ANNUAL REPORT

1976

NEERI

NATIONAL ENVIRONMENTAL ENGINEERING
RESEARCH INSTITUTE, NAGPUR (INDIA)

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NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE
NEHRU MARG, NAGPUR-440 020 (INDIA)

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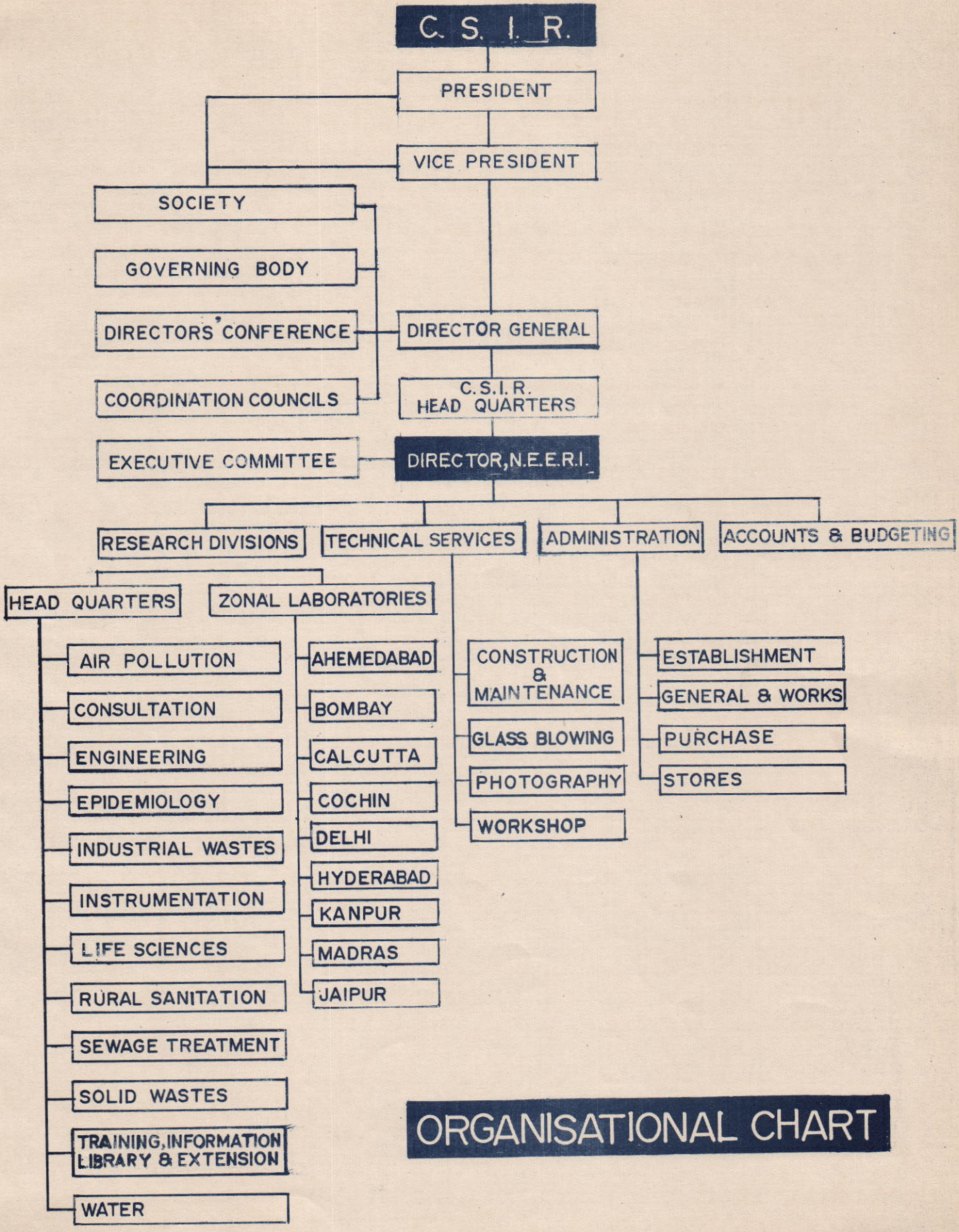

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** Took over as Scientist-in-Charge, NEERI on December 1, 1976.

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7.	Shri Kartar Singh Administrative Officer NEERI Nagpur	Member

DIRECTOR'S REPORT

DIRECTOR'S REPORT

It gives me immense pleasure to present the Annual Report for the year 1976. During the year under review, the Institute carried out investigation on 145 projects of which 30 were sponsored and eight were collaborative schemes. Altogether 25 project reports were published. The Institute completed around 20 short and long-term consultancy assignments and about 30 assignments are in progress.

UNEP Programme

The United Nations Environmental Programme, Nairobi sponsored a project entitled "Identification and Preparation of an Inventory of Institutions in the ESCAP Region with Capabilities of Assessment for Air and Water Pollution" with NEERI as the project coordinator under the CSIR. A significant progress was attained in carrying out the first phase of the UNEP project. On behalf of UNEP, some of our scientists visited the countries in the ESCAP region including Bangladesh, Indonesia, Philippines, Malaysia, Singapore and Sri Lanka, where they collected comprehensive information on the facilities and capabilities available with organisations in the respective countries with regard to air and water pollution monitoring work.

As a WHO Collaborating Centre on Community Water Supply, Waste Disposal and Air Pollution, the Institute continued to furnish data on items of mutual interest to WHO International Reference Centres situated around the globe.

Another milestone in the progress and development of NEERI, was the opening of the Ninth Zonal Laboratory at Kalamassery, near Cochin in June 1976. This Zonal Laboratory will meet the longfelt need of this fast developing region.

Research & Development Activities

The highlights of the major R&D and Extension activities undertaken by the Institute are listed below :

A steady progress was attained in the application of reverse osmosis for treating high salinity water. An experimental reverse osmosis assembly of five tubuler membranes was fabricated at the Institute so as to give 5 cu m/day/product water with permissible salinity of 600 ppm at 42 kg/sq cm as operating pressure.

At the request of the Andhra Pradesh Government, an extension programme was carried in rural areas of the State to demonstrate the 'Nalgonda Technique for Defluoridation of Water'. The rural population was provided with sufficient chemicals to practice this technique for a year using their available domestic utensils. The Andhra Pradesh Government is also taking steps to install a 0.5 mgd (2272 cu m/d) at Kadiri township for defluoridation of water.

NEERI's process know-how for the manufacture of chlorine tablets and chlorine ampoules was released through the National Research Development Corporation of India (NRDC) to four entreprenuers who have launched into production. These items are being used for disinfection of water.

The Institute continued to participate in the international programme on "Slow Sand Filteration for Small Communities." India is represented by NEERI and is among the five other participating countries namely Ghana, Kenya, Pakistan, Sudan and Thailand, in this project, which is being co-ordinated by the World Health Organisation International Reference Centre for Community Water Supply at the Hague, the Netherlands. Presently data is being collected in India so as to develop slow sand filters suitable for rural areas and small communities. The Institute has submitted two Interim Reports on Slow Sand Filtration to WHO IRC.

Data on common air pollutants viz. suspended particulates and sulphur dioxide is being collected as a part of the long-term national air pollution monitoring programme being carried out by the Institute. The ten cities chosen for studying air quality monitoring are Ahmedabad, Bangalore, Bombay, Delhi, Calcutta, Hyderabad, Jaipur, Kanpur, Madras and Nagpur.

The Institute is assisting the Expert Committee of the Government of India to determine the baseline level of air pollution at Agra in view of a proposal to locate on oil refinery at Mathura.

The successful application of pulp mill waste water for agricultural purposes at Orient Paper Mills at Amlai in Madhya Pradesh indicates bright prospects.

Studies were continued on the research-cum-demonstration pilot plant for nightsoil digestion at the Central Prison, Nagpur to determine parameters for studying the feasibility of setting up bio-gas units in the country. The bio-gas generated is being utilised at the prison's canteen and kitchen.

The Institute is collaborating in the All-India Co-ordinated Project on Algae which is sponsored by the Department of Science and Technology of the Government of India. Studies are in progress for the development of a Biotic Index which will help to establish the community structure for biological monitoring of water quality in

terms of organic pollution. Studies are also in progress on the utilisation of waste waters for fish culture. The species of fish which have been cultured include common carp and cat fish.

Significant data have been collected on the study of "Use of Saline Water in Agriculture (Safe and Optimum Utilisation of Sewage Effluents in Agriculture)". This is a part of the Indian Council of Agricultural Research Co-ordinated Scheme for research on use of saline water in Agriculture. Higher crop yields have been obtained using diluted sewage in certain proportions.

The Rural Sanitation Programme which is a project in collaboration with the Zilla Parishad, Nagpur is being well received by the rural population residing in 10 villages around Nagpur where around 640 hand flushed water-seal latrines are in use and studies are in progress to develop suitable low cost superstructures for the latrines out of available local material. Simultaneously a programme of disinfection of wells in rural areas using pot chlorinators and epidemiological studies on "Assessment of Health Status of Rural Population around Nagpur" are being carried out.

The feasibility of employing on a mass scale a biological control of mosquitoes is being studied by using Utricularia, on aquatic carnivorous plant, commonly found in quiesent waters. These plants have been found to trap and kill mosquito larves and is promising method for an effective control on propogation of mosquitoes.

Development of indigenous equipment is an important aspect of NEERI's R&D efforts. The Institute has recently filed the following three patents : (i) Airspora Sampler with Inclined Slide which has been proved to be 12 times more efficient than conventional procedure; (ii) Bellows-type Oil Free Vacuum Pump & (iii) Improvements in/or relating to the Wind Direction Recorder.

The Institute has acquired adequate technical competence on solid wastes management. This is reflected from the sizeable number of civic bodies from all over the country who seek the assistance of the Institute for dealing with their garbage disposal problems. Recently the Institute has submitted a project report for setting up a mechanical composting plant at Gauhati. Investigations have also been completed for studying the feasibility of carrying out mechanical composting of refuse for the cities of Jabalpur and Kota.

Five training courses, specially designed to equip technical personnel in the field, were conducted by the Institute as part of the NEERI's effort to promote transfer of technology through training of personnel. A special Refresher Course sponsored by NEERI and the Central Board for Prevention & Control of Water Pollution, New Delhi was organised at Nagpur for Chairmen and Member-Secretaries of Water Pollution Control Boards during November 5-12, 1976 to equip them for the implementation of the Water Prevention and Control of Pollution Act of 1974.

The Institute participated in a number of symposia, seminars, get-togethers and exhibitions arranged by various organisations and jointly sponsored the holding of the

Second National Convention on Environmental Engineering at New Delhi in January-February 1976 and the Eighth Annual Convention of the Indian Water Works Association at Nagpur on February 4, 1976.

The Institute continued to publish its quarterly journal, "Indian Journal of Environmental Health", Volume 18 (1976), its quarterly publication, "Technical Digest" which highlights important aspects of environmental engineering, research and development activities carried out by the Institute and a Fortnightly, "Guide to Current Literature on Environmental Health, Engineering and Science".

The Institute brought out for the first time a 441-page "Directory on Environmental Organisations in India" which provides information on 219 organisations working in the environmental engineering and related fields. In addition, 25 special project reports and an annual report were published during the year.

An added impetus was given to the use of Hindi in the work of the Institute by way of releasing bilingual press releases in English and Hindi from time to time, bringing out leaflets and booklets in Hindi for popularising the Institute's research products & processes, delivering radio talks and extension lectures.

Acknowledgements

I wish to place on record my profound gratitude to our former Director, Prof. N. Majumder, under whose able stewardship the Institute continued to grow in stature at national and international level as a centre for research and development in environmental engineering, during his tenure from April 1973 to December 1, 1976, to Shri J. M. Dave, Deputy Director, who took over as Acting Director from December 1, 1976 to June 28, 1977 and to all the scientists and the supporting staff for the excellent team spirit in carrying out the Institute's R & D activities.

The continued assistance, co-operation and interest shown by international organisations like WHO, Geneva, and UNEP, Nairobi is gratefully acknowledged.

To our large clientele who sponsor some of our R&D programmes and seek our assistance for consultancy work, we acknowledge their support and are grateful for their patronage.

