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POLLUTION CONTROL IN DYESTUFFS AND PESTICIDES INDUSTRIES

UC/IND/89/098

INDIA

Technical report: Findings and recommendations\*

Prepared for the Government of India  
by the United Nations Industrial Development Organization

Based on the work of L. E. Johansson, consultant in pesticides  
and  
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\* This document has not been edited.

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ABSTRACT

This two-man mission of 4.6 m/m was arranged to collect the necessary information for the preparation of a UNDP Project Document.

It has included a study of existing pollution control operations in the main industrial areas of Gujarat and Maharashtra.

As a result of the extended visits (3 weeks in each location) the Consultants have made recommendations. These indicate ways in which, according to the authors, the ensuing project could best be formulated to obtain the maximum improvement in the state of the environment, within the constraint of reasonable financial expenditure.

Pollution control in Dyestuffs and Pesticides Industries in India  
(UC/IND/89/098/11-01 & 11-02/J13426)

### INTRODUCTION

India has undergone a rapid industrialization in the past 10 years. Government tax incentives are available for the setting up of small scale industries. (Initial capital equipment investment not to exceed R80 lakhs.)

It has been estimated that 70% of All-India industries are located in the States of Gujarat and Maharashtra (comprising 60-64,000 companies in Gujarat and 100,000 companies in Maharashtra).

In Gujarat 85% of industries are situated in industrial estates (142) of which 10 are water intensive whereas in Maharashtra there are large estates at Mulund, Thane, Kalyan, Dombvili, Tarapur. The TransThane Creek area contains large industries which account for 35% of the All-India industrial economy.

This rapid industrial growth has greatly increased the supply of finished products for both the local market and in exports. These have brought economic benefits to the country but at the same time there have been disbenefits. Probably the worst of these has been the increase in pollution (water, air and solid wastes).

The Government of India has recognized the problem and has requested UNIDO technical assistance to assess the situation and to make recommendations. It has been particularly concerned about the dyestuffs pesticides and intermediates manufacturing industries.

The national programme was initiated by Mr. M S Murthy, Advisor in Chemicals and Petroleum, to the Minister of Petroleum and Chemicals, Delhi. The local programmes were organized by Dr U.I. Bhatt, Chief Scientific Officer, Gujarat Pollution Control Board and Mr. K.H. Mehta, Air Pollution Abatement Engineer, Maharashtra Pollution Control Board in their respective States.

It was arranged that one of us (JGW) would carry out a three week tour of Gujarat. Both consultants then carried out a three week tour of Maharashtra, leaving LEJ to complete his assignment by touring pesticide and intermediates factories in Gujarat.

The work of this project was done mainly during the monsoon time in India (15/7 - 8/9 1990) and the experiences of flooded industrial areas have been innumerable.

The following report includes the findings of an exploratory mission arranged to assess the size of the problem and to provide suggestions prior to the preparation of a project document.

### SUGGESTED TECHNICAL ASSISTANCE

It was a surprise to us to find that in both Maharashtra and Gujarat several other teams and consultants recently had been around to the same organizations and industries as we visited asking the same questions about Industrial Pollution Control as we were supposed to ask. The team from the World Bank, SIDA (Swedish International Development Authority), WHO, DANIDA (Danish International Development Authority), The International Development Authority of the Federal Republic of Germany etc. seem also to have had the same purpose with their visits, namely to pave the way for the future assistance to the Federal or Central and State Governments of India.

Tangible proof of these activities is for instance that some analytical instruments recently have been installed in the P.C.B's laboratories with the financial aid of the organizations above. Technical Assistance in the form of training facilities and scholarships for the staff of the different Pollution Control Boards is also on the list of aid from several countries and organizations.

To avoid confusion and double work we therefore suggest that a committee is formed to plan and co-ordinate the contributions from the different organizations and countries for Industrial Pollution Control in India. How this committee shall be made-up in detail is outside the scope of this report.

Though we have tried to avoid working areas which obviously are of great interest to other aid supporting organizations we cannot vouch for UNIDO being in sole control of the topics below



From the discussions held with staff of the Gujarat and Maharashtra Pollution Control Boards, and many industrialists, technical assistance would be welcome in the following topics:

1. Modern production of Dye Intermediates eg H Acid, J Acid, Vinyl Sulphone, Azo reactive dyes, Vat dyes etc, together with methods of effluent treatment and waste disposal assigned to that production.
2. Modern production of Pesticides and pesticide intermediates (eg Halogenated Organics, Phosphorous-containing Pesticides Metallo-organic Pesticides), together with methods of effluent treatment and waste disposal assigned to that production.
3. Design, construction and operation of waste management systems for the safe disposal of solid wastes.
4. Design, construction and operation of treatment plants.
5. Monitoring of effluent, waste and biological material to check the level of cumulative poisons (Cd, Pb, As, Hg) and persistent pesticides.
6. Cost/benefit studies of common primary and secondary treatment plant for selected industrial estates.

TECHNICAL MATTERS

Factory Classification

Industries in India can be divided into four main sections as follows:

1. Large factories with foreign collaboration
2. Large factories based in indigenous development
3. Medium scale factories
4. Small scale factories

Examples of typical installations from each group are:

1. Large Scale (Foreign collaboration)

<u>Name</u>	<u>Products</u>	<u>Effluent Flow/Treatment</u>	<u>Problems</u>
Atic, Bulshar (Atul/ICI)	VAT Dyes	<u>320 m<sup>3</sup>/h</u> - primary/ secondary treatment on pilot scale	Require new treatment plant
Sandoz, Thane (1200/1400 employees)	Dyes 600 Mt/y Pesticides 900 Mt/y	<u>900 m<sup>3</sup>/d</u> - primary/ secondary - eff. BOD below 100 mg/l and COD below 250 mg/l	Require sludge disposal & relaxation of D.O. of 5 mg/l

<u>Name</u>	<u>Products</u>	<u>Effluent Flow/Treatment</u>	<u>Problems</u>
Color Chem. Thane (Hoechst) (1200 employees)	Pigments 350 Mt/m Inter- mediates 220 Mt/m	<u>4500 m<sup>3</sup>/d</u> - primary secondary treatment - Eff. BOD - below 100 mg/l	Solid waste disposal
Bayer AG	Pharma- ceuticals Pesticides	<u>2000 m<sup>3</sup>/d</u>	Incinerator
Gujarat Insec. Ltd	Pesticides	<u>210 m<sup>3</sup>/d</u>	High COD

2. Large Scale (No foreign involvement)

Indian Dyestuffs (I.D.I) Kalyan (1200 staff)	VAT Dyes Disperse Dyes H <sub>2</sub> SO <sub>4</sub> 80 Mt/d	<u>1500 m<sup>3</sup>/h</u> - primary treatment with recovery of Mercury and Zinc discharge to tidal zone	Mercury/ copper in effluent. Sludge disposal
I.D.I Boisar (400 staff)	Dyes - 500 Mt/y Intermediates 1500 Mt/y Pesticides	<u>500 m<sup>3</sup>/d</u> - primary/ secondary with dis- charge to MIDC sewer	Sludge disposal

