribute to the event.

Once interest and ability of all contributors to the regional seminar have been confirmed and all cost estimates updated in accordance with facts and new estimates, it is time to finalize the seminar programme within the available budget and set the timing for the meeting as well as invite the developing countries of the target region to nominate candidates for possible participation in the regional seminar.

Upon receiving sufficient qualified nominees to justify the regional seminar, the organizers will then start to make commitments for the invitation of selected consultants and participants. Invitations will also be send to observers, experts, company representatives and other interested parties. The implementation of the regional seminar will hereafter follow the agreed programme and end with the final report and several ideas for programme intensification.

Project Budget: US\$ 148,000 See also annex II

Project Concept 3

Title: Roving Seminar(s) on Industrial Incineration of Hazardous Waste.

Background Information:

Since the roving seminars fundamentally are a low cost repetition of the regional seminars and organized to establish working contact to many more national officials and experts than possible in the regional seminars, most information describing the regional seminars will also apply to the roving seminars.

This does not mean that the roving seminars should not be adjusted in accordance with new knowledge and special national requirements, which should always be considered in the grouping of countries for a row of seminars. The same apply for the selection of roving experts and in the selection of specific subjects to be dealt with in the next row of seminars. Each string of roving seminars could conveniently be organized to cover 4 selected developing countries with a seminar duration in each country of 4 days preceded by one day for preparatory arrangements. Weekends would be used for travelling between duty stations.

Objective:

The objective of the roving seminars is to enable government authorities in developing countries to improve national pollution regulations and to generate support and interest for specific training activities related to industrial incineration of waste, notably industrial pollution inspection, cleaner operation and containment of waste. It is the objective to enable government officials and managers of industry in developing countries to be informed about equipment, technology and work routines applied in the industrial incineration of waste.

Counterpart Organization:

To be decided by the host government

Target Beneficiaries:

National authorities and experts participating in the meeting.

Description:

As mentioned earlier the roving seminars are tailor made repetitions of the regional seminar(s) with the purpose of addressing maybe 20 national officials and experts in each of the 4 countries lined up for roving seminars. One string of roving seminars should therefore be able to reach 80 participants in stead of only one or two from each participating country as in the regional seminar.

It is basically the idea that one UN official and three selected UNIDO consultant like a theater troop, with a diversified programme, will visit 4 target countries and present their technical show, engage in industrial visits and discussions as agreed with the host authorities before the arrival of the roving seminar. All local preparations, including the sending out of invitations, organization of local travel and accommodation will be the responsibility of the host authorities and local experts. Each roving seminar will be implemented in accordance with a work programme to which UNIDO and the authorities have agreed upon before the roving seminars are activated.

Project budget: US\$ 420,000.

It is anticipated that all 20 countries participating in this programme are covered with the help of 5 roving seminars of US\$ 84,000 each, the estimate for reaching all participating countries amounts to US\$ 420,000. (approximately US\$ 1000 per participant) See also table below:

Roving seminar for 4 countries	Total	Fee	Travel costs	DSA
2 national resource persons	24,000	16,000		8,000
1 UN official	9,000		5,000	4,000
3 consul- tants	51,000	24,000	15,000	12,000
Grand total	84,000	40,000	20,000	24,000

Project Concept 4

Title: Study tours and Fellowship Training

Background Information:

The waste occurring in the developing countries is a consequence of import, local manufacture and the application of chemical products and industrial equipment. Authorities are facing the dual problem of protecting the environment and pacifying all hazardous waste in storage or transit. The management action required to protect the environment from pollution would include a number of activities aiming at identifying and classifying the occurring waste and guiding it to its final neutralization with appropriate control at all turning points.

In order to help local authorities and experts in the development of industrial and integrated management routines, a build up period for the establishment of know how and work routines through study tours and training, would be necessary. During this initial period subjects as diverse as legislation, resource evaluation, logistics and containment, waste treatment and recycling, inspection and safety control would be topics either for study tours or for fellowship training. The bulk of the training will presumably focus on training of pollution inspectors.

Objective:

The objective of the present project is to help the authorities in 20 developing countries in the training of an equal number of pollution inspectors (20) and the training of 20 other experts in other disciplines as required for the introduction of industrial incineration of waste in the participating countries.

Counterpart Organization:

To be decided by national authorities.