I am personally grateful to the Director-General, Scientific and Industrial Research, New Delhi for his guidance and encouragement and to officials of the Council of Scientific & Industrial Research for their encouragement and co-operation.

Dr. B. B. SUNDARESAN
DIRECTOR

Nagpur, July, 1977.

RESEARCH & DEVELOPMENT ACTIVITIES

(DIVISIONS AT HEADQUARTERS)

AIR POLLUTION

Completed Projects

1. Manganese Content in the air-borne dust and Health Study near Ferro-Manganese Alloy Factory

Two sites in the vicinity of a Ferro-Manganese Alloy Factory were selected so that one of them being a distant control station and the other in the proximity of the Factory. The air-borne dust was sampled and analysed for manganese content. The dust levels observed in the range of 0 to 10 $\mu g/m^3$ in the area close to the factory and less than 1 $\mu g/m^3$ at a distant control station. The study indicates that there is a relevance of manganese dust with regard to its toxicity on school-going children. These observations are based on the short-term survey.

2. Air Pollution Survey of Chembur-Trombay Area

Under this 10-month survey, the emissions from a fertilizer plant, refineries, power station and petro-chemical industries located in the Chembur-Trombay area were studied. The ambient air quality and wind pattern in the region were determined at five monitoring stations. A feasible plan of action for abatement of air pollution in a phased manner for different types of sources in the Chembur-Trombay area will be ennumerated in the project report. The project was sponsored by the Maharashtra Prevention of Water Pollution Board, Bombay.

3. Assessment of emissions at Pelletisation Plant at Pale (Goa) and Performance Study of the De-dusting Unit

The survey work was carried out to determine air velocities and dust emissions from various sources of the Pelletisation Plant at Pale (Goa) and the performance of

the existing de-dusting system. The survey report indicates the remedial measures which need to be adopted by the sponsor, M/s Chowgule & Company Pvt. Ltd., Goa.

4. Control of lead fumes from Andhra Prabha Printing Press, Vijayawada, Andhra Pradesh

The objective of this project is to prepare a blue print for the control of lead fumes from the printing press. NEERI designed control equipment which was installed in the factory and it is in operation.

5. Atmospheric Pollution Survey around Indraprastha Thermal Power Station, New Delhi

The air pollution in the surrounding area of Indraprastha Thermal Power Station was assessed by determining the suspended particulate matter under various climatic conditions. The final report is under preparation for submitting it to the sponsor, M/s Delhi Electric Supply Undertaking, New Delhi.

Continuing Projects

1. WHO Collaborating Centre on Air Pollution

This is a collaborative project sponsored by the WHO, Geneva, which has recognised NEERI as a WHO Collaborating Centre on Air Pollution for South East Asia Region. Inter-laboratory studies for sulphur dioxide measurement as per guidelines from WHO were carried out. Air monitoring for air quality data for sulphur dioxide and suspended particulate matter from three selected monitoring stations in Calcutta was communicated to WHO. Similar data is being collected from all over the world by WHO in order to study air quality on a global level.

2. Standardization of Sampling Techniques of aerial pollen grains and fungal spores by methods currently used in India.

The aim of the study is to improve the air spora sampling techniques currently used in India. The development of an "Air-Spora Sampler with Inclined Slide" by the Institute has proved to be twelve times more efficient than the conventional

procedure which has several limitations because of its varying trapping efficiency with different wind speeds and because of its limitation in sampling of air-borne particles only by sedimentation.

3. Air Pollution aspects of Automobile Exhaust Emissions

The study aims at determining the extent of air pollution caused due to emissions from gasoline and diesel vehicles and to standardise methods for specific emissions like lead and carcinogens using atomic absorption spectrophotometer and gas chromatograph. The data on emissions of carbon monoxide from gasoline vehicles under Indian conditions and smoke from diesel engines are being studied.

4. Control of Sulphur dioxide by Adsorption Technique on Mineral Clays

The characteristics of Indian clay minerals is being studied with special reference to its adsorption efficiency of sulphur dioxide. Clay minerals can be used in the desulphurisation of flue gases.

5. Uniform concentration of Hydrofluoric acid gas generating device

The project aims at a fabrication of a dynamic constant concentration generation chamber for hydrofluoric acid and to use it for testing under controlled conditions of temperature and pressure. The chamber can also be used for fumigating vegetable plants and to study the effects of HF. The unit has been fabricated and suitable modifications are being carried out to overcome the existing limitations. A variety of vegetables were exposed in the fuming chamber and the effects of HF were studied.

6. Forecasting of Airspora (aerial pollen grains and fungal spores) which are proved Aero-allergens

The objective of this study is to prepare an airspora calendar for Nagpur and to develop a system whereby it is possible to forecast the air spora concentrations of proved aero-allergens. Daily data on airspora concentrations of Nagpur were collected from June 1975 and the synoptic data on climate of Nagpur were also noted. The airspora calendar is being prepared. Multiple regression analysis of airspora concentra-

tions and climatic factors will indicate the feasibility of preparing a mathematical model for forecasting.

7. National Monitoring Net-work on Air Pollution

The air pollution levels in 10 selected cities including centres where NEERI Laboratories are located is being carried out. The cities include Ahmedabad, Bombay, Calcutta, Delhi, Hyderabad, Jaipur, Kanpur, Nagpur and Madras. Recently, one more city, Bangalore has been included. Pollutants under study include sulphur dioxide, nitrogen dioxide, suspended particulate matter and sulphation rate measurements. The project was launched in 1969 and is to continue on a long-term basis.

8. Preparation of National Emission Inventory

Under the programme, information on the emissions from different types of industries is being collected.

9. Baseline Air Quality Survey at Agra

The study will indicate the impact of environmental pollution on national monuments situated in and around Agra. The pollution parameters under survey are sulphur dioxide, nitrogen dioxide and suspended particulate matter. Meteorological factors such as wind speed and direction are also under study for evaluating the pollution pattern. The national monuments selected for study are Taj Mahal, Agra Fort, Sikandara, Itmatuddaulah and the fifth sampling station is in the centre of Agra city at the Municipal Corporation building. The Delhi Zonal Laboratory of NEERI assisted in carrying out this survey.

10. Air Quality Survey to assess the implications of locating the DMT Polyster Fibre/Film Units in the vicinity of the Coker-cum-Coke Calcination Plant at Bongaigaon, Assam

The pollution due to air-borne dust, particulates existing in the vicinity of the petro-coking and coke calcination plant at Barauni and its impact on air quality is being assessed so that a suitable location for the DMT/Polyster Fibre/Film Unit can be

prepared. An interim report has been submitted to the sponsor M/s Bongaigaon Petrochemicals & Refinery Ltd., New Delhi.

New Project

1. Control of Smoke Emissions from boiler chimney of Hotel Chola, Madras

The project has been taken up to measure smoke emissions from the boiler chimney and to suggest improvements for carrying out suitable modifications so that the existing pollution of the atmosphere due to boiler emissions is controlled. The emissions from the chimney with respect to particulate matter, sulphur dioxide, carbon monoxide and carbon dioxide are being measured.

ENGINEERING

New Projects

1. Studies on Slow Sand Filtration

This research and demonstration project is to promote the application of Slow Sand Filtration in India. This Collaborative Project is partly being financed by the WHO International Reference Centre, the Hague. The programme is divided into two stages. Under the first stage which is in progress, the three aspects being studied are : the performance of slow sand pilot filters installed in the Institute operational performance of a slow sand filtration unit suitable for 28,000 persons and collection of information of units functioning in India.

2. Declining Rate Filtration of Water

Laboratory experiments by direct filtration of alum dosed raw waters with a turbidity of 10-25 units (FTU) have been concluded. Following the laboratory work, studies have been initiated at Kanhan Water Works, Nagpur on a full-scale filter.

3. Development of Reliable House-hold Hand Pump

The aim of the project is to develop a light weight and reliable house-hold hand pump of shallow-well type for use in individual houses. A prototype hand pump has been fabricated and its performance is being tested.

4. Pilot Water Supply Scheme with Slow Sand Filtration for Burjwada village

The project envisages provision of protected water supply by slow sand filtration to Burjwada village under the integrated rural water supply and sanitation programme. A detailed engineering survey of the village will be carried out to decide the location of treatment works using slow sand filtration distribution network and stand posts. The sponsors of this collaborative project are WHO, IRC, Geneva, Government of Maharashtra and Nagpur Zilla Parishad.

5. Two-layer Filtration of Water

Laboratory studies have been completed using indigenous high grade bituminous coal as a filter media to study filtration rates and filtrate quality.

Preventive Maintenance

New Projects

1. Preventive Maintenance of Water Distribution System at Calcutta

Two zones namely Zoroshanko and Willingdon have been selected for this study. Waste assessment through public stand posts in the Willingdon area has been completed. Initial flow test and leak detection studies have been completed. An inte-

rim report has been prepared for the sponsors, M/s Calcutta Metropolitan Development Authority (CMDA) and Calcutta Municipal Corporation.

2. Reconditioning of Water Mains

Drag scrapers for cleaning of water mains were fabricated and tested. Field trials are in progress in Bombay.

3. Study on Waste Water Meter District in Panaji, Goa

In a selected pilot zone, the preliminary work of updating the distribution map, fixing of bypass meters, leak detection work and waste assessment using minimum night flow technique have been completed. The final flow test to assess the wastage after carrying out remedial measures for the detected leaks has been completed. This collaborative project was sponsored by the Public Works Department, Goa.

EPIDEMIOLOGY

Continuing Project

1. Assessment of Health Status of Rural Population around Nagpur

Collection of data on health status of rural population in selected villages around Nagpur was continued. Blood and stool samples were collected and analysed. A programme of deworming was undertaken to remove gastro-intestinal parasitic infestations. This project is complementary to the Rural Sanitation project of the Institute. A pilot programme of constructing sanitary latrines at some selected villages around Nagpur is in progress. By improving sanitation, it is expected that the faeco-oral cycle of enteric parasites will be disrupted and the health of the people will show improvement in due course.

Completed Projects

1. Colour Removal Studies on Pulp and Paper Mill Wastes of the Nagaland Paper Project at Tulu, Nagaland

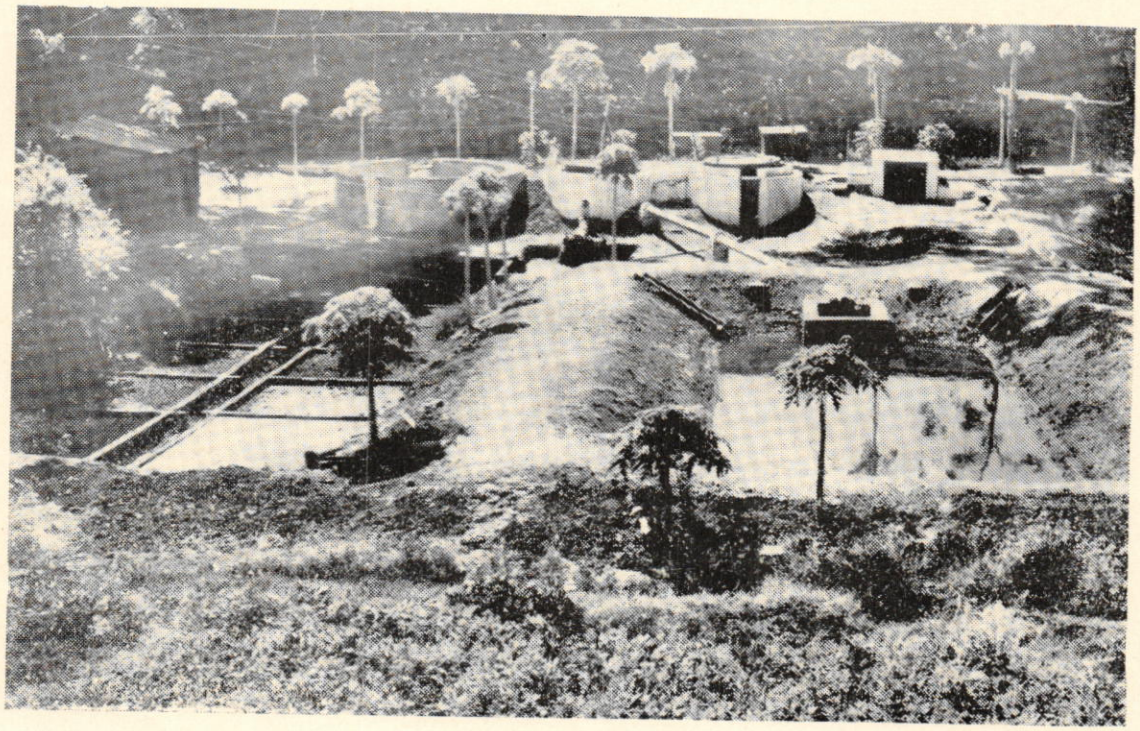
Laboratory studies indicated that colour can be reduced by 90 per cent in combined coloured waste water. Based on these studies, treatment flowsheets for colour removal for treating 7100 m^3/day of combined coloured waste water were suggested. The National Industrial Development Corporation, New Delhi had sponsored this study.