<u>Name</u>	<u>Products</u>	<u>Effluent Flow/Treatment</u>	<u>Problems</u>
Jaysynth Dye chem. (600 staff) Thane	Reactive Dyes - 650 Mt/y	<u>700 m<sup>3</sup>/d</u> - primary treatment	Shortage of space. Loss of dyestuff whilst salting out
Exel Ind. Ltd Bombay	Organophos- phorus Pesticides	<u>40 m<sup>3</sup>/d</u> - primary treatment	Solid waste
<b>3. <u>Medium Scale</u></b>			
Amal Rasayan Ankleshwar	H Acid etc 1200 Mt/y	<u>425 m<sup>3</sup>/d</u> - evaporation powder primary treat- ment	Mother liquor solids high COD/BOD acid wastes
Hickson & Dadajee Bombay	Sulphur Black 1000 Mt/y	<u>200 m<sup>3</sup>/d</u> - primary secondary treatment	
Lona Industries Patil Ganga	C.P.C. etc 1200 Mt/y	<u>850 m<sup>3</sup>/d</u> - primary discharge pipeline	Reduction in colour re-use of acids

<u>Name</u>	<u>Products</u>	<u>Effluent Flow/Treatment</u>	<u>Problems</u>
Rallis India Ltd	Organophosphorus	<u>250 m<sup>3</sup>/d</u> - primary +sec. treatment	Solid waste Incineration
Exel Ind. Ltd Bhavnagar	Endosulfan organophosphorus	<u>150 m<sup>3</sup>/d</u>	Incineration problem (800° C) Dust probl.
<b>4. <u>Small Scale</u></b>			
Sagar Drugs Ahmedabad	Vinyl sulphone 40 Mt/m	Primary/Secondary treatment/evaporation basins/irrigation (zero discharge)	Acid wastes (by-prod.) sludge disposal
Mardia Chem.	H. Acid	<u>5 m<sup>3</sup>/d</u> , primary/secondary/tertiary zero discharge	Acid wastes lime sludge disposal
Dipika Colour Industries Surat	Disperse Dyes 15 Mt/m	<u>2-3 m<sup>3</sup>/d</u> no treatment	Recovery of dyes
Colour Synth. Thane (600 staff)	Acid AZO dyes	<u>40 m<sup>3</sup>/d</u> primary treatment with lime	Restrict. factory site high COD (1000 mg/l)

<u>Name</u>	<u>Products</u>	<u>Effluent Flow/Treatment</u>	<u>Problems</u>
Pidilite, Vapi	Dyes/ Intermediates 30 Mt/m	300 m <sup>3</sup> /d primary/ secondary	Dye recovery, Fe/HCl sludge
Shree Raghvir Dye Chem. Vapi	Dyes 2 Mt/m	5 m <sup>3</sup> /d neutralization with NaOH	Colour wastage
JKBM	Pesticide Formulator	5 m <sup>3</sup> /d	Low land, Liquid waste inc. too costly

Factories in groups 1 & 2 were very much aware of the need for pollution control measures and most of them were carrying out R&D work to improve processes and reduce waste products. The attitude of medium sized factories in Group 3 varied depending on the amount and quality of the technical supervision available.

The largest group (No 4) did not want to be involved with pollution control measures. Many had no qualified technical staff and did not want to spend money on waste treatment. Even those with primary treatment equipment in place could not be relied upon to operate it continuously. All the neutralization of the waste was carried out manually and, apart from one or two exceptions, PH control was by the use of test papers.

The standard of maintenance and 'house keeping' was, apart from a number of notable exceptions, very poor. Many factories were reminiscent of the dark gloomy places which existed in Victorian England. Clearly there is a need to improve the present working conditions and to show that good maintenance and quality control can produce savings and increased production.

#### Dyes/Pesticides and Intermediates Production

During the course of visits to factories, managers were recommended to look at their processes to see if modifications could be made to reduce waste.

One source of acid waste occurs in the sulphonation of naphthalene (in the production of H acid). The traditional process involves the use of an excess of oleum/sulphuric acid. Some factories recover this waste acid and sell it for the neutralization of alkaline wastes. It is suggested that the use of SO<sub>3</sub> in non-aqueous medium may be more 'environmentally friendly' than the present method.

A few pesticide manufacturers still produce mercury-containing fungicides (for instance as seed-dressing agents) but the production and use in India is small and it should be possible to replace the mercury agents for this purpose by for instance guazatine triacetate alone or in combination with imazalil and fenfuram or quintozone. This change can also be motivated by the appearance of mercury resistance among the pests.

In one case we found that mercury was used as a catalyst in a reaction. The amount of mercury used up in this way was, according to the information given to us, about 500 kg per month. No mercury was recovered and it was obvious that it was discharged as liquid effluent into the sea or disposed of

as landfill together with solid waste. No information was available about the amount of mercury vapour emitted. We strongly recommend that the processes are changed in order to avoid the use of mercury. As the amount of mercury lost is alarming high there should be an immediate stop of the processes where the metal is used.

A number of factories are 'scrubbing out' hydrogen chloride released from reactions involving chlor sulphonic acid. These gases are collected, concentrated, and sold. The scrubbing equipment is made of glass reinforced fibre (grp) or polypropylene and is fabricated locally in Bombay.

Other possible modifications to processes involve the separation, salting-out, and drying stages. The use of ultra-filtration membranes for the selective separation of large molecules (eg dyestuffs) may have advantages over the manually operated plate and frame presses. The salting-out process used for rendering dyestuffs insoluble does not provide 100% recovery and as a result colour is lost to drain. The use of spray dryers (with or without use of Ultra filtration) reduces the amount of handling appreciably and provides a much cleaner working environment.

#### Wastewater Treatment Processes

Most factories have some form of effluent treatment plant. Those discharging to sewer are required to have primary treatment and those with high BOD and discharge to watercourses have secondary treatment as well.



An important aim of the proposed Project should be the evaluation of newer treatment techniques. Bio disc contactors and packed towers could be useful in factories with space restrictions. The use of activated carbon for removal of colour, non-biodegradable COD and persistent toxic compounds should be investigated. The use of reverse osmosis to allow the re-use of process water should be demonstrated especially in view of the high cost of water in the Bombay area (Rs 25/1000 litres). One factory is already studying the feasibility of using this technique since the cost of using reverse osmosis has been quoted as Rs 12/1000 litres. The use of parallel plate settlers could provide an useful saving when compared with the cost of conventional settlement tanks. Solid wastes could be more conveniently managed by dewatering on continuous belt filters or centrifuges. The present method of using nitches, plate and frame presses and drying beds all involve considerable manual effort.

Some of the effluent treatment problems in the pesticide manufacturing industries may partly be the consequence of a muddled idea of the concept of combined effluent streams. Whereas it is true that for a good biological treatment process nutrients from domestic sewers or other similar sources often have to be combined with the industrial effluents it is also clear that the primary treatment by preference should be performed close to the source of pollution in segregated streams. Effluent pH and temperature is easier and cheaper to alter in a small stream or in small quantities. Hydrolysis of for instance phosphonates and phosphates and their thio-analogues is thus cheaper and quicker in the segregated stream form.

Also process waste waters with high levels of settleable solids and with high organic loadings will as a rule if treated and disposed of separately cause fewer problems and be cheaper in handling.

It is important that compounds with high bactericidal or fungicidal properties do not enter a secondary treatment plant. Toxic materials should also not be allowed to be discharged into any receiving waters.

Pesticide industries therefore often solve this type of treatment problem by incinerating the toxic solid or liquid wastes. We have found an over-confidence among the industries regarding the usefulness of this method and would like to see an evaluation considering cost/benefit of this method compared to others. It should be kept in mind that an incinerator ought to work continuously at its best load to give good results. Normally incinerators below 5-6 Mt/day are difficult to obtain commercially.

Depending on the material to be incinerated the temperature and residence time should be adjusted (> 1250° for organochlorine hydrocarbons, >800°C for organophosphates and similar, for at least 2 sec.).