Target Beneficiaries:

National officials and experts

Description:

Anticipating that the regional and the roving seminars repeatedly indicate that there is an uncovered need for training of pollution inspectors and other professionals, it is then the intention to manage this training as a separate project activity under the proposed programme. Fundamentally it is anticipated that the major part of the training required will be promoted as bilateral stipends as spin off from the present programme.

As mentioned elsewhere industrial incineration of waste is an established industrial activity in Europe and North America and experts, assistance service and equipment is available as for any other industry. It is therefore quite uncomplicated to organize study tours and training in all aspects relating to industrial incineration of waste.

The main conditions for fulfilling the task is that adequate funding and qualified professionals are available for the training required. The activity of organizing study tours and training is a well established UNIDO routine and provided the training needs are well defined, there should be no problems in placing UNIDO fellows and organizing UNIDO study tours.

Project Budget: US\$ 140,000.

The average duration of study tours and training arrangement will be one month per expert and anticipating that 40 local professionals will be in need of UNIDO support covering travel and DSA amounting to US\$ 7000 per person, the project budget then reach 140,000 in total without agency costs.

Project Concept 5

Title: Promotional and Technical Studies.

Background Information:

The organization of regional and roving seminars in combination with study tours and training is among others expected to transfer know how on industrial pollution regulations and knowledge about how to live up to the new requirements. The new knowledge will help national experts to identify local shortcomings and will presumably alert these to use their experience from study tours and training abroad in the discussion and promotion of improved waste disposal technique. Some landfills and waste deposits may for instance be seen as temporary storage and call for improved work routines and additional control. Special waste may call for tailor made small scale incinerators for the treatment of industrial waste. Existing cement plants may for instance be considered for high temperature digestion of different kind of waste.

The idea about new solutions and technology is however not the same as experience and knowledge, as available from developed countries engaged in industrial incineration of waste. It is therefore anticipated that the implementation of improvements in the industrial incineration of waste will have to start with technical and economic studies evaluating the technical feasibility of the new proposals and analyzing investment requirements and the economic commitments accompanying the installation of new industrial facilities and methods.

The present project is therefore proposed for the programme on industrial incineration of waste to promote and support the elaboration of feasibility studies so investment decisions can be made on the basis of the best possible knowledge about advantages and commitments in the establishment of industrial incineration.

Objective:

It is the objective to enable authorities and decision makers to compare advantages and commitments between existing disposal routines and industrial incineration of waste, which like other industrial installations are promoted and compared with the help of pre-investment and feasibility studies.

Counterpart Organization:

To be decided by the host authorities.

Target Beneficiaries:

National officials and experts.

Description:

Local experts will in cooperation with UNIDO and other consultants elaborate work plans and terms of references as required for engaging authorities and consulting companies in detailed techno-economic analysis of the solution possibilities. UNIDO will in special cases also engage in the elaboration of feasibility studies, but will with the help of the terms of references mentioned above aim at mobilizing bilateral authorities to execute some of the proposed studies so the programme can have a multiplier effect over and above the resources reserved for this project.

Project Budget: US\$ 750,000

Anticipating 20 developing countries serviced with the help of the present project in terms of preparatory counselling and advice in the elaboration of work plans and terms of reference and anticipating further that 10 developing countries will need at least one pre-feasibility study each from UNIDO to promote their new solutions, we arrive at the following budget estimate:

20 man/month counselling assistance US\$ 300,000
plus 10 special pre-feasibility studies US\$ 450,000.
Total US\$ 750,000.

Project Concept 6

Title: Investment Promotion and Mediation.

Background Information:

The establishment of industrial facilities for the storage and treatment of waste in the developing countries is handicapped by a general lack of understanding for having the waste producer to pay for the waste treatment. It is therefore of utmost importance that such industrial projects are appropriately supported with soft loans and donations so the burden of fixed costs will not prevent a successful start of efficient waste management.

In this connection it should be noted that the capacity utilization during the first years may be quite modest and totally insufficient for a gainful operation, particularly for an incineration plant which is totally dependent of incineration fees to be received from those producing the waste.

Taking however into account that pollution does not stop at national borders if insufficiently arrested and controlled, one may expect both regional and international support for efficient industrial solutions. It should also not be excluded that operating costs, at least in an initial period, would have to be covered from those benefitting from quality improvements in the environment, because a fee on waste delivered for incineration may provoke uncontrolled and harmful disposal of waste. Another approach may be to impose a fee on all waste which can be controlled with such a security that nothing escape and practice free service for uncontrollable waste.