2. Effluent Treatment at the proposed Corned Meat Factory at Aurangabad

Based on the data supplied by the factory, a feasibility report was prepared for the treatment and disposal of the waste water. Two treatment flowsheets have been suggested. The second alternative is being implemented. M/s Brooke Bond India Ltd. who have sponsored the project are establishing an integrated meat canning factory at Aurangabad.

3. Waste Treatment and Disposal at Fertilizer Corporation of India, Ramagundam

The sponsor of the project, M/s Fertilizer Corporation of India is establishing a f etory at Ramagundam for the manufacture of urea based on coal carbonisation. Based on the data provided by the factory on the composition of waste water treatment flowsheets have been suggested to segregate urea bearing waste water and its disposal by evaporation. Suitable treatment for the chromium bearing wastes was suggested. The combined waste water is expected to satisfy the required standard for discharge into the river Godavari.



A Total Utilization of Night Soil

4. Treatment and Disposal of Wastes from Low Temperature Carbonisation Plant at Ramkrishnapur, Andhra Pradesh

Biological treatment of waste water consisting of extended aeration and activated sludge process has been recommended to the sponsor, M/s Regional Research Laboratory, Hyderabad. The treated wastewater can be used on land for agricultural purposes. NEERI Hyderabad Zonal Laboratory assisted the Industrial Wastes Division at Headquarters in carrying out this project.

Completed Projects

1. Treatment of Slaughter House Wastes by Anaerobic Filter

The increase in the loading of the anaerobic filter from 100 to 200 kg COD/ $100m^3$/day has shown no appreciable decrease in the performance of the filter.

At 40 kg loading, BOD reduction ranged from 87 to 93 per cent and COD reduction from 74 to 77 per cent. The experiments are being continued till the loadings reach the optimum stage.

2. Agricultural Utilisation of Pulp and Paper Mill Waste Water

Studies were conducted to see the effect of pulp effluent on the germination of crops in sand media. These studies revealed that except gram and ground nut, all other Rabi & Kharif crops responded quite favourably when irrigated with pulp mill effluent.

In green house studies, wheat and barley crops irrigated with pulp mill effluent gave significantly higher yield than with plain water irrigations.

Fertility evaluation of the virgin land earmarked for effluent disposal and crop growing showed no explainable fertility variability.

Different Rabi and Kharif crops were grown in soil media in the green house and in the field (micro plot, macro plot and large scale field plots). The crops irrigated with pulp mill effluent have, in all respects, provided either equal yields or significantly more yield when compared to plain water irrigated ones. The Orient Paper Mills Ltd., Amlai (Madhya Pradesh) is the sponsor of this project.

3. Treatment of nightsoil and utilisation of by-products

The two night-soil digesters of 18 m^3 capacity have been set up at the Central Prison, Nagpur. Data on the performance of the digesters and treatment of the supernatant is being studied. Loadings were increased upto 3.5 kg./day/m^3 and the existing sludge drying beds were modified using brick bats instead of usual coarse sand. Laboratory experiments showed that a species of Spirulina *(S: Plantensis)* could grow well in the filtrate. The filtrate is now being treated in oxidation ponds.

New Project

1. Performance of waste treatment plant at Nagpur Milk Scheme

The physico-chemical characteristics and flow measurement of waste water at Nagpur Milk Scheme and the performance of the oxidation ditch for treatment of waste water, are being studied.

INSTRUMENTATION DIVISION

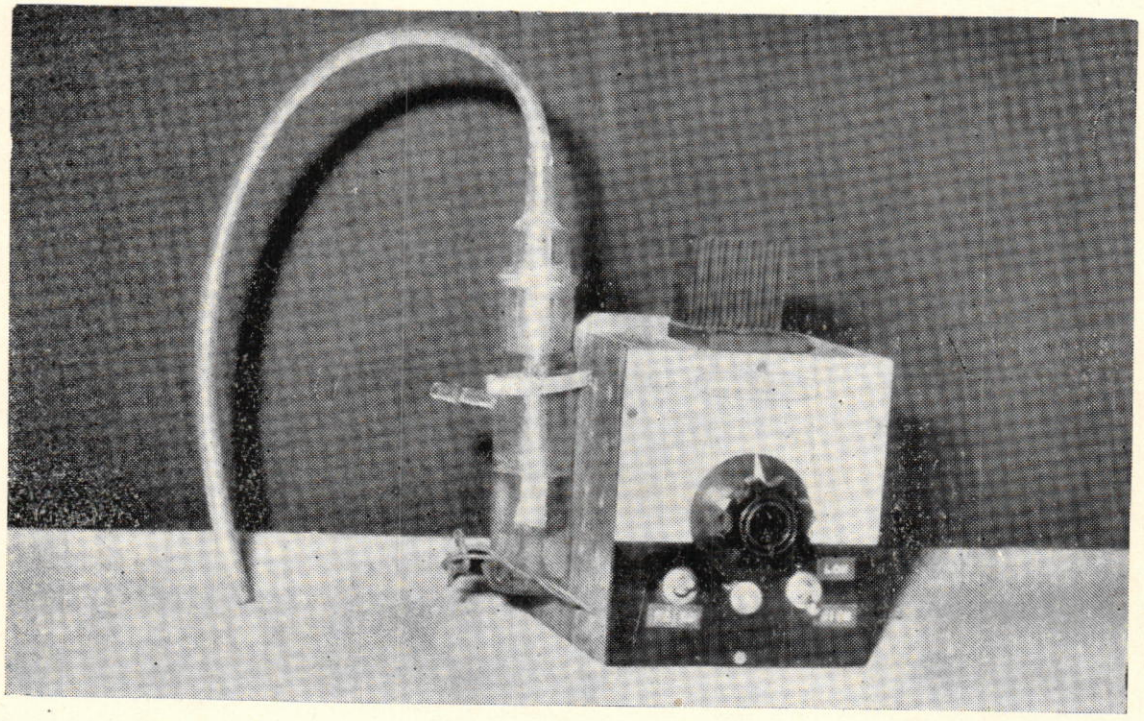
Completed Projects

1. Temperature Humidity Index (THI) Meter

A unit consisting of a single transistor amplifier and two thermistor probes—one to serve as dry bulb and another to serve as wet bulb was developed. The equipment gave an accuracy within $\pm$ 10 per cent as compared to the Kata Thermometer and Whirling Hygrometer.

2. Development of an Oil Free Vacuum Pump for Air Sampling

A rotary vane vacuum pump developed and coupled with a universal motor has been tested and found suitable for air pollution survey.



Electrolytic Feeding Pump

Continuing Projects

1. Motor aspirated radiation shielded Temperature Probes

A continuous automatic system has been developed for collection of temperature inversion data using thermistor probes which have been tested at Agra and two other sites. Four thermistor probes have been fabricated by the Institute.

2. Motor Speed and Power Controlling and continuous Feeding Device using Silicon Controlled Rectifier

The first phase of the project, namely the application of silicon controlled rectifier in controlling motor speed and power has been completed. Efforts are being concentrated on the development of a continuous feeding device, to meet the specific requirement namely, to replace the media dispenser unit. The device can provide the media solution at sufficiently constant rate of 0.5 ml/min. and is found to be a good substitute for an imported unit.

3. Development of Continuous SO_2 Recorder using Conductivity System

The 10 cm liquid quartz cell was modified for collection of gas. Studies were carried out on the Perkin Elmer 350 Model (recording Ultraviolet-Visible-Near Infrared) Spectrophotometer. SO_2 absorption showed a distinct wave. This will help in standardization of the conductivity system for measurement of SO_2 which is in progress.

LIFE SCIENCES

Bacteriology

Continuing Projects

1. Efficiency of stabilisation ponds with respect to removal of pathogenic bacteria, indicator organism and parasites

The single cell stabilisation ponds of 1 m, 1.2 m and 1.5 m were used for the study. The loadings of the ponds were the same and ranged between 200 to 240 kg/

hectare/day. The detention time was 15 days and the same raw sewage was fed to all the three ponds. It was observed that the overall efficiency of the ponds in removal of Salmonella ranged between 50 to 90 per cent as against the earlier observation of multi-cell ponds which gave effluent most of the time negative for Salmonella or when positive a very low count. The efficiency of the three ponds did not differ by a significant margin. The single cell ponds were not as efficient as multi-cell ponds in the removal of pathoganic organisms.

Continuing Projects

1. Occurrence of bacterial pathogens in Slaughter-house waste water and their reduction by various treatment processes

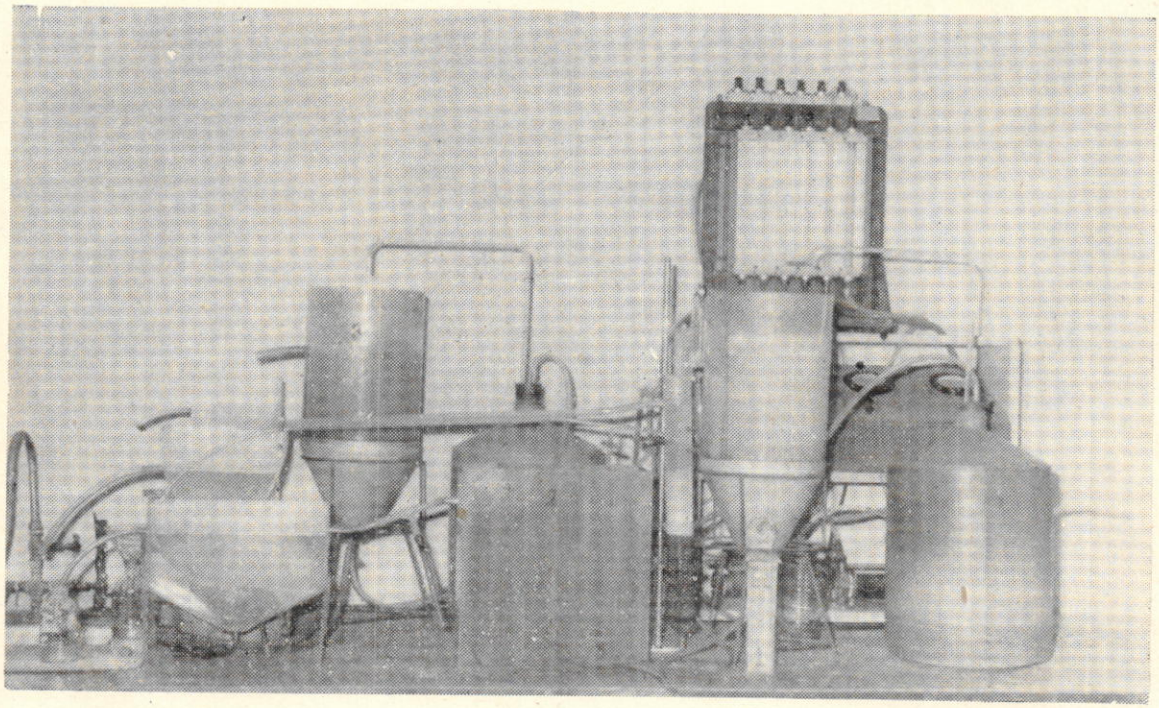
Performance studies on laboratory scale model of an anaerobic contact filter in the reduction of pathogens were continued with increasing loading rates of 10 kg and 40 kg/ 36 m^3 for 24 hours and 6 hours. These studies revealed that for a loading rate upto 75 kg the filter worked quite well with 90 to 99 per cent reduction in indicator bacteria as well as Salmonella.