It should be also investigated if there are any nearby cement industries using a process kiln of rotary type. This type of kiln is suitable for incinerating several kinds of wastes and should be considered as an alternative way of toxic waste destruction before investment in a separate incinerator is made.

For dilute solutions of toxic organic materials the method of ozone-treatment followed by microbial degradation should also be considered as an alternative method of destruction.

The method of using molten salt combustion for the disposal of hazardous wastes seems not yet to be fully developed for the industrial scale and the methods of using different kinds of adsorption materials means as a rule only a transfer of the destruction problem.

#### Solid/Toxic Waste Disposal

The Industrial Development Corporations of Gujarat and Maharashtra are responsible for the planning, construction and management of industrial estates. Most estates are without sewerage systems and this is causing pollution of the groundwater in places (eg Pandesara Estate in Gujarat). No arrangements are at present in place for the disposal of sludges or refuse. As a result many estates are becoming unsightly and the open channel drainage ditches blocked with debris.

There is, therefore, a pressing need for technical assistance in solid wastes management and this could well be covered by the following topics:

1. Selection, Design, Construction and Operation of landfill sites
2. Recovery of methane from landfill sites
3. Destruction of solid toxic wastes, including the advantages and disadvantages of incineration
4. Composting of domestic refuse with or without admixture of industrial waste

The technical assistance/training should be made available to members of the Pollution Control Boards, the Industrial Development Corporations, engineers responsible for solid wastes disposal in the Municipalities and Industry.

#### Gaseous Emissions

Probably the main source of public concern with industrial operations is the release of noxious gases and smells. Because of this many factories have already installed gas scrubbing equipment and one or two have been able to turn this into a commercial advantage by selling recovered hydrochloric acid. Other factories have arranged their production schedules so that obnoxious gaseous emissions are released at night. Thus in many cases the methods of treatment of gaseous emissions are known and only require implementation.

Should any further investigation be required, the Country Director has stated that the mobile pilot plants, presently located at the Pollution Control Research Institute (PCRI) Hardwar, are available. These units were purchased by UNIDO when the PCRI was established in 1986 and they have now been found to be surplus to requirements. The equipment consists of a wet scrubber, lime dosing equipment and a rotary vacuum filter; fitted on to two trailers. It is understood that this equipment could be transferred to the proposed project at transportation cost only.

#### Distribution of Technical Assistance

From discussions with Chairman and senior staff of the Pollution Control Boards it was clear they agree with the Central Government's desire to help small scale industries, especially those manufacturing dyes and pigments, pesticides and intermediates.

One possible method of meeting this requirement is to extend the role of the pollution control boards by increasing their industrial experience. This could be done by each Board selecting technical/scientific staff to receive in-depth training in industrial processes, and the treatment of gaseous emissions, liquid discharges and solid wastes.

In addition, as the respective Industrial Development Corporations are responsible for managing industrial estates they have an interest in design of sewerage systems, combined secondary treatment plants and solid waste management. They, too, have expressed a desire to be involved in technical training in these topics.

It would also seem useful to make the large Municipalities (eg Ahmedabad, Baroda, Bombay, Surat) aware of the project so that they could be involved with solid waste management topics if they desire to be.

### TRAINING

From the large number of factories visited it was apparent that the majority were small scale industries and these were the ones in most need of technical support. In addition, they were in the main, somewhat reluctant to appreciate the need for pollution control measures. During the course of visits to factories efforts were made to try to get managers to examine their processes to see if improvements could be made to increase product yields whilst at the same time reducing wastes.

#### Technical Assistance for State Pollution Control Boards

One of the ways small scale industries could be helped is by extending the present "adversarial role" of the Pollution Control Boards to provide technical guidance. Such an approach should lead to a better spirit of co-operation, rather than just relying on the threat of legal action.

If the Pollution Control were given training in industrial processes and in the latest pollution control techniques they could provide a convenient way to carry the knowledge to industries because they already have right of access. It would also strengthen the technical base of Pollution Control Boards and enable them to have a more "equal" relationship with Industry. It was most noticeable that Pollution Control staff were at a disadvantage in discussing technical matters with Industrialists and the situation was aggravated, in many cases, by the 'generation gap' that exists.

It would seem the main aim of any programme should be directed to strengthening the technical experience of the Pollution Control Boards and that this could best be done by providing a team of carefully selected consultants. The team should be capable of bringing knowledge of recent development in low-waste processes and be prepared to carry out field investigations to make Industrialists aware.

Initially however some training will need to be given at some suitable central location (preferably a Public Institution). Pollution Control Board staff will need to acquire some in-depth knowledge of industrial processes used in the manufacture of dyes, dyes intermediates and pesticides. This will enable them to discuss possible process modifications with factory managers.

Following this initial training they can then study the design of industrial wastewater treatment processes etc.

From the Pollution Control Boards of Maharashtra and Gujarat requests have been made that UNIDO should help to upgrade the skill of the analysts of their laboratories regarding residue analysis from biological materials (including diluted waste water). This kind of analysis is now made very infrequently and by other laboratories. To make it possible for the Boards to evaluate the environmental impact of discharges it is important that the skill of the analysts and the capacity of the laboratories is increased considerably.

From discussions with the director of NIOH (Ahmedabad) it was clear that this institute has the capability to train a limited number of staff from the P.C.B's laboratories in the analytical work in question. If, however, this teaching (training) burdens the normal work of the Institute too much some help might be needed in the form of an extra teacher and an additional analytical instrument.

It is suggested that UNIDO support the training of some analyst from the P.C.B's laboratories by placing an expert (consultant) at the disposal of NIOH according to their request. Regarding an additional analytical instrument WHO or Central Government may be able to support as required (Discussions with WHO and NIOH).

#### UNIDO Consultants - Job Descriptions

It is proposed the project work could be covered by six consultants, with financial arrangement to allow for additional assistance as the programme progresses. It has been divided into the following topics:

1. Solid Wastes Management - Consultant to cover the following aspects in:

Design, Construction and Operation of landfill sites:  
Recovery of methane from landfill sites  
Destruction of toxic wastes  
Incineration (advantages and disadvantages)  
Composting of domestic refuse with or without industrial wastes

2. Industrial Processes - Consultant to have considerable industrial experience in:

Manufacture of AZO dyes and pigments  
Production of disperse dyes  
Manufacture of reactive dyes  
Production of Copper Phthalocyanine and derivatives  
Manufacture of dye intermediates including H Acid,  
Gama Acid, Tobias Acid etc and vinyl sulphone  
Use of unit processes, belt filters, spray dryers, UF/RO membranes  
Chemical plant maintenance



3. Industrial Processes - Consultant to have considerable industrial experience in the manufacture and formulation of pesticides including:

Organic Pesticide Chemicals

Halogenated compounds

Phosphates and Phosphonates

Phosphorothioates and Phosphorodithioates

Organo- Nitrogen Pesticides

Chemical plant maintenance

4. Cost/Benefit Evaluation

Consultant to provide training in cost/benefit analysis and to carry out studies on some planned common industrial treatment plant projects. for industries estates.

5. Design, Construction, Operation of Industrial Wastewater Treatment Plants  
- Consultant to provide design information on newer methods of treatment including:

Neutralization/Settlement systems (including parallel plate settlers and 'Banks' filter)

Rotating disc/packed column aeration systems

UF/RO membrane systems

Electrolytic cells

Air flotation units

Colour removal processes

C.O.D. - chemical oxidation

6. Effluent and Biological Monitoring - The Consultant should provide:

- Sampling and analytical techniques for marine fauna
- Monitoring of accumulation of mercury copper and persistent compounds  
(eg D.D.T) in effluents and biological materials
- Selection of bio indicators
- Evaluation of existing bio assay techniques

Arrangements for the Project Staff etc

It became apparent that consultants from temperate zones would find it difficult to function to their full capacity during the period mid-March to mid-September, especially when undertaking field investigations.