The income problems indicated above does not facilitate the release of investment capital and it is very probable that promoters of industrial waste incineration will have to be very inventive in their presentation of investment intensive solutions for the treatment of waste. The present project is designed for helping authorities, promoting industrial incineration, in the design of structural business solutions which may be acceptable to society, waste producers and lenders.

Objective:

It is the objective to enable national authorities and managers to promote the establishment of industrial waste management and to find solutions for raising and amortising loans and capital for the establishment and development of installations neutralizing hazardous waste.

Counterpart Organization:

To be decided by the national authorities.

Target Beneficiaries:

National authorities and experts.

Description:

The pollution situation in many developing countries call for structural business solutions satisfying both lenders, waste producers, operators of waste treatment installations and the national community. The first techno-economic feasibility study for an industrial incineration plant, whether elaborated by UNIDO or a friendly government, may presumably not go into details about from where capital and income should come, and special national conditions may undermine the credibility of the industrial project.

It is therefore important to develop and accumulate special experience in the structurization and the promotion of industrial projects for waste treatment installations. It is known that UNIDO already has experience from the promotion of marginal industrial projects and building further on this experience should be a good starting point for helping national authorities and experts in structuring and promoting industrial incineration plants and other pollution abatement installations.

Project Budget: US\$ 280,000.

It is anticipated that each one of the participating developing countries will have at least one difficult industrial project to promote and it is further estimated that the mediation work required for one project will amount to a total of six weeks. One mediation mission including the necessary international travel is estimated to US\$ 28,000. Ten engagements amount to US\$ 280,000.

Project Concept 7

Title: Monitoring Activities and case studies.

Background Information:

The detailed study of specific pollution problems or treatment technique is an important entry point for further improvements in waste treatment and management. For this purpose and for the fostering of increasing awareness for the need of pollution abatement, it is important to engage local universities and professionals in monitoring activities and case studies regarding the efficiency of different disposal methods in regard to the protection of natural resources and public health.

Special attention should be devoted to uncover malpractice and possible erroneous theories about waste disposal. The impact of waste on soil and ground water for instance be examined to pave the way for safe transport (containerization) and safer waste deposits. Similar may the need for neutralization of incineration ash and safe storage of filter sludge or dust from industrial installations be examined together with the disposal methods applied at present for the disposal of such waste materials.

Case studies reporting on pollution problems are generally expected to create interest for improvements. Similar it appear logical to monitor selected installations or to examine how modifications and improvements influence the pollution situation. Such monitoring activities, over and above the inspection routines established in connection with ongoing waste disposal, could be an interesting entry point for case studies and the development of a public awareness for need of a clean environment.

Objective:

The objective is to establish nation-wide awareness for the need of industrial pollution abatement and give professionals and student a ballast of knowledge about pollution dangers so the in the future can be critical and constructive guardians of the environment and well prepared specialists for the promotion of a sustainable development.

Counterpart Organization:

To be decided by the host authorities.
Target Beneficiaries:

National authorities and professionals.

Description:

The idea of the awareness activities is to engage engineering and science students and their teachers in such pollution abatement studies that they in their professional work for industry and authorities are well informed about the degradation of the biosphere caused by pollution. It is therefore planned, in cooperation with pollution inspectors to design and implement monitoring activities over and above the routines of the pollution inspectors and select special pollution problems and curiosities to be presented as educational case studies.

It is the intention already in relation to regional and roving seminars to establish working contact with relevant university faculties and invite these in cooperation with foreign or local pollution inspectors or consultants to prepare proposals for monitoring activities, which could be considered for UNIDO sponsorship on certain conditions and within limited budgets. UNIDO would then evaluate such proposals considering the experience of the proposed tutors and the need for avoid to pay for exactly the same studies in several countries.

Project Budget: US\$ 100,000.

Anticipating at least one monitoring study sponsored in each of the participating 20 countries with an engagement of one tutor and four science or engineering students and anticipating further the study to last five months it is estimated that one fully reported monitoring activity with chemical analysis and evaluation of findings would call for a reserve of US\$ 5,000 per country. Total requirements are therefore estimated to US\$ 100,000.