2. Cellular protein from cellulosic solid wastes

Experiments were carried out to saccharify the bagasse with cellulose enzyme from *Trichoderma* species. Optimum conditions for the maximum production of enzyme such as nutritional requirement, addition of surfactants, different cellulosic substrates and inducers of cellulase enzyme and their concentrations, were worked out.

3. Use of Soil Culture for the Biological Treatment of Toxic Wastes

Micro-organisms capable of degrading phenol and cyanides have been developed. Yeast isolates capable of utilizing phenol as the source of carbon have been characterised. Batch experiments were conducted to test the yeast cultures to grow in different concentrations of phenol. The properties of the yeast isolate indicate that they could detoxify upto a loading rate of 3 kg phenol/kg MLSS/day under steady conditions to discharge effluent having less than 1 mg/l. The isolate is now being characterised for an effluent from a producer gas plant.



Bench Scale Studies in Biodegradation of Phenol

4. Development of rapid test for detection and enumeration of faecal coliforms in polluted waters

The modified Pour-Plate Technique developed at the Institute has been compared with the conventional MPN method. In all 105 different sewage samples were analysed by both the methods. Statistical analysis of the data revealed that there is no significant difference between the counts obtained in these methods. This work has been extended to study naturally polluted waters. With a little modification in the medium, it has been found that the technique gives reliable and reproducible results for well waters.

5. Bacteriological Performance of Slow Sand Filters

This project is in collaboration with the Institute's Engineering Division and is being sponsored by the WHO International Reference Centre, the Hague, the Netherlands. The study revealed that the bacteriological performance of slow sand filters gave good quality waters, under increased rate of filtration upto 0.3 m/hr after shading but permitting diffused light, and under conditions of intermittent operations. The filtered water was mostly free from *E. coli.* However, with increased pollution load the filtered water quality deteriorated as compared to previous studies.

New Project

1. Development of rapid Dip Slide Technique for studying the performance of sewage treatment processes in the reduction of faecal coliforms

The preliminary work of fabrication of a Dip-Slide, and sterile glass chamber to hold these slides has been completed. Trials with oxidation pond samples have been carried out with success.

Biology

Completed Project

1. Biological and Bacteriological Growth in Water Supplies with special reference to the Distribution System at Nagpur

Studies were carried out on each of the three water sources of Nagpur, namely Kanhan, Gorewara, Ambazari, their treatment units and for biological and bac-

teriological growths and for some pertinent chemical parameters. No specific correlation could be observed between chemical and biological parameters. At the dead end of the distribution system, there was an accumulation of organisms.

Continuing Projects

1. Pisciculture in Stabilisation Pond Effluent

Studies were carried out on the productivity of *Cyprinus carpio* (air-breathers) in large-sized sewage fertilized fish ponds. Physico-chemical, biological characteristics, primary production and fish biometry were carried out as operational parameters. Comparative observations between the control and the experimental ponds show an increase of approximately six times growth in experimental ponds. Attempts were also made to evaluate the energy flow for the ecosystem. *Cyprinus carpio* attained the average weight of 600 grams in one year.

2. Bioassay studies of Chlorinated Hydrocarbons using fish

Bioassay studies were carried out using chlorinated hydrocarbons such as Aldrin, Dieldrin, Chlorodane, DDT and BHC using fresh water fish as a test animal. After an exposure period of 10, 20 and 30 days, tissues of the fish such as liver, gill etc., were removed and processed for histo-pathological examination. Fresh water fish used for this study were *Cyprinus carpio* (Common carp), *Rasbora dniconuis*, etc.

3. Studies on Algal Succession in sewage and biological control of algae from treated sewage effluents

This study was carried out on algal nutrition using pure cultures of *Chlorella* It was found that there was an increase of algal growth, when acetate, carbon source, was supplemented to the culture medium. Critical experiments with various concentrations of acetate revealed that 0.5 mg/l is the optimum level required to permit maximum algal growth. It was found that carbon nutrition has pronounced effect on algal growth. Studies with reference to biological control of algae were done using *Moina dubia*, as a control agent. This organism has preferential feeding habits to *Anacystis* in comparison with other algae. For the study pure cultures of *Chlorella* and *Anacystis* were used.

4. Biological Assessment of Water Pollution—Biotic Index

Studies were undertaken to establish the 'Community Structure' or the 'Key Groups' associated with different degrees of organic pollution. A detailed biological survey of the Nag Nallah and its confluence with Pili River (into which the domestic water from house-holds in Nagpur are discharged) was undertaken. The course of the river represents zones having varying degrees of pollution. Physico-chemical, biological and benthic parameters have been analysed and the observations recorded in order to arrive at the Biotic Index.

New Project

1. All India Coordinated Project on Algae

This project has been sponsored by the Department of Science & Technology, Government of India, New Delhi. So far, the work on algal harvesting from the sewage stabilisation ponds for the feeding experiments has been undertaken.

Virology

Completed Projects

1. Virus removal during primary sedimentation

A two-year study on the performance of the activated sludge treatment plant at Dadar, Bombay revealed 41 to 83 per cent virus removal in the primary settling tanks. An evaluation of the efficiency of the primary sedimentation tank for the removal of enteric viruses under different flow rates, detention time, suspended solids and surface loadings, showed that the average percentage removal of viruses ranged between 40.9 to 59.1 during July 1974 to May 1975 and 40 to 82 per cent during April 1976 to December 1976.

2. Virus Removal from Facultative Stabilisation Pond

Grab samples consisting of raw sewage and effluents from stabilisation pond of varying depths operated at the Institute's campus were studied for virus removal during all seasons. Virological enumeration was carried out using the Membrane Filter Technique (MFT) developed in the laboratory. The results indicated highest efficiency of the pond operated at 1.3 m depth when compared to other two ponds in all seasons. The extent of virus removal was 94.37 per cent. There is no significant improvement of virus removal when the pond depth is increased to 1.5 m.

Continuing Project

1. Virological Quality of Water with respect to methods of treatment

Studies on virological quality using the iron oxide technique are being carried out by using water samples collected from various ponds of Nagpur where water is supplied from the Kanhan Water Treatment Plant.

SEWAGE TREATMENT

Completed Projects

1. Performance Studies on 25 hp aerator supplied by Dorr Oliver with changed reduction gear unit

The aim of this study was to evaluate the power transfer with modified assembly Experiments were carried out using the modified reduction gear unit under batch flow conditions using tap water. At optimum submergence, the gross oxygenation capacity was found to be satisfactory. The report has been submitted to the party.

2. Development of Entrainment-type Aerators

Surface aerators with 3.5, 10 and 15 hp have been designed and characterised for oxygenation capacity and efficiency.

Continuing Projects

1. Evaluation of the effect of depth on the Anaerobic-Aerobic BOD satisfaction in a Facultative Stabilisation Pond

Performance of ponds with depths of 1 m, 1.2 m, and 1.5 m are under study. During the period of study uniform organic loading of 200-240 kg/hectare/day was applied. The algal growth in the pond was estimated in terms of chlorophyl concentration. Diurnal fluctuation of DO and BOD is being carried out. The results obtained have shown that the standard practice of water irrigation combined with full dose of the recommended dose of NPK through fertilisers gave the highest yield as compared to the other irrigation treatments. The increases is 24, 29 and 61 per cent for raw sewage, settled sewage and oxidation pond effluent respectively. The intensity of irrigation and gypsum application treatment did not give significantly different results.

2. Sewage Utilisation in Agriculture

(i) EFFECT OF DIFFERENTIALLY DILUTED RAW SEWAGE IRRIGATION IN COMBINATION WITH NUTRIENT FORTIFICATIONS ON THE GROWTH AND YIELD OF CROPS AND SOIL PROPERTIES

This project is in progress since last five years. During the year, three crops, Mong (summer), paddy (Kharif) and wheat have been grown to assess effects of different irrigational and nutritional treatment on the growth and yield of crop and properties.

(ii) EFFECT OF IRRIGATION WITH RAW SETTLED AND TREATED SEWAGE AT VARYING INTENSITIES WITH AND WITHOUT GYPSUM ON THE GROWTH AND YIELD OF CROPS AND SOIL PROPERTIES

The results obtained have shown that the standard practice of water irrigation combined with full dose of the recommended does of NPK through fertilizer gave the highest yield as compared to the other irrigation treatments. The increases were 24, 29

and 61 per cent for raw sewage, settled sewage and oxidation pond effluent respectively. The intensity of irrigation and gypsum application treatment did not give significantly different results.

(iii) EFFECTS OF DIRECT CROP IRRIGATION WITH AEROBIC SEWAGE SLUDGE SLURRY ON PLANT AND SOIL

Pot culture experiments were initiated to ascertain the effects of direct irrigation with sewage slurry from oxidation ditch pilot plant on the growth of paragrass and soil properties. There was a tremendous increase in the growth of paragrass due to sludge irrigation. The soil under sludge irrigation got heavily enriched in respect of nitrogen and organic carbon which was approximately proportional to the quantity of solids applied.

(iv) EFFECT OF VARYING LEVELS OF BOD IN SEWAGE IRRIGATION ON THE PHYSIOLOGICAL RESPONSES OF PLANTS INCLUDING UPTAKE OF MAJOR NUTRIENTS

Sewage having a wide range of BOD (about 150 to 2000 mg/1) is applied to the crop grown in garden plots. The BOD ranges higher than that of the normal sewage were adjusted by mixing the appropriate quantity of primary sewage sludge with the settled sewage. The plant growth and yield were measured and also the appropriate plant tissues were sampled and analysed for moisture, major plant nutrients, sugars, organic acids, amino acids, etc. In the summer of 1975, maize was grown as an experimental crop and followed by tomato in the Rabi season. Subsequently tomato crop has been planted in the Rabi season of 1976, which is still under observation.

New Projects

1. Sewage Treatment by Biological Disc

A 'Biological Disc' demonstration plant containing 40 discs of one metre diameter made up of PVC sheets is in operation for studying sewage treatment under various loading conditions. At a loading of 2 Kg. of BOD/200 cu m of disc area/day an efficiency of 85-88 percent is obtained. The efficiency dropped down to 70-72 per cent at an increased loading of 6 kg BOD/200 cu m of disc area/day.

2. Sewage Treatment by Anaerobic Contact Filter

An anaerobic filter demonstration plant of the size 1.5m x 1.5m x 1.5m and filled with stones of 2.5 cm to 2.7 cm dia stones to study its efficiency as a composite

treatment plant for small communities. The depth of the filter is 1.2m. Percentage removal is 75-80 at COD loadings of 30 kg/20 cu m/day at a flow rate of 35/cm/100 hours.

3. Determination of 'Alpha' Constant for Aeration of wastewater by surface aerator

'Alpha' value of raw sewage and settled sewage at various COD concentrations were found out. Further the alpha value of phenols and ABS at different concentrations are being studied.

4. Performance of Settling Tank with special reference to SS, BOD, Virus and Indicator Organism removal

At various overflow rates and detention time, composite samples were collected and analysed for S S, BOD, COD, indicator organisms and virus in the settling tanks at NEERI campus.

5. Enumeration of Micro-organisms by enzyme action in biological processes

Enzyme reactions in different polluted liquors have been studied to evaluate the relationship between enzyme activity and microbial population.

6. Standarisation of Tracer Measurement Techniques and evaluation of interferences from oxidising and reducing agents, turbidity, algae and other particulate matter

Exciting and emitting wave lengths were worked out for some tracers. Using Rhodamine B as the tracer, effect of turbidity, pH, ageing, colour and temperature on fluorescence are being studied.

7. Sewage Disposal of Greater Bombay

Under this 'Technical Consultancy' Project, it is proposed to prepare a feasibility report on land application of sewage and sludge and to prepare a design criteria for

a sewage treatment plant under Indian conditions. Data on design of sewage treatment plant is being collected and will be submitted to the Bombay Municipal Corporation. M/s Metcalf and Eddy and Environmental Engineering Consultants are also providing assistance for this project.

Rural Sanitation

Continuing Projects

1. Rural Sanitation Programme

(i) CONSTRUCTION OF SANITARY LATRINES IN RURAL AREAS

About 640 hand-flushed water-seal latrines have been constructed upto plinth level in eight out of 10 villages around Nagpur. This project is in collaboration with Zilla Parishad, Nagpur. Upto to Dec. 1976, about 400 latrines have been in use. Superstructures of the newly constructed latrines are being raised.