One approach would be to organize assignments on a split mission basis (eg two one-month visits per year). This would allow consultants an opportunity to initiate programmes of work and then to return to study their outcome.

It would also provide an up-date on the continuing development of clean technologies as consultants will invariably keep themselves abreast of developments.

It is for consideration whether arrangements could be made for consultants to enter and leave India through the UNDP office in Bombay. Such an arrangements would reduce the time/cost of flying to and from New Delhi for administrative purposes only.

In view of the number of experts involved it could be an advantage to request consultants to present their reports before they complete their assignment. To facilitate this arrangement secretarial services should be made available (including word processor and printer) in the field (perhaps by using local agencies). This will make the reports immediately available to UNIDO (GOI etc).

### Training Equipment

It is certain that both Pollution Control Board staff and Industrialists would benefit from hands-on experience. This could be provided by supplying selected small pilot plant scale units in transportable form. Staff etc could then be trained in the use of this equipment before it is taken into factories for evaluation purposes. The type of units envisaged could be selected from the following:

- |                                |  |
|--------------------------------|--|
| <u>Carbon Absorption Unit</u>  | - for removal of organic matter in solution (eg dyes, pesticides etc)              |
| <u>Bio disc Contactor</u>      | - for biological treatability studies on industrial wastes                         |
| <u>Packed Tower Contactor</u>  | - for treatability studies especially where land and area is scarce                |
| <u>Acid Concentration Unit</u> | - many factories have acid wastes. Such unit could concentrate the acid for re-use |

Spray Dryer

- the use of spray dryers can increase product yield whilst reducing colour in effluent and improving working conditions

Belt Filter Press

- this continuous belt filter could be an improvement in the use of plate and frame presses and centrifuges etc

UF/RO Unit

- these units should be evaluated to provide increased recovery of product and treating process waters for re-use.

Parallel plate settler

- the use of this technique should reduce the size of conventional settlement tanks considerably

Air Flotation Unit

- could prove to be useful in recovery of metals and other lightweight precipitates (eg Aluminium Hydroxide)

Electrolytic Metal Recovery Unit

- these small scale units are of recent design and are providing to be useful in the recovery of copper, nickel, zinc, cadmium, silver and gold

Incinerator -  
Preferably of the  
Rotating Kiln Type

- this unit will provide knowledge about the necessary conditions for a "complete" destruction. Should be able to be connected to the "Andersen" scrubber. For financial support a coordination with the World Bank "incinerator" project should be tried to obtain

### Training - Overseas

Originally it was thought better to provide training in the host country, especially since it gave the Consultants an opportunity to see the problems at first hand. They could then make any adjustments to their programmes as the training progresses.

However, since there are wide differences in management procedures and in the design of factories, we believe that some exposure to chemical factories overseas would be of benefit.

Accordingly some overseas training is recommended. It should follow the initial training and should be limited to those people who could benefit and can communicate easily.

It is suggested that arrangements should be made for candidates to work in dye/dye intermediate/pesticide factories (for 1-4 week) before proceeding to work with H.M. Inspectorate of Pollution or similar agency. A selection of suitable places for this practical training purpose should be made as soon as possible. The candidates should also work with authorities responsible for solid wastes disposal.

The period of the fellowships could be three months and candidates should be required to write a report of their visits including their personal observations and suggestions.

As there is a growing public awareness and concern in India for environmental issues, the public relations aspect of the Pollution Control Boards should be strengthened. The present public relations staff could

benefit from working with counterparts in Government service in Europe. They should acquire knowledge of the latest audio/visual techniques and gain experience from exposure to environmental pressure groups.

Training - Financial arrangements

A preliminary estimate of costs is given in Annex 5. It will be seen that the majority of the cost is given to technical assistance/training with equipment being supplied for demonstration purposes and field investigational work.

COMMENTS AND RECOMMENDATIONS

1. It was apparent that those manufacturers which collaborate with "western" companies have access to the latest techniques in pollution control and are capable of modifying their operations to reduce their pollution load up to Indian standard.

If by nonchalance or negligence the effluent threshold values are (repeatedly) exceeded by this type of industries an increased administrative pressure from, the instance, the State Pollution Control Boards should have the desired corrective effect.

2. Large scale and some medium size factories established from indigenous development also have the capability to modify their processes. They are also competent to operate pollution control equipment but would benefit from exposure to methods used in "western" countries.

In Recommendation (6) a Training Center for the operation of industrial pollution control equipment is suggested. The Center is supposed to benefit from "western" consultants and other experts to be able to familiarize the trainees with the development of industrial pollution control both abroad and in India. It is understood that this Center should be open to all qualified persons in India involved in the pollution control and we recommend specially the medium scale and indigenous industries to make use of this training possibility.

3. The main problems occur in those factories which have little or no technical supervision. Most of these factories belong to the medium or small scale type of industries. There is a need to examine the processes used in these factories to see if they can be modified (using new techniques) to improve the product yields and to reduce waste products.

If for economical or other reasons the recommendation of (2) cannot be followed only one way of acting remains according to our opinion.

The necessary technical knowledge and economical means must be obtained entirely or partly from external sources. It is therefore recommended that the small scale industries in question either join together to erect and operate a treatment plant themselves or are connected to an existing common industrial treatment plant ran by an Industrial Association or the like, with or without the financial support from the State Government. The option is a total close down.

4. In many cases we found that factory processes and the treatment of effluents produce wastes which were sent for landfill or incineration.

More consideration should be given to find out if wastes can be reprocessed within the factory to give either a higher yield of the intended reaction or a byproduct which can be used by other nearby industries, so decreasing the total amount of waste produced.

5. Wastes common to many industries include acids and sludges arising from the neutralization of effluents. Other wastes, which can contain mercury, copper and persistent toxic compounds are non-bio-degradeable and may be responsible for a high chemical oxygen demand.

For the primary treatment it is often best not to combine the mentioned types of effluents but to accomplish the treatment as close to the point of organization as possible. We therefore recommend the industries to reconsider their scheme of effluent treatment utilizing this idea of separate stream primary treatment.



6. Among the duties of the different State Pollution Control Boards is to give advice to the industries about the ways to achieve low air- and water pollution. According to what we have found during our field visits most of the staff of the Boards are lacking such industrial experience which is necessary for this work.

To remedy this deficiency we suggest that a Training Center is set up and equipped with, among other things, transportable pilot scale air- and water-treatment equipment, which can be operated in such a way that the treatment can be altered according to the quality and quantity of the inflow. It is expected that the understanding of the connection between taken treatment measures and resulting effluent quality will guide for instance the staff of the Pollution Control Boards when dealing with industrial pollution problems.

It should be noted that the mobile gaseous emission treatment unit, presently situated at the PCRI, Hardwar, is available (free of charge). Apparently the unit (containing a wet scrubber, lime preparation unit and rotary vacuum filter) has not been used and the Country Director is anxious to re-deploy them.

Equipment for the Training Center could include:-

Carbon Absorption Unit	Belt filter press
Bio Disc Contactor	UF/RO Unit
Packed tower Unit	Parallel plate settler
Acid concentration Unit	Froth flotation Unit
Spray dryer	Electrolytic metal recovery Unit
Gaseous Emission	
Treatment Unit	Incinerator

7. The present State Pollution Control Laboratories are not suitable for housing the pilot scale equipment mentioned in (6) and some consideration has been given to suggest a suitable location for training purposes etc.