ANNEX II

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

(First draft)

Project Proposal

Title: Regional Seminar on Industrial Incineration of Waste.

Number: ../RAS/95/.../.

Host Country: India

Total UNIDO budget: US\$: 148,000
(incl. support costs): US\$: 167,240
(currency and amount)

Estimated
starting date: 07/1996
(month/year)

Planned duration: 4.0 months from invitations to final
seminar report.

Project site: to be decided

Government
Implementing Agency: to be decided

Brief description:

The proposed regional seminar on industrial incineration of waste is organized to familiarize government officials and operators of industry with industrial incineration as practiced in Europe and North America. The transfer of know how during the seminar is designed to help authorities in developing countries to set in motion the development of national pollution regulations and to lay the foundation for an efficient strategy for industrial pollution inspection. The seminar is further expected to help government officials and managers from industry in developing countries to be informed about technology, equipment and work routines applied in the industrial incineration of waste.

I. BACKGROUND AND JUSTIFICATION

In 1985 "CHEMICAL ENGINEERING", a well known technical periodical, decided to find out from their professional readers what they felt about hazardous waste. They received more than 2000 answers to their questionnaire and 70 per cent of those expressing their opinion had graduated in chemical engineering. The majority of the respondents expressed the following:

- The chemical process industries, in general, do not have the problem of hazardous waste under control (In other words the environment and all of us have a problem with hazardous waste).
- No untreated hazardous waste should be disposed of by any means, and particularly not by landfill or deepwell injection.
- The preferred treatment for most hazardous waste is high-temperature incineration.
- Regulations concerning hazardous waste are adequate (in USA), but underenforced or inconsistently enforced.

Ten years have gone and the present proposal is devoted to the developing countries. Many of these had pollution problems already ten years ago and few have invested in improvements in the meantime. It is therefore anticipated that pollution abatement is needed more than ever.

Clean Air, Water and Land is world wide becoming increasingly important as environment pollution is increasing. Yet population growth, industrial development and increasing living standards, although not available to all, invariably lead to an expanding output of waste. Some waste has little or no impact on the environment and may as such be rated harmless. Other types of waste, like some industrial by-products, are hazardous and their handling and disposal accompanied with the risk of damaging the environment. The same apply to a number of industrial products and intermediates, which pollution potential is known and their storage and transport therefore regulated in accordance with their pollution potential.

The dilemma with waste is its negative or very low value and the fact that practically nobody wants it. Since however society has to protect the environment, in order to protect itself, it is no longer permitted to dump waste at the convenience of the waste producer. Regulations are fairly new in many countries and still under development to match the needs. Some developing countries have only a fragmented legislation for environment protection and insufficient resources and experience for the enforcement of regulations.

The waste occurring in the developing countries is a consequence of import, local manufacture and the application of chemical products and industrial equipment. Technical installations (factories) may for instance have transformers which are cooled with PCB's and when such installations are damaged few people may think about the need for collecting the coolant for correct disposal before metallic parts are recycled or thrown away. The same apply for CFC's in cooling installations in air conditioners and refrigerators. Also lube oil, grease and cutting oil and other utilities are partly escaping during their application as well as they call for safe disposal after their use.

Manufacture of metallurgical products, organic and inorganic chemicals, pesticides and fertilizers are all accompanied by the generation of waste. Every workshop and vehicle depend on lubricants and special products like sealants, oils and paints, and while their application is increasing, so is the disposal of used materials.

A presentation of a complete list of problem waste is not meaningful in the present context, but an idea about the diversity of commonly occurring hazardous waste may emerge from the following early OECD list dividing the rejects in three categories:

A: RED LIST

Wastes containing PCB's, polychlorinated terphenyl, polybrominated biphenyl, chlorinated dioxin, asbestos, leaded anti-knock compound sludge.

B: AMBER LIST

Ash from iron and steel manufacture, petrol coke and bitumen, lead acid batteries, waste oils and oil/water mixtures, phenols, thallium compounds, hydrogen peroxide solutions.

C: GREEN LIST (Recyclable waste)

Scrap metals:

gold, platinum, silver, iron and steel, copper, nickel, lead, cadmium, indium, gallium, thallium.

Plastics:

PVC, polythene, polypropylene, styrene polymers, polyamides, Teflon, phenol-formaldehyde resins.