(ii) HEALTH STATUS OF RURAL POPULATION AROUND NAGPUR

The base-line data on health status, particularly the load of gastro-intestinal parasistic infestation were collected from six out of the 10 project villages by examining 25 per cent of the population. Medicines were administered for deworming. A similar survey will be undertaken after 2-3 years when the sanitary latrines are constructed and put to use.

(iii) FIELD STUDIES ON CHLORINATION OF WELL WATERS USING POT CHLORINATORS IN SELECTED VILLAGES

Pot chlorinators developed by NEERI were introduced in all wells in one project village and recharging of the chlorinators was done once a week. Various compositions of bleaching powder and sand were tried and it was observed that 1:4 mixture

gave better leaching of chlorine. The double pot system is also being tried to study the rate of leaching of chlorine.

(iv) TO EVALUATE SANITARY LATRINE DESIGN

At Paunar Ashram, about 85 km from Nagpur, four sanitary latrines have been constructed. Charts showing the usages of latrines are placed inside and the users indicate its use by daily marking on it.

(v) SUITABLE LOW-COST SUPERSTRUSTURES FOR SANITARY LATRINES

A variety of superstructures suitable for sanitary latrines have been designed by the Institute. These are :

1. Split bamboo matting;
2. Brick work in mud motar and painting on the outside;
3. Brick work in cement and plastering;
4. Brick pannelling; and
5. Unburnt brick in mud mortar with bitumen kerosene emulsion spraying.

Cost estimates have been worked out and some of these superstructures will be put into use at the project villages to check their feasibility.

SOLID WASTES

Completed Projects

1. Feasibility studies on Mechanical Composting of Kota City Refuse

The collected data was analysed and the refuse characteristics were evaluated. A semi-mechanised compost plant was recommended. This project was sponsored by the Kota Municipal Council, Kota, Rajasthan.

2. Feasibility Studies on Mechanical Composting of Jabalpur City Refuse

The collected samples of refuse were analysed and the data critically studied. A semi-mechanical compost plant was recommended. The plant is designed for a period of 25 years. An exhaustive report was prepared and submitted. The project was sponsored by the Jabalpur Municipal Corporation.

3. Project Report on Mechanical Composting Plant at Gauhati

A total of 26 samples were collected and analysed for physical and chemical characteristics. The possible demand of compost in the surrounding areas was estimated. Based on the local climatic conditions, specific layout was prepared for a semi-mechanised compost plant. Capital requirements and recurring costs were worked out. The project was sponsored by the Gauhati Municipal Corporation, Assam.

Continuing Projects

1. Change in Leachate Characteristics during passage through different soil strata

Studies are being carried out to assess the capacity of various soils for removal of pollutants from leachates coming out of refuse dumping sites. Work is being carried out on black cotton soil available in and around Nagpur to determine its efficiency as a soil filter and to determine the various known pollution parameters.

2. Anaerobic Digestion of Refuse

Laboratory-scale studies have been completed to find out a suitable mixture of refuse and dung for maximum gas production. A mini gas plant was operated throughout the year using only refuse as an input material.

3. To arrive at Minimum Fraction of compostable matter in Aerobic Composting

Full-size windrows containing different percentage of compostable matter were prepared and turned on the alternate days. The moisture content was maintain-

ed within optimum values and samples collected at different turning intervals. The collected samples were analysed for various parameters. Studies are being carried out to determine an ideal test for judging maturity of compost.

4. Occurrence of Trace Elements in Urban Refuse

The extent of presence of trace elements in urban refuse is being studied. The method for estimation of manganese in refuse samples was standardised and its accuracy tested.

5. Studies on Cellulose Degradation and Mineralisation of Nitrogen during Aerobic Composting

Studies are being carried out to find out optimum conditions under which cellulose degradation will occur. Studies are being carried out initially on cotton dust and then verified by using city refuse.

6. Feasibility Studies on Mechanical Composting of Ajmer City Refuse

Field visits have been carried out to obtain data regarding present methods of refuse collection, transporation and disposal. A total of 34 refuse samples were collected and have already been analysed both for physical and chemical characteristics. Possibility of selling the compost in the surrounding area and the likely sale price have been assessed. The project is being prepared on the basis of the collected information. This project has been sponsored by the Ajmer Municipal Council, Rajasthan.

7. Project Report on Mechanical Composting Plant at Kota, Rajasthan

The Feasibility Report submitted earlier by the Institute had established that a mechanical composting plant can be set up at Kota. Various alternate sites for location of the plant and detailed recommendations regarding flow sheet, various facilities to be provided at the site, etc. have been suggested. The Kota Municipal Council, Kota has sponsored this study.

New Projects

1. Studies on a Multi-chamber Heat-utilisation Type Incinerator

A laboratory-scale model of incinerator was set up at the Institute. On the basis of observations, modifications, if any, will be carried out to obtain the best design.

2. Studies on Working of Hammer Mills for size reduction of City Refuse

Case hardened M.S. hammers were tried on the baby shredder of the Institute. Literature review and availability of various alternate materials are being studied before actual experimentation.

3. Optimisation of Transportation Routes of refuse transportation vehicles with the use of computer

Different mathematical models developed in Western Countries have been studied for their applicability in the Indian situation. The problem was sub-divided into a number of parts viz (i) Finding shortest route between the different collection points; and (ii) Allocation of different collection points to the disposal site for minimisation of cost. One Aeuristic approach to find out shortest distance was tried out and the same was programmed in a Fortran IV for which a satisfactory trial was taken out at the Tata Institute of Fundamental Research (TIFR), Bombay.

4. Pyrolsis of Solid Wastes

Laboratory experiments were carried out using a reactor made of 5.5 cm M S cyclinder, 90 cm long which is electrically heated annularly and the heating rate is controlled. Runs have been carried out between temperatures of 500°C and 800°C. On the basis of experiments carried out, it is seen that the dried organic portion of refuse when pyrolysed, gives about 30-35 per cent char, 35-40 per cent tar and oil in addition to some amount of low boiling organic compounds, 10-20 per cent reaction water and the rest as the fuel gas. It was seen that larger amount of gas is obtained at higher temperatures and at a higher rate of heating while more liquid products (tar, oil, organics etc.) are obtained at relatively lower temperatures and lower rates of boiling.

WATER

Completed Projects

1. Reverse Osmosis (First Phase)

The Institute's objective in undertaking this project is with a view to obtain detailed knowledge and to generate first-hand information on "Reverse Osmosis Technique" so as to be in a position to guide those in the field of water and waste water use.

The programme completed under Phase I was carried out using inorganic solutes and included: (i) Standardisation and development of Casting Assembly (CA); (ii) Development of technique for casting flat and tubular membranes; (iii) Evaluation of optimum parameters for casting membranes; (iv) Design and fabrication of accessories for Reverse Osmosis (RO) Unit; and (v) Design and fabrication of a 6 1/h R.O. Unit. The report is under preparation.

2. Chlorine Ampoules

The know-how developed earlier was scaled up to pilot plant level and the production continued. Detail information generated on the manufacturing process was standardised. The process was released through NRDC to three entrepreneurs who were trained at the Institute and also assisted to bring the product in the market. About 55,000 ampoules of 25 ml capacity were supplied to various parties by the Institute.

3. Disinfection Tablets

The process and product was developed prior to this reporting period. The production on pilot plant scale was continued to generate and standardise the data useful for commercial production. The process was released to four enterpreneurs through NRDC (National Research Development Corporation of India). All the four entrepreneurs were trained at the Institute and assisted to bring the product to the market to meet the high demand.

About 30,000 tablets were supplied during the period. Hundreds of applications were received from entrepreneurs.

4. Effect of Polyphospates, Nitrates and organic matter on fluoride removal by Nalgonda Technique

The study indicates that there is no interference from :

(i) Polyphosphates in the range 1—5 mg/P/1;

(ii) Soluble nitrates in the range 1—11 mg N/1; and

(iii) Organic matter in the range 4—20 mg 0A/1.

Residual fluoride increases with increase of silicates for the same dose of alum and lime. Natural waters do not normally contain soluable silica beyond 30 mg/1 and hence the presence of silica need not adversely effect fluoride removal by Nalgonda Technique to any considerable extent.

5. Pilot Project of Domestic Defluoridation in Prakasam District, Andhra Pradesh

At the request of the Andhra Pradesh Government, a Pilot Plant Defluoridation Project on a domestic scale was undertaken by the NEERI scientists in Prakasam District in March 1974. The pilot project covered 119 villages in Podili, Darsi and Kanigiri taluqas of Prakasam District. The pilot project was a total success. The cost of domestic defluoridation worked out to be Rs. 5.34 per capita per annum @ 10/1pcd which was acceptable to everyone.

Continuing Projects

1. Development of Membrane filter of pore size less than 0.45 micron

A few batches of these membranes were prepared and tested. The test conditions were standardised.

2. Studies on Soluble Polyphosphates in Water and Degree of their Interference in Coagulation

The study is aimed at confirming the earlier observations on the effect of phosphates in coagulation of suspended matter in municipal water treatment plants. It has been reported in literature that phosphates interfere in the coagulation process, particularly during monsoon and consequently large doses of alum are required to produce good quality of settled water. The study included ortho, pyro—and tripolyphosphates. Floc size appears finer at phosphate concentrations above 2 mg/1 (p) indicating only marginal interference of phosphates, so far evaluated.

3. Sulphamic Acid as Stabiliser of Chlorine in aqueous solution

The results indicate that the per cent chlorine residuals last much longer in water treated with sulphamic acid.

4. Fluoride contribution by Food Materials

The following samples were analysed during the reporting period :

Material	Dry wt basis mg F/kg	Fresh wt basis mg F/kg
1. Cauli flower	30.4	2.75
2. Brinjal	23.1	2.58
3. Tomato	23.2	1.14
4. Methi leaves	30.04	5.73
5. Tabacco leaves	54.8	14.75
6. Rice	2.7	2.42
7. Wheat	2.1	1.90
8. Udad Dal	2.1	1.88
9. Jowar	2.4	2.11
10. Moong dal	2.1	1.89
11. Tuar dal	4.8	4.38

The procedure of Milton *et al.* was modified by NEERI in the estimation of fluorides in food materials.

New Projects

1. Preparation of Magnetic Iron Oxide for Virology Studies

A method for the preparation of magnetic iron oxide, has been developed by NEERI. The product is found to be satisfactory for the concentration of viruses in large volumes of water.

2. Efficiency of Clay Minerals in the removal of Soluble Polyphosphates in water treatment

Exploratory work has indicated a possibility of polyphosphate removal by clay minerals and this requires to be studied systematically.

Analytical Technique Development

Completed Project

1. Development of Poison Removal Kit

Experimental tests on the kit have been completed and it is established that the kit is capable of removing suspended solids, dissolved solids (upto 10,000 mg/1) and poisons (arsenic, copper, chromium, cadmium, mercury, lead and cyanide) from two litres of water at a time. However, toxicity studies could not be carried out on the raw and effluent water samples due to lack of adequate facilities in the Institute. The project is completed and may be continued again when facilities for toxicity evaluation are available.

Continuing Projects

1. Fluoride Electode

Keeping in view the increasing interest in fluoride estimations, attempts were made for constructing the fluoride electrode indigenously. Encouraging results were obtained and further work is in progress for preparing suitable lanthanum fluoride membrane.

2. Studies on Estimation of Heavy Metals

Studies on heavy metals estimation are being continued. Wet methods are followed for these estimations. However, lead and copper are being estimated using the ion electrodes. Arsenic, chromium, cadmium, zinc and cyanide are estimated as per Standard Methods (silver diethyl dithiocarbonate method for As, diphenylcarbazide method for Cr, dithizone method for Cd and Zn, pyridine-pyrazolone method for cyanide). Calibration graphs of electrode potentials versus activity has been plotted for copper, lead and cyanide. Recovery studies of copper, chromium, arsenic and cyanide from tap water have been made. Known amounts of copper (as cupric sulphate) were added to the tap water and its recovery was studied by the cuprethol method. Similarly recovery of chromium, arsenic and cyanide (added as potassium dichromate, sodium arsenate and sodium cyanide) was studied by the respective methods.