It is recommended that the UNIDO-consultants and equipment shall be based at an institution having nearby industries good communications and facilities for lecturing and guest accommodation etc. If this institution is under the direct supervision of the Central Government or of a federal state, is, according to our opinion, of minor importance; just it is open to all qualified Indian citizens. Such establishments as IIT (Powai) G.P.C.B (Gandhinagar or Baroda) are both suitable.

Requisite infra-structure and housing, not already available on these places, will, according to our information, readily be supplied by the State Governments respectively.

A possibility, not very supported by the different Pollution Control Boards, is of course to separate the sites for air pollution and waterpollution control. It should mean that some equipment and other facilities have to be duplicated.

8. In some industrial areas of Maharashtra and Gujarat the air pollution is a growing problem. It seems therefore logic to station analytical air-pollution control equipment preferably of mobile or movable type within these states.

It is recommended that at least one mobile unit for the control of ambient air quality is stationed close to the industrial sites of Gujarat. Such a unit (van) is already stationed in Maharashtra, which state could make better use of a movable unit.

9. With regard to technical assistance and training, the following topics should be covered:

- a) Solid Waste Management including incineration
- b) Industrial Processes (Dyes and Dye intermediates) including plant maintenance
- c) Industrial Processes (Pesticides) including plant maintenance
- d) Design, construction and operation of industrial waste water treatment plants and air purification equipment.
- e) Residue analysis in biological material.
- f) Cost/benefit evaluation of common treatment plants for industrial estates.

Technical assistance in the form of UNIDO-consultants is suggested for the specified subjects above. Six consultants working two months each year during three consecutive years will help in constructing training programmes and initiate the training.

10. A few industries, mainly large and medium sized pesticide industries, have added an incinerator to their waste treatment facilities. Though incineration is by us not considered as a good waste treatment method it is sometimes recommended and may also in some cases be the last way out of difficulties in handling some hazardous and persistent waste.

It is therefore recommended that an incinerator of pilot scale size is included in the equipment of the Training Center and that UNIDO offers technical assistance for the training of its operation and maintenance.

11. There is a pressing need for treatability studies to be carried out on combined effluents from industrial estates. This is especially important at Vapi, Ankleshwa and Panoli estates partly because there is no or little domestic sewage available for an admixture.

It is recommended that UNIDO offers a consultant for the evaluation of the possibility to make use of the combined effluent idea in a proper way and to evaluate the advantage of common treatment plants in the selected cases.

As a good guideline the "Report on Hazardous Waste Management in Electroplating Industries of Delhi Region" can serve (NPC and WHO).

12. Complaints have been made to us about the non-existence of officially approved sites for the deposit of hazardous wastes in Maharashtra and Gujarat.

Only recently (July 1989) the rules on Hazardous Waste (Management and Handling) came into force in India. The states are now working with guidelines to be used for the application of these rules. A draft of a guideline is already available in Gujarat and the other states are following.

We recommend that such guidelines are based on the World Bank Technical Paper No 93, The Safe Disposal of Hazardous Wastes, The Special Needs and Problems of Developing Countries, Washington 1989, adjusted to Indian conditions.

13. To facilitate the work of the UNIDO consultants we suggest:
- a) that they should work two months each year in one month's visits.
  - b) that the work is planned in such a way that they are at least two in post at any time.
  - c) that facilities are provided for secretarial services.
  - d) that the UNIDO staff is exempted from expenditure, luxury and other taxes as are the Project items exempted from customs duty.
  - e) that the States of Gujarat and Maharashtra concur to these arrangements.
  - f) that suitable accommodation is provided at an appropriate place.

ACKNOWLEDGEMENTS

The Consultants wish to extend their thanks for the assistance provided by Mr. M.S. Murthy, Advisor, to the Ministry of Chemicals and Petroleum, and the Chairmen of the Gujarat and Maharashtra Pollution Control Boards.

To Dr. U.I. Bhatt, Chief Scientific Officer, GPCB, and Mr. H.B. Mehta, Air Abatement Engineer, MPCB, for arranging the programmes in their respective States.

To the Regional Officers and their staff and Mr. V.S Patki for escorting them and dealing with their travel arrangements.

Finally to all the factory managers for their kind hospitality and a willingness to discuss their operations and problems. It is sincerely hoped that the ensuing project will suitably reflect the problems facing pollution control in the dyestuffs and pesticides industries and provide some practical solutions.

ANNEX 1

ABBREVIATIONS

The following abbreviations are used in the text:

PCRI	-	Pollution Control Research Institute
GPCB	-	Gujarat Pollution Control Board
MPCB	-	Maharashtra Pollution Control Board
GIDC	-	Gujarat Industrial Development Corporation
MIDC	-	Maharashtra Industrial Development Corporation
NPC	-	National Productivity Council
SIDA	-	Swedish International Development Authority
DANIDA	-	Danish International Development Authority
CPC	-	Copper Phthalocyanine
BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
UF	-	Ultra Filtration
RO	-	Reverse Osmosis
GOI	-	Government of India



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

**JOB DESCRIPTION**

UC/IND/89/089/11-01

- Post title** Expert in Industrial Pollution Control (Dyestuff)
- Duration** 2.3 m/m
- Date required** August/September 1989
- Duty station** Delhi with travel to Western India and Vienna (to finalize report and assist in preparing follow-up project document)
- Purpose of project** To provide advisory services for an overall improvement to industrial pollution control measures in one of the regions of the country.
- Duties** The expert in collaboration with another expert dealing with pesticides and the project authorities is expected as a team to:
- Visit selected areas in the country where the dyestuff and pesticide industries are concentrated and assess the existing facilities in pollution control measures;
  - Discuss with the Government officials and industrialists appropriate measures needed to control pollution to a desirable level both at source and at downstream;
  - Advise on the facilities to be provided, the training needs to establish effective economical pollution control measures for air, water and soil with likely cost;
  - Submit a report on his findings and recommendations;
  - Assist in writing project document for the follow-up phase.

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Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division  
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria



- Qualifications** Chemist, Chemical Engineer or Environmentalist with extensive experience dealing with effluent control in chemical industry mainly in the dyestuff sub-sector. He must be familiar with international norms in effluent control measures and dealing with legislative measures involved in pollution control in chemical industries.
- Language** English.
- Background information** In India, the dyestuff industries are one of the very early chemical industries established while the pesticide industries are relatively recent. Both the industries are producing finished products for local market and for export. While the Dyestuff industries are using old technology, the pesticide industries utilize both old and modern technology in their production. The industries are operated by large, medium and small scale operators. The effluent control arrangements in both the industrial sub-sectors are not well organized and do not have a systematic approach and control measures either on an individual or on a collective basis. These industries are concentrated in the western region of India (Maharashtra State) and they need an overall improvements and creation of awareness among the industrialist, Govt.officials and the people at large.
- Having recognized the problem, the Government of India is requesting UNIDO's assistance in assessing the situation in a particular region of the country where these industries are concentrated and make suitable recommendations with estimated cost (for training, equipment, monitoring station etc.) and modalities of approach to pollution control measures from these industries.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

**JOB DESCRIPTION**

UC/IND/89/098/11-02

**Post title** Expert in Industrial Pollution Control (Pesticides)

**Duration** 2.3 m/m

**Date required** August/September 1989

**Duty station** Delhi with travel to Western India and Vienna (to finalize report and assist in preparing follow-up project document)

**Purpose of project** To provide advisory services for an overall improvement to industrial pollution control measures in one of the regions of the country.