Other:

Ceramics, mining waste, glass, rubber waste, textile and tannery wastes, gypsum, and certain ashes from coal fired power stations.

The above rudimentary list give a good idea about the diversity of problem materials to deal with in the dual management task of protecting the environment and pacifying all hazardous waste. The management action required to protect the environment from pollution would among other include the following:

D: RESOURCE EVALUATION

Identification and classification of waste components through producer declarations and/or chemical analysis. The examination of the waste is needed to determine its nature and recycling possibilities as well as its transport and treatment requirements.

E: LOGISTICS AND CONTAINMENT

The environment should be protected through the safe collection, transport and storage of waste in all forms in accordance its nature and classification. Decisions are required on mean and mode of transport as well as the transport route and the control required.

F: PROCESSING OF WASTE

Blending, incineration, recycling and immobilization with appropriate process and pollution control. Depending on the waste occurring and the treatment options available, decisions are required on how to blend the waste (cocktail) and how to feed it to the treatment installations or how to recycle it.

G: DISPOSAL OF REJECTS AND WASTE

Neutralization, containment (if required) and depositing. Both temporary and final storage of neutralized waste and residues from the treatment of waste require planning and management action. Decisions are required on how to transport and deposit the rejects and how to monitor and control the waste deposits.

H: INSPECTION AND SAFETY CONTROL

Periodic monitoring and checking, by sampling and testing, of the waste components through their entire life cycle from their occurrence, through treatment and neutralization, to their safe release. Special attention must be given to ensure the integrity of the inspection function for instance by making it totally independent from the industry it is supposed to inspect.

The know how and the experience so far developed in industrial incineration of waste has mainly been to the benefit of industrialized countries, where decisions were made to invest in industrial solutions. In the developing countries the situation is somewhat different. Officials and decision makers are often not well informed about the pollution risks accompanying the application of landfills and they see no urgent need for corrective action. Government authorities and environmentalists in developing countries are facing two problems. One is that environment legislation is often incomplete, another is the shortage of resources and experienced personnel for enforcement of regulations and for pollution inspection activities.

In the industry itself, many developing countries only accord low priority to preventive action in matters of technique including waste disposal. The likelihood that some waste dumps and landfills may poison soil, crops and ground water for a lifetime seem to be of limited importance as long as it does not happen. The tragedy is unfortunately that environmental repairs are many times as expensive as well planned and executed preventive waste management. Simple landfilling and dumping is therefore expected to continue, mainly because it is easy and cheap, unless action is taken to strengthen regulations as well as to train operators and inspectors to protect the environment in accordance with the regulations. Besides the upgrading of personnel and regulations also transfer and development of technology is required.

The above described activities may be combined in a multilevel and multi-disciplinary programme of activities mobilizing participants from both developed and developing countries. The main components of such a programme are:

- J: transfer of technology and know how through the organization of technology workshops and seminars for officials and managers from developing countries. Such meetings are to be organized in cooperation with officials, consultants, equipment suppliers and participants from developing and developed countries to discuss and review pollution regulations and their enforcement, industrial waste incineration and training of pollution inspectors and operators.
- K: implementation of techno-economic feasibility studies and environment impact assessments for the promotion of environmental protection. Both the improvement of existing installations (cement plants ?) and the establishment of new facilities (high temperature incinerators) should be considered.
- L: training and study tours focussing on legislation, operational efficiency and performance inspections are proposed for government officials (legislators), managers (decision makers), operators, pollution inspectors and laboratory personnel.
- M: applied research focussing on the long term and long distance impact of incorrect waste disposal on the environment (case studies). Likewise the innocence of correctly neutralized and immobilized waste could be verified.

The need for UNIDO engagement in pollution abatement activities was latest confirmed in December 1994 during the second session of the open-ended ad-hoc committee for the implementation of the Basel Convention. Delegations were during the meeting in Geneva unanimously recognizing the role that UNIDO and other organizations could play in the implementation of the convention and identified specific areas where inter agencies and member states cooperation should be reinforced.

Of particular importance was the decision of the committee to promote the establishment of regional or sub-regional centers for training and technology transfer regarding the management of hazardous and other waste including to minimize of their generation. Operative para. J of the decision invites UNIDO together with UNEP and UNDP to

assist in feasibility studies for and the establishment of the above mentioned centers in locations to be decided.