New Projects

1. Study on Water Quality of Well Waters with particular reference to Nitrates and Nitrites in and around Nagpur City

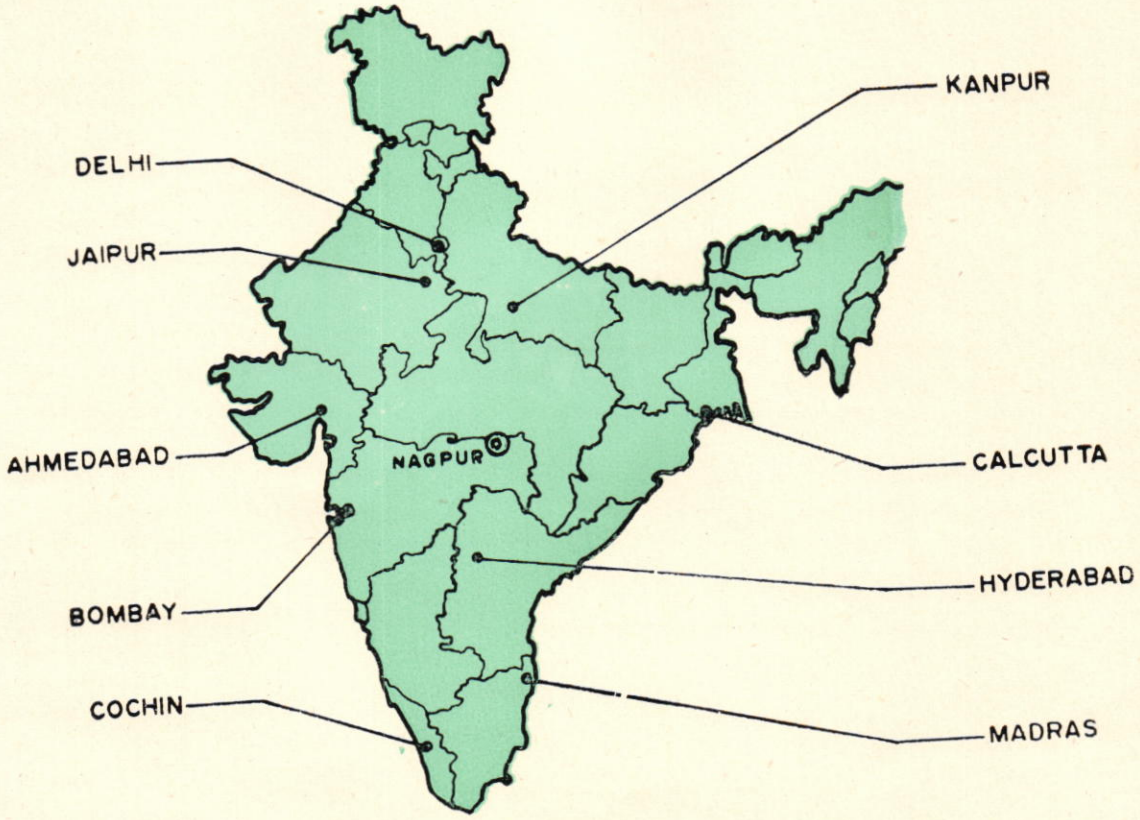
Nitrates and nitrites are among the priority list of pollutants and environmental health hazards in the WHO Environmental Criteria Programme. Nitrate in drinking water was first associated in 1945 with a temporary blood disorder in infants called methemoglobinemia, which causes serious illness and on occosion death when infants consume water containing concentrations gerater than 10 mg nitrate nitrogen/1. With

this information, it was considered worthwhile to assess the concentrations of nitrates, nitrites in well waters of Nagpur city and nearby areas. Survey of some of the well waters of Gandhibagh and Jawahar Nagar area of Nagpur City have been made to investigate the concentrations of nitrates and nitrites. Other physico-chemical characteristics have also been studied simultaneously.

2. Studies on Instrumental Techniques

Preliminary studies for the standardisation and development of atomic absorption spectrophotometric, gas-liquid chromatographic and polarographic methods for the estimation of trace pollutants have been completed.

ZONAL LABORATORIES



THE INSTITUTE SERVES THE NATION THROUGH NAGPUR AND 9 ZONAL LABORATORIES

NEERI Ahmedabad Zonal Laboratory,
Suburban-Sub-Pumping Station
(Beyond Calico Mills),
Sewage Farm Road,
Ahmedabad-380 022 (Gujarat)

NEERI Bombay Zonal Laboratory,
89 B, Dr. Annie Besant Road,
Worli,
Bombay-400 018 (Maharashtra)

NEERI Calcutta Zonal Laboratory,
Fourth Floor of Premises No. 23
R. N. Mukerjee Road,
Calcutta-700 001 (West Bengal)

NEERI Delhi Zonal Laboratory,
Chandrawal Water Works-II,
Lala Shyamnath Marg,
Delhi-110 054

NEERI Hyderabad Zonal Laboratory,
RRL Campus,
Hyderabad-500 009 (Andhra Pradesh)

NEERI Jaipur Zonal Laboratory,
First floor, Chemistry Block,
Malviya Regional
Engineering College,
Jaipur-302 004 (Rajasthan)

NEERI Kanpur Zonal Laboratory,
6/33, Civil Lines,
Kanpur-208 002 (Uttar Pradesh)

NEERI Madras Zonal Laboratory,
CSIR Campus, Adyar,
Madras-600 020 (Tamil Nadu)

NEERI Cochin Zonal Laboratory,
CSIR Complex,
Kalamaserry Development Plot,
Kalamaserry (South)-683 104
(Kerala).

ZONAL LABORATORIES

Besides the research projects that are listed under each Zonal Laboratory separately, these laboratories took part in the following activities :

1. In organising training programmes—both the Institute's own as well as those conducted in collaboration with outside organisations.

2. Meetings of the State Water Pollution Control Boards of the respective States, where such Boards have been established.

3. Meetings of the reconstituted Advisory Committees of the Zonal Laboratories to formulate guidelines for R & D activities.

4. Assisting the Headquarters of the Institute on the various sponsored projects from various organisations located in their respective region. Analysis of water and waste water samples was also carried out on behalf of several parties.

5. Collection of data on the Long-term Air Quality Survey in the respective cities and forwarding the information in the prescribed proforma to Headquarters for necessary compilation.

6. Short-term Consultancy Services to various industries on air pollution, solid waste management and water pollution problems have been taken up and reports submitted.

AHMEDABAD

Completed Projects

1. Characterisation and Treatibility Studies on effluents discharged by the factory of M/s Madhusudan Vegetable Oil Products Ltd., Ahmedabad

The project has been completed and a detail project report has been submitted to the sponsor with regard to biological treatment for BOD reduction and disposal of wastes. Based on the results of laboratory studies, design criteria for areated lagoon and oxidation ditch were developed.

2. Characterisation of Wastes and their Treatment at M/s Farmsons Pharmaceutical Works, Vallabh Vidyanagar, Kaira

The pollution load of the effluent from the factory was found to be considerably high in terms of COD, suspended solids, phenol and sulphate. A feasibility report has been submitted to the sponsor.

Continuing Projects

1. Performance Studies on the Municipal Sewage Treatment Plant at Vasna

The performance of the plant was studied during two seasons in 1975-76 i.e. during summer and winter, to assess the efficiency of the plant with regard to BOD reduction and suspended solids removal. The project has been sponsored by the Ahmedabad Municipal Corporation.

2. Performance Studies on Waste Stabilisation Ponds

This project is being undertaken with a view to assess the performance of the ponds which are in regular operation at Anand and Kolol in North Gujarat. The Public

Health Engineering Department, Gujarat has installed a number of oxidation ponds for waste treatment in the State.

3. Characterisation of Textile Mill Effluents

The process waste streams from textile mills in Ahmedabad are presently being discharged entirely into the city's sewerage system. This study is being undertaken with a view to determine the characteristics from the point of reclamation and reuse of waste water.

4. Industrial Wastes Survey at the Gujarat Industrial Development Corporation (GIDC) Estate at Vapi

The GIDC Estate has about 300 industrial units including 140 water intake units consisting of chemical dyes, pharmaceuticals, paper and textile manufacturing units which contribute nearly 0.25 mgd of highly concentrated effluents. Studies are being conducted to determine the pollutional effects of the effluents in the receiving streams, the nature and degree of treatment required and to advise the sponsors, M/s. GIDC on standards for effluent quality.

5. Bioassay Studies to determine the Toxicity of Insecticides and Pesticides

This study was initiated to determine the toxicity of commonly used pesticides such as endrine, malathion, aldrin, DDT and BHC by bioassay methods.

BOMBAY

Continuing Projects

1. Characterisation of Wastes from a Petrochemical Industry

Samples of effluent from different plants of M/s Fertilizer Corporation of India and M/s Union Carbide were collected and analysed. A simple method of effluent treatment for wastes from FCI has been suggested.

2. Air Quality Survey of Chembur-Trombay area

Three sampling stations were established in residential areas of Chembur-Trombay region and the concentration of the common air pollutants were measured. A study of seasonal variation of pollutants has been carried out. The Bombay Zonal Laboratory assisted the Air Pollution Division at Headquarters in this survey. The sponsor of this collaborative project was the Maharashtra Prevention of Water Pollution Board, Bombay.

3. Effect of Air Quality on Health

Air quality monitoring was carried out in Bombay City near Khar Railway Station. The information connected with health status of school children was collected together with their heights and weights. The project was taken up in collaboration with the Maharashtra Prevention of Water Pollution Board, Bombay and the report has been submitted.

4. Cultivation of Citronella Grass using sewage effluent from Municipal Sewage Treatment Plant at Dharavi

Soil and sewage used were analysed to know their effect on the growth of citronella. It was observed that sewage effluent is suitable and can be used with profit for citronella cultivation. The sponsor of this collaborative project is the Bombay Municipal Corporation.

5. Atmospheric Corrosion Studies

Standard candles coated with lead peroxide and tin coated MS plates were exposed to atmosphere for different periods so as to find out the sulfation and corrosion rates. The rust from the tin coated plates were analysed to know the causes of corrosion. It was observed that humidity, salinity, oxides of sulphur and temperature are responsible for corrosion. In Worli area, humidity and salinity being high the corroiion rates are higher. The project was sponsored by M/s Metal Box Co. of India Ltd.. and a report has been submitted.

6. Characterisation and incineration of refuse

Samples of refuse brought from the dumping site were analysed for determining the physical characteristics. It contained a large percentage of moisture with less of easily combustible material like paper, plastics, straw and dry leaves. Hence these could not be burnt without the use of an auxillary fuel. Dry refuse consisting of packing grass if mixed with it in the ratio of 4:1could burn on its own. The stack emissions were studied for dust content. They were found to be within limits. The project was taken up in collaboration with Bombay Municipal Corporation and a report has been submitted.

Continuing Project

1. Chemical Analysis of water samples from Thana Creek

The Thana Creek receives industrial wastes from various industries situated in its vicinity. At present very few industries are discharging their wastes directly into the Creek. This survey is making a study of the present level of pollution. The project has been spsonsored by the Maharashtra Prevention of Water Pollution Board.

New Project

1. Sewage Disposal of Greater Bombay

Raw sewage, treated effluent and sludge from seven different plants and outfall stations were analysed for 20 different parameters and particularly with regard to irrigatios properties. Data on the design of sewage treatment plant has been collected and submitted to M/s Metcalf & Environmental Engineering Consultants. Percolation tests are being carried out and open ditches have been examined to study soil profile. The Bombay Zonal Laboratory is assisting the Sewage Treatment Division at Headquarters in carrying out this project.

CALCUTTA

Completed Projects

1. Survey of Wastewater Outfalls discharged into the Hooghly Estuary within Calcutta and Howrah Corporation limits

All the 113 wastewater outfalls which have outlets into the Hooghly Estuary and situated within the Calcutta and Howrah Corporation limits were located. Grab samples and flow rate at the time of collection from these outfalls were taken. These outfalls have a total flow of 7,40,000 m^3 /day, BOD load of 67 tonnes/day, COD load of 271 tonnes/day and suspended solids load of 165 tonnes/day. The Calcutta Metropolitan Development Authority (CMDA), Calcutta sponsored this project.