**Duties** The expert in collaboration with another expert dealing with dyestuff and the project authorities is expected as a team to:

- Visit selected areas in the country where the dyestuff and pesticide industries are concentrated and assess the existing facilities in pollution control measures;
- Discuss with the Government officials and industrialists appropriate measures needed to control pollution to a desirable level both at source and at downstream;
- Advise on the facilities to be provided, the training needs to establish effective economical pollution control measures for air, water and soil with likely cost;
- Submit a report on his findings and recommendations;
- Assist in writing project document for the follow-up phase.

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Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division  
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

- Qualifications** Chemist, Chemical Engineer or Environmentalist with extensive experience in industry or Government dealing with chemical effluent control especially with hazardous waste with emphasis on pesticides and their intermediates. He must be familiar with international norms in effluent control measures and dealing with legislative measures involved in pollution control in chemical industries.
- Language** English
- Background information** In India, the dyestuff industries are one of the very early chemical industries established, while the pesticide industries are relatively recent. Both the industries are producing finished products for local market and for export. While the Dyestuff industries are using old technology, the pesticide industries utilize both old and modern technology in their production. The industries are operated by large, medium and small scale operators. The effluent control arrangements in both the industrial sub-sectors are not well organized and do not have a systematic approach and control measures either on an individual or on a collective basis. These industries are concentrated in the western region of India (Maharashtra State) and they need an overall improvements and creation of awareness among the industrialist, Govt. officials and the people at large.
- Having recognized the problem, the Government of India is requesting UNIDO's assistance in assessing the situation in a particular region of the country where these industries are concentrated and make suitable recommendations with estimated cost (for training, equipment, monitoring station etc.) and modalities of approach to pollution control measures from these industries.

ANNEX 3

Mission schedule for L.E. Johansson

1990	15/7	dep. from Stockholm
	16/7	arrival in New Delhi
	17/7	dep. from N.D. and arrival in Bombay
	17/7 - 8/8	industry visits in Maharashtra
	8/8	dep. Bombay and arrival in New Delhi
	8/8 - 19/8	administrative visits in N.D
	19/8	departure from New Delhi and arrival in Ahmdebad
	19/8 - 2/9	industry visits in Gujarat
	2/9	dep from Ahmdebad and arrival in New Delhi
	29/9 - 8/9	administrative visits in New Delhi
	8/9	dep from New Delhi and arrival in Stockholm

In Maharashtra about 30 and in Gujarat about 20 factories were visited. concerned organizations like the Pollution Control Boards and their laboratories, the Industrial Development Corporations, Indian Institute for Technology in Bombay, National Inst. for Occupational Health (Ahmdebad), The Factory Inspectorate (Ahmdebad), The Associations for Indian Chemical Manufacturer, National Environmental Engineering Research Institute, Executive Secretary to Min of Environment (Bombay) etc.

In New Delhi the Central Government offices for Petroleum and Chemicals, the National Productivity Council, the International organizations like WHO, UNEP, UNIDO, World Bank and some embassies of India aid-giving nations were visited.

Between 16/7 and 9/8 Messrs J.G. Wain and L.E. Johansson made the joint visits.

ANNEX 4

Time-Table of Mission (JGW)

Sun 17th June	Left U.K. for Vienna
Mon 18th June	Briefing for Project US/NEP/87/052
Tues 19th June	Briefing for Project VC/IND/89/098
Wed 20th June	UNIDO
Thurs 21st June	Left for New Delhi, via Frankfurt
Fri 22nd June	UNDP New Delhi, Ministry of Chemicals and Petroleum
Mon 25th June	Left New Delhi for Ahmedabad, Gandhinagar
Tues 26th June	Head Office, Central Laboratory of the Gujarat Pollution Control Board
Wed 27th June	Odhav and Vatwa Industrial Estates Associations
Thurs 28th June	Visited Municipal Sewage Works and Co-op Industrial Estate
Fri 29th June	Naroda Industrial Estate
Sat 30th June	Factories on Naroda Estate
Sun 1st July	Travelled to Baroda
Mon 2nd July	Regional Office/Laboratory, Baroda and Effluent Discharge Channel, Nandesari
Tues 3rd July	Nandesari Association
Wed 4th July	Visit to Nandesari Estate continued
Thurs 5th July	Travelled to Baruch and Ankleshwar Industrial Estate Association
Fri 6th July	Ankleshwar Industrial Estate visit continued and also Regional Office/Laboratory
Sat 7th July	Travelled to Surat and attended Seminar
Sun 8th July	Visited Hazira Industrial Estate

Mon 9th July	Visited factories in Pandesara Estate
Tues 10th July	Travelled to Vapi, met Vapi Estate Association
Wed 11th July	Visited factories in Vapi Industrial Estate
Thurs 12th July	Travelled to Bulshar to visit the Atul Complex
Fri 13th July	Travelled to Baroda (by train)
Sat 14th July	Returned to New Delhi from Baroda
Mon 16th July	Met Dr L. E. Johansson and Chairman of Central Pollution Board
Tues 17th July	Travelled to Bombay and met chemical manufacturers Association. Also officials of Pollution Control Board and State Ministry of Environment
Wed 18th July	Visited Andheri and Vishweshwar Industrial Estate
Thurs 19th July	Visited Amboli/Jogeshwari estates, Bombay
Fri 29th July	Holiday
Sat 21st July	Travelled to Thane Regional Office and Dombivli Industrial Estate
Mon 23rd July	Kolshet Road Industrial Estate, Thane
Tues 24th July	Travelled to Patilganga Industrial Estate
Wed 25th July	Visited Kalyan and Ambernath Estates
Thurs 26th July	Visited Muland Estate and Central Laboratory, Belapur
Fri 27th July	Travelled to Mulund Municipality Industrial Estate to visit Jay Chem Colour Industries, Rallis India and International Research Laboratories
Sat 28th July	Visited the IIT Bombay campus at Powai at the invitation of Professor S. P. Mahajan Head of Department of Chemical Engineering
Mon 30th July	Travelled to Boisar to visit factories in the MIDC Tarapur Industrial Estate. These included I.D.I, Chem-equip, Tarapur Dyestuff Industries and Krishna Kant
Tues 31st July	Continued visit to Tarapur Estate and called on Tarapur Chemical and Pesticides and on the Regional Office of the State Pollution Control Board

Wed 1st Aug           Travelled to Trans Thane Creek (TTC) Industrial Estate to visit Jay Synth Dye Chem, Rallis Industries and Mazda Dye Chem Ltd

Fri 3rd Aug           Left Bombay for Pune. Visited Arlabs Ltd at Bose

Sat 4th Aug           Continued visit to Pune and visited Sudarshan Chemical Industries and Kamdhenu Pesticides

Sun 5th Aug           Attended Seminar on Non-toxic Fungicides. Returned to Bombay

Mon 6th Aug           Visited NEERI Zonal Laboratory, Bombay

Tues 7th Aug          Concluding visit to Pollution Control Board and Ministry of Environment

Wed 8th Aug           Returned to New Delhi

Thurs 9th Aug         Visited UNDP and Ministry of Chemicals and Petroleum

Fri 10th Aug          Returned to U. K. via Frankfurt

ANNEX 5

Mission schedule for L.E. Johansson

1990	15/7	dep. from Stockholm
	16/7	arrival in New Delhi
	17/7	dep. from N.D. and arrival in Bombay
	17/7 - 8/8	industry visits in Maharashtra
	8/8	dep. Bombay and arrival in New Delhi
	8/8 - 19/8	administrative visits in N.D
	19/8	departure from New Delhi and arrival in Ahmdebad
	19/8 - 2/9	industry visits in Gujarat
	2/9	dep from Ahmdebad and arrival in New Delhi
	29/9 - 8/9	administrative visits in New Delhi
	8/9	dep from New Delhi and arrival in Stockholm

In Maharashtra about 30 and in Gujarat about 20 factories were visited, concerned organizations like the Pollution Control Boards and their laboratories, the Industrial Development Corporations, Indian Institute for Technology in Bombay, National Inst. for Occupational Health (Ahmdebad), The Factory Inspectorate (Ahmdebad), The Associations for Indian Chemical Manufacturer, National Environmental Engineering Research Institute, Executive Secretary to Min of Environment (Bombay) etc.