UNIDO could with the help of the presently proposed seminar initiate both training and transfer of technology in such a way that national authorities can efficiently engage in the development of their pollution regulation and in the training of pollution inspectors, waste managers and operators of industrial installations. The following project details represent only a modest part of the programme idea outlined above but this first support activity could never the less serve as an important starting point for the authorities to develop regulations and control and to upgrade installations and operational skills to respond to the requirements.

(a) Project Objective

The objective of the present project is to enable government authorities in developing countries to establish an integrated approach for management and treatment of waste, among others by setting in motion development and improvement of national pollution regulations and laying the foundation for the establishment of industrial pollution inspection as well as generating support for specific study tour and training activities discussed during the seminar. It is further the objective to enable government officials and managers of industry in developing countries to be informed about equipment and technology applied in industrial waste incineration.

(b) Output(s)

The output of the project is the following:

- b1: the assurance that participants to the meeting are well informed about the (draft) "Model National Legislation on the Management of Hazardous Wastes and Other Wastes as well as on the Control of Transboundary Movements of Hazardous Wastes and Other Wastes and their Disposal". (UNEP/SBC/94/2)
- b2: increased understanding among government officials and managers from developing countries for the necessity of industrial pollution inspection and the first proposal for specific training activities for industrial pollution inspectors ready for further development and implementation as follow up to the present meeting.

- b3: increased knowledge among government officials and managers from developing countries about equipment and technology applied in the industrial incineration of waste.
- b4: increased knowledge among government officials and managers from developing countries about equipment and technology applied in the industrial incineration of waste in cement factories.
- b5: increased knowledge among government officials and managers from developing countries about work routines in high-temperature incineration of hazardous waste and the control methods applied to limit industrial pollution.
- b6: increased knowledge among government officials and managers from developing countries about the work routines in traditional incineration of waste and the control methods applied to limit industrial pollution.
- b7: increased knowledge among government officials and managers from developing countries about how pollution inspection is organized and implemented in selected industrialized countries.
- b8: increased knowledge among the participants about the waste disposal methods commonly applied in the participating developing countries.
- b9: Increased transparency about the work of UNIDO and UNEP for the promotion of industrial waste management and pollution abatement.

(c) Activities

Preparatory activities:

- c1: Negotiate seminar arrangements with host authorities and establish preliminary contact with experts, officials, consultants, suppliers and plant managers to ensure the availability of all lecturers before invitations to nominate participants are sent out to selected Asian countries.
(Responsible UN officer(s) managing project)
- c2: Elaborate aide memoire for the first regional seminar and distribute invitations to Asian countries for nomination of participants in accordance with the concept of the meeting. From the nominations received select a balanced group of participants not exceeding 30 persons for budgetary reasons. In case more than the participants

selected should be interested in participating as observers at their own costs, then the seminar should be prepared to receive up to 20 observers from Asian countries. Also observers should be requested to submit some kind of nomination forms to facilitate so the seminar administration to give preference to the observers best matching the group of participants. (Responsible UN officers in consultation with host authorities)

Proposed seminar activities:

- c3: Distribute and present the UNEP document on "Model National Legislation on the Management of Hazardous Wastes and Other Wastes as well as on the Control of Transboundary Movements of Hazardous Wastes and Other Wastes and their Disposal" (UNEP/SBC/94/2) and make comparisons to other national regulations for the protection of the environment.
(UNEP officer, DSA and travel costs)
- c4: Present a paper describing why industrial pollution inspection and control is necessary and elaborate first proposal for training of industrial pollution inspectors in such a form that the proposal is ready for further development and implementation as follow up immediately after the present meeting.
(Consultant from NIFES*, DSA and travel costs)
- c5¹: Present a paper describing equipment and technology applied in the high-temperature incineration of hazardous waste and explaining which kind of waste such installations can process and the kind of rejects and waste they produce and how these waste products are neutralized and discarded.
Consultant from CLEANAWAY*, DSA and travel costs)
- c5²: Present a paper describing equipment and technology applied in the high-temperature digestion of hazardous waste in the cement making process and explaining which kind of waste such installations can digest and the kind of rejects and waste they produce and how these waste products are neutralized and discarded.
(Consultant from Castle Cement*, DSA and travel costs)
- c6: Present a paper describing equipment and technology applied in the traditional incineration of waste and explaining which kind of waste such installations can process and the kind of rejects and waste they produce and how these waste products are neutralized and discarded.
(Consultant from EPEC*, DSA and travel costs)