2. Survey of Bathing Ghats on Hooghly Estuary within Calcutta and Howrah Corporation limits

Six bathing ghats were selected on either side of Hooghly Estuary for bacteriological examination. Throughout the stretch the coliform count was very high. Faecal pollution was confirmed by the presence of high count of faecal streptococci. The study revealed that the entire stretch of Hooghly Estuary is of poor quality water and is not suitable for bathing and recreational activities. The project was sponsored by Calcutta Metropolitan Development Authority (CMDA), Calcutta.

3. Treatment of Effluents from Bowreah Cotton Mills Ltd., Bowreah

Three inplant surveys were undertaken. Bowreah Cotton Mills located at Bowreah in Hooghly District discharges its wastes effluents into the Hooghly Estuary. The report which comprised of treatment alternatives has been submitted to the sponsor, M/s Bowreah Cotton Mills Ltd., Bowreah, West Bengal.

4. Treatment and Disposal of Pulp and Paper Mill Effluent from Bengal Paper Mills

The sponsor, M/s Bengal Paper Mills employ kraft process for the manufacture of variety of papers. Inplant surveys and waste water sampling at the three drains

were carried out. Based on the characteristics of the wastewater, treatment alternatives have been proposed. A report has been submitted to the sponsor.

Continuing Projects

1. Air Pollution Survey for Calcutta and Howrah

Stack sampling programme has been carried out in Calcutta City and the nature and magnitude of emissions from stacks of various industries were estimated. Vertical temperature profile study has been carried out during these studies and existence of "Inversion phenomenon" has been estabished. On the basis of the data collected, short and long term measures have been recommended to clear the ambient air in the twin cities. During the last three years, two reports "Interim" and 'Mid-term" were submitted to the sponsor, M/s Calcutta Metropolitan Development Authority (CMDA), Calcutta.

2. Salinity Levels in Hooghly Estuary at selected points

The objective of these studies are to assess the chloride levels in Hooghly river water after the commissioning of the Farakka Channel at the proposed water work intake points. Samples of Hooghly River Water during high and low tides were collected at the proposed water work intake points at Garden Reach and Howrah. The Calcutta Metropolitan Development Authority (CMDA), Calcutta is the sponsor of this project.

New Projects

1. Water Quality of Hooghly Estuary at the five water-work intake points

Sampling of water from Hooghly Estuary at the five water work intake points at Patla, Serampore, Kamarhati (Barranagar), Garden Reach and Howrah Water Works were carried out during low and high tides and during all seasons on behalf of the sponsor, M/s Calcutta Metropolitan Development Authority (CMDA), Calcutta.

2. Preventive Maintenance of Water Distribution System at selected zones in Calcutta

At selected zones of Jorasanko and Wellington, the leakages through pipes and valves were located and repaired. Cleaning of water main, determination of hydraulic capacity of old mains and survey for 'C' value determination were carried out. The Calcutta Corporation is the sponsor of this project. The NEERI Calcutta Zonal Laboratory is assisting the Preventive Maintenance Cell at Headquarters in carrying out this project.

COCHIN

R & D activities have yet to be taken up by this newly opened Zonal Laboratory.

DELHI

Completed Projects

1. Keetham Lake Survey for Mathura Refinery Water Supply

Four surveys were conducted for chemical, bacteriological and biological qualities of the Keetham Lake and Agra Escape Canal with a view to determine the water quality of these two water sources. Sludge analysis, bioassay studies and nature of water hyacinth growth were also conducted for the sponsor, M/s Indian Oil Corporation who propose to locate a petroleum refinery at Mathura, Uttar Pradesh and tap the Keetham Lake or Agra Escape Canal for water supply.

2. Water Quality Monitoring for Municipal Corporation of Delhi

The water supply to the Nation's capital from the Delhi Water Supply and Sewage Undertaking was monitored for chemical and bacteriological quality. The Delhi Municipal Corporation sponsored this project.

3. Air Pollution Survey around Indraprastha Thermal Power Station

The Delhi Zonal Laboratory staff assisted the Air Pollution Division at Headquarters in carrying out this survey work on behalf of the sponsor, M/s Indian Oil Corporation, New Delhi who propose to set-up an oil refinery at Mathura, near Agra.

Continuing Projects

1. Studies at Okhla Sewage Treatment Plant

Various phases of sewage treatment at the Okhla Sewage Treatment Plant of the Delhi Municipal Corporation are being studied to determine the efficiency of the settling tanks, effect of ABS on plants irrigated with sewage.

2. Baseline Air Quality Survey at Agra

The air pollution survey has been taken up in connection with Indian Oil Corporation's proposed refinery at Mathura, near Agra. The Delhi Zonal Laboratory assisted the Air Pollution Division at Headquarters in conducting this study.

3. Plant-scale Studies on Declining Rate Filtration

At Chandrawal Water Works No. 2 of the Delhi Municipal Corporation, studies on the feasibility of declining rate filtration under field conditions of water quality variations were carried out. The assisting beds have been studied and two beds have been chosen, one for declining and another for constant rate. An online turbidity meter has been installed.

New Projects

1. Jamuna River Survey

The degree of pollution in terms of physical, chemical, bacteriological and biological parameters in being determined. Samples are being collected once a month from the six sampling stations along the river course.

HYDERABAD

Completed Project

1. Methyl-Benzimidazole Carbonate (MBC) Waste from Pesticide Plant

Three alternatives for waste disposal have been suggested. These are : disposal by solar evaporation, disposal into an effluent channel and disposal on land by irrigation. The project report has been submitted to the Director, Regional Research Laboratory, Hyderabad, Andhra Pradesh.

Continuing Project

1. Treatment of Industrial Wastes from Synthetic Drugs Plant—Phase I

The period of study was ultilised to update the drainage maps, marking various equipment and to check the data on waste waters which was provided by the sponsors, M/s Indian Drugs and Pharmaceuticals Ltd., Hyderabad.

New Project

1. Pollution Studies of Kukatpalli Nallah and Hussain Sagar

The Kukatpalli Nallah and Hussain Sagar are heavily polluted due to wastes discharged by industries situated in the industrial estate of Balanagar and Sanathnagar. This project has been taken on collabortive arrangements with the Andhra Pradesh Board for Prevention and Control of Water Pollution. NEERI is providing technical guidance.

JAIPUR

Continuing Project

1. Air Quality Monitoring at Jaipur

To determine air quality, particulate matter in air, sulphation rates, gaseous pollutants and dust fall out rates are being studied. This is part of the national programme of air pollution monitoring and is being co-ordinated by the Air Pollution Division at Headquarters.

KANPUR

Completed Projects

1. Studies on the Treatment of Vegetable Tanning Wastes

A cheaper and an efficient method of treatment of vegetable tanning wastes has been developed.

2. Inplant Survey and Characterisation of waste water from various types of industries

Inplant survey and characterisation of waste water from the following industries were carried out :

(i) M/s The Mahabir Sugar Mills Pvt. Ltd., Siswar Bazar;

(ii) M/s The Lakshmi Devi Sugar Mills Pvt. Ltd., Chhitauni;

(iii) M/s The Lakhmiji Sugar Mills Co. Ltd., Maholi;

(iv) M/s Brooke Bond India Ltd., Tundla, Agra; and

(v) M/s Bapur Distillery, Bazpur.

Continuing Projects

1. Treatment of Tanning Wastes at TAFCO

Inplant survey and characterisation of effluents from the factories of the sponsor, M/s Tannery & Footwear Corporation of India, Kanpur has been completed and work is in progress to develop a flow-sheet for the treatment of waste waters.

2. Residual Pesticides in Non-vegetarian Foodstuffs

The estimation of residual pesticides in milk and fish samples have been determined by thin layer chromatography and efforts are being made to carry out the studies using gas-liquid chromatography.

3. Treatibility of Slaughter House Wastes

Studies are in progress to find out an effective and economical treatment method of slaughter house wastes by modifying the conventional process of anaerobic digestion.

4. Air Quality Monitoring at Kanpur

Air monitoring studies to determine air quality, particulate matter in air, sulphation rates, gaseous pollutants and dust fall out rates are being studied. This is part of the national programme of air pollution monitoring and is being coordinated by the Air Pollution Division at Headquarters.

New Projects

1. Characterisation and Treatibility of Effluents from M/s Synthetic and Chemicals Ltd., Bareilly, Uttar Pradesh

Laboratory studies have been conducted to determine the suitability and dosage of different coagulants. Studies on the biological treatment of waste water is under progress. M/s Synthetic and Chemicals Ltd., has sponsored the project.

2. Industrial Survey of Kanpur-Unnao belt, Uttar Pradesh

Inplant surveys and sampling of waste waters from seven industries in the Kanpur—Unnao belt are being carried out. The Directorate of Industries, Uttar Pradesh is the sponsor for this project.

MADRAS

Continuing Projects

1. Characterisation and Treatment of Tannery Wastes

Inplant surveys were carried out in two tanneries in North Arcot district with a view to collect information on the quality and quantity of individual as well as composite wastes. Based on these studies, detailed engineering drawings for a demonstration unit to be set up at Ranipet were prepared. This collaborative project is sponsored by the Central Leather Research Institute, (CLRI) Madras.

2. Air Quality Monitoring at Madras

Air monitoring studies to determine air quality, particulate matter in air, sulphation rates, gaseous pollutants and dust fall out rates are being continued. This is part of the national programme of air pollution monitoring and is being coordinated by the Air Pollution Division at Headquarters.

New Projects

1. Optimisation of Aerators for Industrial Waste Treatment

A laboratory model of an aerator has been designed. This study will provide the basic data for developing aerators for various industrial uses.

2. Survival of Bacteria and Viruses during treatment of Sewage for Reclamation and Reuse

This is an Institute's own project and is being carried out in collaboration with the Tamil Nadu Water and Drainage Board. The survival of enteric bacteria and pathogens during different stages of treatment in the oxidation pond were studied with the assistance of the College of Engineering Guindy, Madras. The effect of the treated effluent on ground was also investigated.

3. Studies on Pollution of Well Waters in Madras City and Bhadra River Water

This is being carried out on :

(i) Bhadra River Water near Kudremukh on behalf of the sponsor, M/s National Mineral Development Corporation; and

(ii) Well waters in Madras city to determine the quality of water with respect to bacteriological quality.

OTHER ACTIVITIES

CONSULTATION

The Institute through its Consultancy Cell continued to render assistance to government departments, corporations, municipalities, industries and local bodies on problems in the field of environmental engineering and science. The consultancy services attended to during the year are given below :—

Consultation Projects completed in 1976

Sl. No.	Title of the Project	Sponsor	Work carried out by
1.	Effluent treatment for proposed distillery at Chagallu	Govt. Distillery Chagallu (A.P.).	Consultation Cell
2.	Effluent treatment of a distillery	Gujchem Distillery (India Ltd., Bilimora, Gujarat.	Consultation Cell
3.	Effluent treatment for the distillery	Bazpur Co-operative Sugar Factory, Bazpur, Nainital Distt.	Consultation Cell
4.	Effluent treatment for a paper mill	Amaravati Sri Venkatesa Paper Mills Ltd., Madathukulam, Tamil Nadu	Madras Zonal Laboratory & Consultation Cell
5.	Characterisation of waste water from M/s Tapioca Products	The Tapioca Products, Chalakudy, Kerala.	Madras Zonal Laboratory & Consultation Cell
6.	Effluent treatment for a Textile Mill	Bowreah Cotton Mills, Bauria, West Bengal.	Consultation Cell
7.	Characterisation of waste water from a textile mill	Binny Limited, Bangalore.	Madras Zonal Laboratory & Consultation Cell