In New Delhi the Central Government offices for Petroleum and Chemicals, the National Productivity Council, the International organizations like WHO, UNEP, UNIDO, World Bank and some embassies of India aid-giving nations were visited.

Between 16/7 and 9/8 Messrs J.G. Wain and L.E. Johansson made the joint visits.





Thurs 28th June      Mr Raman Prasad, Chief Chemist) Municipal  
                         Mr Manked, Dept Chief Engineer) Sewage works

                         Mr S.C. Choksi, Regional Executive Officer

                         Mr R.S. Shah, President) Gujarat Chamber of  
                         Mr Maggiawalla, Manager) Commerce Ind. Estate

Fri 29th June      Mr G.B. Shah, Pres. Naroda Estate Association

Sat 30th June      Mr Bhatt, Sagar Drugs & Pharmaceuticals

                         Mr R.S. Mardia, Mardia Chemicals

                         Mr Sanjay Mehta, Metro Chem. Ltd

                         Mr S.K. Jasim, Mayar Dye-Chem. Industries

Sun 1st July      Mr V.C. Shah, Dept. Environ. Eng. GSPC Board

                         Mr K.G. Prajapati, Snr. Ind. Inspec. I.D.C.

                         Mr C.P. Patel, Manager I.D.C.

Mon 2nd July      Dr G.P. Soni - Regional Officer

                         Dr G.K. Trevedi - Chief Chemist

                         Mr J.H. Jani - Dy executor Eng., E.C.P.

                         Mr A.G. Bhatt - Chief Chemist

Tues 3rd July      Ramesh C. Gani, Pres. Nandesarie Association

                         Ramesh Surti, Secretary

                         B.C. Patel, Chairman, Polln. Advisory Comm.

                         J. Patel, Dinesh Chemicals

                         Chandrakant A. Dhabala, Prarthana Chemicals

Wed 4th July      K.S. Jain, Nandesari Ransayane Ltd

                         O.P. Jain, National Dye Chem. Industry

                         D.R. Gaur, Shreeji Colour Chem.

Thurs 5th July      Dr Dalwadi, R.O. Baruch, GSPB  
                         K.K. Sundaram, SBS Organics

Fri 6th July        N.P. Rathi, Amal Rasayan  
                         P.K. Patel, Chemo-Parma Ltd  
                         G.K. Jain, FICOM Organiser  
                         Dr V.M. Aras, Hoechst India  
                         A. Kapoor, Rallis India

Sat 7th July        S. Gujarat, Chamber of Commerce & Industry

Sun 8th July        Dr R.N. Soni, KRIBLCO, Surat  
                         M.S. Shukla, GSPCB, Surat  
                         Sha, R.O, GBPSB, Surat

Mon 9th July        D.B. Desai, GSPCB, Surat  
                         H. Bharucha, Dipika Colour Industries  
                         N.C. Patel, Consultant  
                         P. Kabutarwala, Colour Synth Industries

Tues 10th July     G.H. Trivedi, GSPCB, Vapi  
                         A.G. Deo, Vapi Industries Association  
                         M.C. Goyal, Pidilite Industries

Wed 11th July      V.P. Gaur, J. Colour PVT  
                         A. Shukla, Shree Raghuvir Dye Chem  
                         A. Moody, Vison (India) Ltd  
                         A. Javeri, Chem. Synth.  
                         M.S. Goyal, Pidilite

Thurs 12th July      Dr A.B. Diwadkar, Cyanamid India  
R.S. Naunda, Cyanamid India  
Dr H Kaiwar, ATIC  
Dr K Aparajitha ATIC  
T.P. Desai, Cibatul  
Dr A. Venkateswarfu, Atul. Products  
Mr Acharya, Atul Products  
Mr Desai, Atul Products  
Mr Lalbhai, Atul Products

Sun 15th July      Claridges Hotel, Delhi - Mid-point discussion with  
Mr M.S. Murthy

Mon 16th July      UNDP office to meet Mr M Islam, Country Director  
P.C. Tyag: - Chairman, Central Pollution Control Board  
M S Murthy - Advisor, Ministry of Chemical Petroleum

Tues 17th July      Mr V.M. Patki - Maharashtra Pollution Control Board  
Mr C.D. Oommachen, Chairman MPCB  
Mr D.R. Rasal, Member Secretary  
Mr Y.N. Mahendran - Addl Chief Eng. MIDC  
Mr K.H. Mehta, Air Pollution Abatement Eng.  
Mr U.K. Mukhopadhyaya - Executive Secretary M.O.E.

Wed 18th July      Mr R.S. Adhav, Regional Officer, Sub-Regional  
Mr N.R. Talpade - Hickson & Dadajee  
Mr D.K. Joshi - Hickson & Dadajee  
Mr R.A. Patel - Western India Dyestuffs Corporation

Thurs 19th July      K.C. Shroff - M.D. Excel  
                         C.M. Despande - Excel Amboli  
                         M.C. Jawdekar - Excel Amboli  
                         K.M. Shah - Excel Jogeshwari  
                         Dr A. Chaudury - Research Manager Scroff R.I.  
                         Dr M. Sharma - Plant tissue culture

Sat 21st July        Mr B.D. Kude - Regional Officer, Thane  
                         Mr A. Bodare - D. MIDC, Dombivili Estate  
                         Dr D.C. Mansharamani - Gharda Chem  
                         Mr A. Udas - Gharda Chem  
                         Mr B. Satay - Premier Dye Chemicals  
                         Mr S.K. Sengupta - Blue Rock Dyes & Chem  
                         Mr M.S. Vartak - Blue Rock Dyes & Chem

Sat 21st July        Mr J.N. Singhal - Indian Dyestuffs & Chem

Mon 23rd July       Mr S.Y. Phondge - Sandoz, Kolshet Road, Thane  
                         Mr V. Jagadeesh - Project Manager, Agrochemicals  
                         Dr A. Barawy - Bayer Kolshet Road, Thane  
                         Dr Mottar - Technical Director, Colour Chem  
                         Mr S.G. Advani - Colour Chem

Tues 24th July       Mr N.P. Manatkar - Lona Industries  
                         Mr S.K.K. Kothari - Director, Jaisymth Dyechem  
                         Mr V.M. Ramachandran - Works Manager  
                         A. Mathew - General Manager - Hindustan Insecticides  
                         D.K. Arora - Dy Manager (ETP)

Wed 25th July      J.K. Doshi - General Manager I.D.I  
D.H. Davar Dy Chief Engineer I.D.I.  
B. Bhattacharjee - Safety Officer  
Dr Ashutosh, R & D Manager, Chemiequip Ltd

Thurs 26th July    B. Lal, Manager. Hoechst India, Mulund  
A.K. Grover, Manager Safety and Environment Protection  
Dr K.B. Deshpande, S.S.O., Central Laboratory  
V.M. Bhosale, Air Pollution Control Officer