- c7¹: Present a paper describing work routines in high-temperature incineration of hazardous waste and the pollution control measures applied to limit or eliminate industrial pollution.
(Consultant from CLEANAWAY*, DSA and travel costs)
- c7²: Present a paper describing work routines in the high-temperature digestion of hazardous waste in the cement making process and the pollution control measures applied to limit or eliminate industrial pollution.
(Consultant from Castle Cement*, DSA and travel costs)
- c8: Present a paper describing work routines in traditional incineration of waste and the pollution control measures applied to limit or eliminate pollution.
(Consultant from CHEMCONTROL*, DSA and travel costs)
- c9: Present a paper describing how pollution inspection is organized and implemented in selected industrialized countries.
(Consultant from NIFES*, DSA and travel costs)
- c8: Organize a meeting session during which participants from the developing countries present their country papers and explain about the waste disposal methods commonly applied in their countries.
(Chairman and co-chairman selected among participants)
- c9: Elaborate and disseminate meeting report with summaries of the seminar papers and extracting the substance of discussions, findings and recommendations.
(UN officials and resource person in cooperation with rapporteur and lecturers)
- *NB: All indication of company names is preliminary and does not indicate that consultants from the mentioned companies are ready to participate in the regional seminar at the mentioned conditions.

(d) Inputs

(i) Government Inputs

The Government hosting the seminar will make meeting facilities available together with a local secretariat to assist in organizing and implementing the meeting. The local meeting secretariat will further organize all local travel, assist participants in confirming return flights and organize transport from and to the airport.

(ii) UNIDO Inputs

International staff

11-50 Short term consultants

11-51	Consultant on training of pollution inspectors, c4 + c9 (NIFES*, Fee, DSA and travel)	1.0 m/w US\$	7,000
11-52	Consultant on incineration technology and work routines, c5 ¹ + c7 ¹ (CLEANAWAY*, Fee, DSA and travel)	1,0 m/w US\$	7,000
11-53	Consultant on incineration technology and work routines, c5 ² + c7 ² Castle cement*, Fee, DSA and travel)	1.0 m/w US\$	7,000
11-54	Consultant on incineration routines and pollution control, c8 (CHEMCONTROL*, Fee, DSA and travel)	1.0 m/w US\$	7,000
11-55	Consultant on incineration technology and its limitations, c6 (EPEC*, Fee, DSA and travel)	1.0 m/w US\$	7,000
11-56	Rapporteur and resource person I (Fee, DSA and travel)	2.0 m/w US\$	11,000
11-57	Rapporteur and resource person II (Fee, DSA and travel)	2.0 m/w US\$	11,000
16-00	Headquarter support (UNEP + UNIDO officials)		US\$ 10,000
17-01	National resource person I		US\$ 3,000
17-02	National resource person II		US\$ 3,000
35-00	30 Asian participants (DSA and travel)		US\$ 75,000
99-99	Total		US\$ 148,000
	Programme support costs		US\$ 19,240
	GRAND TOTAL		US\$ 167,240

*NB: All indication of company names is preliminary and does not signify that consultants from the mentioned companies are ready to participate in the regional seminar at the mentioned conditions.

Overview of costs elements, agency costs not included.

	Total	Fees	Travel costs	DSA
2 national resource persons	6,000	4,000		2,000
2 resource persons	22,000	12,000	8,000	2,000
2 UN officials	10,000		8,000	2,000
2 plant managers	14,000	4,000	8,000	2,000
3 consultants	21,000	6,000	12,000	3,000
30 participants	75,000		45,000	30,000
Grand total	148,000	26,000	81,000	41,000

III. REPORTING AND EVALUATION REQUIREMENTS, EXPECTED FOLLOW-UP

The project will end with a final report and the proceedings from the seminar will in selected Asian developing countries be used for the organization of roving seminars on management and treatment of industrial waste. Similar will the entire experience from the Asian programme, piece by piece, be used for the similar programme activities in other regions. Additional follow up activities in the form of technical studies, training and promotional activities as described in programme document may at any time supplement the programme in accordance with available resources and the interest of participating countries.