Fri 27th July      J.K. Karambelkar, Works Manager, Jay Chem-color  
S.R. Wadia, Rallis India, Bombay  
N.V. Rege, Chief Chemist, Int. Res. Laboratories

Sat 28th July      Prof. S.P. Mahajan, IIT. Bombay

Mon 30th July      M.S. Tawakley, Vice President, I.D.I Boisar  
A.S. Shewale, Works Manager  
H.B. Kale, Chief Analyst  
P.R. Desai, Production Manager, Chemiequip Ltd  
R.M. Tejuja, M.D. Tarapur Dyestuff Industries

Tues 31st July     A. Parekh, Director Tarapur Chemicals and Pesticides

Wed 1st Aug        L.R. Ratnaparkhi, Works Manager, Jaysynth Dychem  
V. Viswanathan, Environ. Engineer, Rallis India  
M. Bahadurji, M.D. Mazda Industrial Chemicals

Fri 3rd Aug        A. Wakankar, Works Manager Arlabs Ltd, Bose  
P. Purandare, Chemical Engineer Arlabs Ltd

Sat 4th Aug            K Rathi, Vice President, Sudarsham Chemicals Ltd  
                         T.M. Agarwal, Manager, Sudarsham Chemicals  
                         R.V. Chiplunkar, Technical Executive, Sundarsham  
                         I.J. Vernal, Chief Chemist/Manager, Kamdhenu Pesticides  
                         R.M. Kulkarni, Regional Officer, MPCB, Pune

Sun 5th Aug            J.F. Moore, Jr, S.W. Missouri State University  
                         M.N. Sukhatme, Herringer Brights Ltd

Mon 6th Aug            Dr R.K. Pandit, NEERI, Bombay  
                         Dr V.G. Pangarkar, Dept. of Chem. Tech. University of Bombay  
                         M.B. D'Cunha, Astra Publishers  
                         C.P. Moraes, Urban Dev. Institute

Tue 7th Aug            C.D. Oomachen, Chairman, Pollution Control Board  
                         D.R. Rasal, Member Secretary, Pollution Control Board  
                         U.K. Mukhopadhyaya, Executive Secretary, Ministry of  
                         Environment

Wed 8th Aug            V.M. Patki, Pollution Control Board

Thurs 9th Aug          M. Islam, Country Director, UNIDO, Delhi  
                         M.S. Murthy, Advisor, Ministry of Chemicals and Petroleum  
                         (counterpart)

Fri 10th August	Mr. A.P. Hirano, Sanitary Engineer, WHO Mr. R.J. Robinson, Senior Economist, World Bank
Mon 13th August	Mr. E. Berger, SIDA Mr. O. Lundberg, SIDA
Tue 14th August	Mr. M. Islam, UNDP, UNEP, UNIDO
Fri 17th August	Mr. H. Richter, Fed. Rep. Germany
Tue 21st August	Mr. Muzumdar, Tech. Director, Mr. Jayendra Kumar Hiralal Mr. Amin, Prem Chemical Ind.
Wed 22nd August	Mr. S.N. Pathak, Gen. Manager, Exel Ind. Mr. P.V. Kango, Chief Exe., Exel Ind
Thurs 23rd August	Mr. A.K. Dave, Senior Scientific Assistant, G.P.C.B.  Mr. D.C. Dave, Scientific Officer, G.P.C.B.
Thurs 23rd August	Mr. P. Patel, Baroda Minerals Ind.
Fri 24th August	Mr. R.P. Joshi, Works Manager, JKBM Ltd
Sat 25th August	Mr. D.K. Sawhney, Works Manager Gujarat Insecticides Ltd
Mon 27th August	Mr. J. Joshi, S. Manager Gujarat Nar. Vellely Fer. Co. Ltd  Mr. H. Ruparel, Gen Manager Khatau Junker Ltd
Tue 28th August	Mr. K. Nangia, Prod. Manager Searle Agrochem
Fri 31th August	Mr. S. Kashyap, Director, NIOH
Fri 5th September	Mr. G. Garland, Tech. Adviser, WHO



ANNEX 7

List of equipment for site monitoring, training and field investigations.

1. Mobile Laboratory fitted with diesel generator A/C (split units), flow measuring/recording equipment and field testing Kits
2. The following mobile small scale pilot plant mounted on skids and wheels for transporting to factories to include:-

Carbon Filter Unit, together with a range of activated carbons.

Flocculation Unit fitted with dosing units and parallel plate settler

Belt filter press

UF/RO unit with range of membranes

Bio disc and packed tower aeration units

Ozoniser, for chemical oxidation

Acid waste recovery unit

Spray dryer unit

Froth flotation unit electrolytic cell for recovery of metals

3. Suitable trailers (fitted with roof and removable canvas sides), to carry pilot plant equipment
4. Spare parts for pilot plant equipment including pump seals, voltage stabilisers, belt fitters, membranes, carbon fitters
5. A supply of nose/mouth face masks for issue to persons working in dusty areas in pesticide and dyestuffs industries

Preliminary Project Cost Estimate

1. <u>Technical Assistance/Training</u>	\$
6 Consultants of 2 m/m (split mission) for 3 years i.e. 36 m/m at \$US 20,000/m	720,000
Additional Funds for the other specialists 4 m/m at \$US20,000/m	80,000
Local Travel/transportation expenditure	<u>20,000</u>
	<u>820,000</u>
2. <u>Overseas Training</u>	
8 Fellowships of 3 months, to include factory experience as well as industrial pollution control i.e. travelling \$US 5,000 and Training/Accommodation food etc \$US 20,000	<u>200,000</u>
3. <u>Equipment</u>	
Transportable pilot scale treatment units, to include Carbon Adsorption Unit, Metal recovery unit UF/RO unit, Bio Disc Unit, Packed Tower Unit Parallel plate settler, belt filter, spray dryer, etc. (see annex 4)	500,000
Mobile Laboratories (two) fitted with sampling/flow measuring equipment air conditioning, generators and field testing kits @ \$US 150,000	300,000
Supply of mouth/nose masks with replaceable pads for dusty operations in the production of pesticides and dyestuffs (for distribution)	10,000
Selected textbooks for the Central Pollution Control Laboratories, together with visual aids (two sets at (\$US 20,000)	40,000
Additional Funds for additional equipment	<u>150,000</u>
	1,000,000

Administration

C.T.A, 6 months/y for three years

18 m/m at \$US 150,000/y

225,000

Secretarial/Accountancy assistance

(possible use of business agencies/accommodation)

18 months at \$US 50,000/y

75,000

UNIDO management fee (14% of total)

324,800

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624,800

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Grand Total \$US 2,644,800

ANNEX - 9

List of Books for the Central Laboratories of Gujarat and Maharashtra  
Pollution Control Boards

1. Encyclopaedia of General Chemical Technology Volume 3 Kirk/Othmer.  
Publisher J. Wiley and Sons
2. Code of Practice for Solid Waste Management
3. Water Pollution Papers
4. Notes on Best Practicable Means (BPM)
5. Audio Visual or Videos on Laboratory Management or waste treatment
6. Wastewater Treatment Design, J.B. White, Arnold
7. The Safe Disposal of Hazardous Wastes (The Special Needs and Problems  
of Developing Countries), R. Batstone, J. Smith and D. Wilson, World  
Bank 1989
8. Hazardous Waste Management in Electroplating Industries of Delhi Region  
(WHO and NPC, New Delhi)
9. Dyes and Dye Intermediates Industries in India (Paramount Corp, World  
Bank 1990)
10. Pesticides and Tanning Industries in India (World Bank 1990)