Sl. No.	Title of the Project	Sponsor	Work carried out by
8.	Effluent treatment for a paper mill	Mandya National Paper Mills, Belagula, Mysore District.	Madras Zonal Laboratory & Consultation Cell
9.	Effluent treatment for proposed wool development centre	Public Health Engineering Department, Srinagar.	Delhi Zonal Laboratory & Consultation Cell
10.	Effluent treatment for a paper mill	Star Paper Mill, Saharanpur (U.P.)	Delhi Zonal Laboratory & Consultation Cell
11.	Performance of waste treatment plant	Bank Note Press, Dewas.	Consultation Cell
12.	Effluent treatment for paints and varnish works	Modi Paint and Varnish Works, Modinagar (U.P.)	Consultation Cell
13.	Effluent treatment for a synthetics factory	J. K. Synthetics Ltd., Kota.	Jaipur Zonal Laboratory & Consultation Cell
14.	Effluent Treatment for a paper mill	Punalur Paper Mills, Punalur (Kerala)	Madras Zonal Laboratory & Consultation Cell
15.	Sewage Disposal for a township	Bharat Aluminium Co., Belgaum	Consultation Cell
16.	Effluent treatment for a sugar factory	M/s Ganganagar Sugar Mills, Rajasthan	Jaipur Zonal Laboratory & Consultation Cell
17.	Effluent treatment for a vanaspati factory	M/s R. C. S. Vanaspati Factory, Jaipur Rajsthn.	Jaipur Zonal Laboratory & Consultation Cell
18.	Effluent treatment for textile mills	M/s Rajasthan State Industrial & Mineral Development Corporation, Jaipur, Rajasthan	Jaipur Zonal Laboratory & Consultation Cell

Sl. No.	Title of the Project	Sponsor	Work carried out by
19.	Effluent treatment for a steel industry	M/s Kamani Engineering Corporation Jaipur, Rajasthan	Jaipur Zonal Laboratory & Consultation Cell
20.	Effluent treatment for a metal industry	M/s Multimetals, Kota, Rajasthan	Jaipur Zonal Laboratory & Consultation Cell
21.	Air pollution study for chemical factory	M/s Resin & Chemicals, Jodhpur, Rajasthan	Jaipur Zonal Laboratory & Consultation Cell

Consultation Projects in Progress

Sl. No.	Title of the Project	Sponsor	Work carried out by
1.	Performance study of sewage treatment plant	Ahmedabad Municipal Corporation, Ahmedabad	Consultation Cell
2.	Advice on location of industries	SIPCOT, Tamil Nadu	Consultation Cell
3.	Advice on location of industries	CIDCO, Bombay	Consultation Cell
4.	Performance Study of Sewage Treatment Plant	Brakes India Ltd., Madras	Consultation Cell Madras Zonal Laboratory
5.	Effluent treatment for insulated cables	Deepak Insulated Cable Corporation Ltd., Bangalore	Madras Zonal Laboratory & Consultation Cell
6.	Effluent treatment for a distillery	Gemini Distilleries, Bangalore	Madras Zonal Laboratory & Consultation Cell

S. No.	Title of the Project	Sponsors	Work carried out by
7.	Effluent treatment for a distillery	Pampasar Distillery, Pampasar, Karnataka	Madras Zonal Laboratory & Consultation Cell
8.	Effluent treatment for a vegetable oil industry	Madhusudan Vegetable Products, Ahmedabad	Ahmedabad Zonal Laboratory & Consultation Cell
9.	Effluent treatment for Heavy Electricals Plant	BHEL (Boilers), Trichy, Tamil Nadu	Madras Zonal Laboratory & Consultation Cell
10.	Effluent treatment for a cellulose factory	Sri Sai Baba Cellulose Ltd., Patancheru (A.P.)	Hyderabad Zonal Laboratory & Consultation Cell
11.	Effluent treatment for an industrial complex at Unnao.	Deptt. of Industries, U.P.	Consultation Cell
12.	Starting an oxidation ditch	India Tobacco Co. (ITC) Ltd., Agra	Delhi Zonal Laboratory & Consultation Cell
13.	Effluent treatment for a textile mill	The Coimbatore Pioneer Mills Ltd., Erode	Madras Zonal Laboratory & Consultation Cell
14.	Effluent treatment for a milk plant	Paschim Rajasthan Dugdha Sahakari Mandal Ltd., Jodhpur	Consultation Cell
15.	Effluent treatment for a rubber chemical plant	Alkali & Chemicals Ltd., (ICI), Rishra (West Bengal)	Consultation Cell
16.	Effluent treatment for a tannery	Elegant Leathers Ltd., Kanpur	Consultation Cell
17.	Effluent treatment for a sugar factory	Vanivilasa Co-op. Sugar Factory Ltd., Karnataka	Madras Zonal Laboratory & Consultation Cell

S. No.	Title of the Project	Sponsors	Work carried out by
18.	Effluent treatment for a milk plant	Uttari Rajasthan Milk Co-op. Society, Bikaner	Consultation Cell
19.	Treatment of sewage by low cost methods	M/s Mysore Kirloskar Ltd., Harihar	Madras Zonal Laboratory & Consultation Cell
20.	Treatment and disposal of wastes	M/s Kissan Products, Bangalore	Madras Zonal Laboratory & Consultation Cell
21.	Sewage reclamation for horticulture	Jawaharlal Nehru University, New Delhi	Delhi Zonal Laboratory
22.	Characterisation of effluents	M/s Aditya Mills, Kishangarh, Rajasthan	Jaipur Zonal Laboratory

SYMPOSIA & SEMINARS

AT ALL-INDIA LEVEL

(i) Second National Convention on 'Environmental Engineering' at New Delhi

The Second National Convention on 'Environmental Engineering' was held at the Indian Institute of Technology, New Delhi on 21-23 February, 1976 in collaboration with the Institution of Public Health Engineers, Calcutta and NEERI, Nagpur.

(ii) Eighth Annual Convention of the Indian Water Works Association at Nagpur

The Eighth Annual Convention of the Indian Water Works Association (IWWA) was held at NEERI Nagpur in collaboration with the IWWA on 2-4 February, 1976. This was followed by the one-day Convention of the Indian Association for Water Pollution Control on 5 February, 1976 at the Institute.

(iii) All-India Seminar on Environmental Control at Kanpur

An All-India Seminar on 'Environmental Control' was organised by the Hartcourt Butler Technological Institute (HBTI) Kanpur, the Kanpur University and NEERI at Kanpur on 12-13 March, 1976.

AT INSTITUTE

Seminars are a regular activity of the Institute for the dissemination of information and discussions. This enables our scientists to keep abreast with the latest development in the field of environmental engineering and science and related aspects in research and development

The office-bearers of the Seminar Group are :

Chairman : Ex-Officio : Prof. N. Majumdar*
Director
Shri J. M. Dave **
Scientist-in-charge

Convener : Shri A. D. Bhide

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* Till 1.12.76

** From 1.12.76 and onwards

Sl.No.	Speaker	Date	Title
1.	Shri V. Raman Scientist, NEERI	16.1.1976	Comprehensive Rural Water Supply Programme in Iraq.
2.	Shri S. K. Maira Scientist, NEERI	23.1.1976	Stack Sampling.
3.	Dr. D. Djurich W.H.O. Consultant	6.2.1976	Research on Environmental Lead Concentration.
4.	Prof. F. Green Assistant Administer U.S., E.P.A.	11.2.1976	Environmental Planning in U.S.A.
5.	Shri V. R. Apte Scientist, NEERI	13.2.1976	Fluorescent Tracers.
6.	Dr. B. L. Dybern F.A.O. Consultant	17.2.1976	Activities of F.A.O. in Fisheries and Pollution Field.
7.	Dr. J. C. Dodd Caldwell & Connel Engineers Pvt. Ltd., Melbourne, Australia.	27.2.1976	Algae Harvesting for Protein Production from Waste Water.
8.	Dr. P. M. Phirke Scientist, NEERI	12.3.1976	Rapid Agar Pour Plate Technique for Detection and Enumeration of Faecal Coliforms in Sewage.
9.	Dr. C. R. V. Raman Dy. Director General Meteorology Dept. New Delhi	29.3.1976	Climatology and Air Pollution.
10.	Shri C. Subbarayudu Hon'ble Minister for Municipal Administration Andhra Pradesh.	3.5.1976	Environmental Problems in Andhra Pradesh
11.	Shri P. Kumaran Scientist, NEERI	15.5.1976	Phenol Metabolism in Candida Tropicalis.
12.	Dr. M. G. McGarry Programme Officer, International Development Research Centre, Canada	3.6.1976	Activities of IDRC, Canada in Environmental Field.
13.	Mr. W. Martin W.H.O. Consultant Switzerland	23.7.1976	Air Quality Management Standard.

14.	Shri K. Ganesan Scientist, NEERI	10.9.1976	Air Pollution Survey of New Bombay.
15.	Dr. R. Perry W.H.O. Consultant U. K.	17.9.1976	Air Pollution Research— The Analytical Requirements.
16.	Dr. R. Perry W.H.O. Consultant U.K.	24.9.1976	Modern Analytical Procedures used in Water Quality Monitoring.
17.	Shri T. N. Ramaprasad Scientist, NEERI	8.10.1976	Observations on the Nightsoil Digester at Central Prison, Nagpur.
18.	Mr. G. E. Eden Assistant Director, WRC, Stevenege Laboratory, Stevenage, U.K.	11.10.1976	Water Situation in England.
19.	Mr. G. E. Eden, Assistant Director, WRC, Stevenage Laboratory, Stevenage, U.K.	12.10.1976	Water Research in U. K.
20.	Dr. B. D. Nag Choudhari, Vice-Chancellor, Jawaharlal Nehru University, New Delhi and Dr. A. K. Ganguly, Director Chemical Group, BARC, Bombay	29.10.1976 29.10.1976	Coordination in Environmental Pollution Control Activities in India.
21.	Dr. S. N. Kakde Scientist, NEERI	29.11.1976	Enzyme Approach on the Enumeration of Sewage Micro-Organisms.
22.	Shri N. Shivaraman Scientist, NEERI	24.12.1976	Phenol Metabolism in Candida Tropicalis (II).

TRAINING, INFORMATION, LIBRARY AND EXTENSION (TILE)

Training

A. INSTITUTE'S PROGRAMME

1. The Institute organised seven regular training/refresher courses during the year

These courses were held at Nagpur, Hyderabad and Pune. Three of the training programmes were sponsored by CPHEEO, Ministry of Works and Housing, one by the National Safety Council and remaining three were Institute's own. Course manuals for some training courses were prepared for the use of the participatants :

Sl. No.	Name of the course	In collaboration with/venue	Dated	No. of Participants
1.	Preventive Maintenance of Water distribution system.	CPHEEO/Hyderabad	12-1-76 to 28-1-76	46
2.	Chlorination and use of Chlorinators	IWWA, Bombay & M/s Candy Filters/Pune	24-4-76 to 28-4-76	28
3.	Process design in Water Analysis	NEERI/Nagpur	15-6-76 to 15-7-76	13
4.	Water & Waste Water Analysis.	NEERI/Nagpur	26-7-76 to 29-9-76	15
5.	Sewage Works Supervisors.	CPHEEO/Nagpur	10-11-76 to 7-12-76	9
6.	Solid Waste Management.	CPHEEO/Nagpur	22-11-76 to 26-11-76	19
7.	Environmental Microbiology.	NEERI/Nagpur	14-12-76 to 31-12-76	3

2. Refresher Course for Chairmen and Member-Secretaries of the State Water Pollution Control Boards

The Institute conducted a seven-day refresher course for Chairmen and Member-Secretaries of Water Pollution Boards of various States at Nagpur during 5-12 Nov. 76. The course was organised jointly by NEERI and Central Board for Prevention and Control of Water Pollution, New Delhi.

B. TRAINING COURSE CONDUCTED BY OTHER ORGANISATION

The following staff member attended, training course conducted by other organisation :—

(i) Shri R. K. Saraf, Scientist, TILE Division attended the R&D Project Management Workshop-cum-training course convened by the CSIR at the National Institute of Oceanography, Goa from 13-20 January 1976.

(ii) Dr. V. I. Pandit of Air Pollution Division returned after completing advance training in Air Pollution Control in West Germany on a German Academic Exchange Fellowship from December 1974 to March 1976.

(iii) Dr. N. M. Parhad, Scientist-in-charge, Bacteriology Cell, Life Sciences Division completed advanced training in Japan on a five-month programme from February-July, 1976 on a Fellowship of the Japan International Co-operation Agency, Tokyo.

(iv) Dr. N. M. Parhad, Scientist-in-charge. Bacteriology Cell, Life Sciences Division, completed a three-month course from 18 July to 20 October 1976 in USA on a WHO Fellowship.

(v) Shri V. Hanumanulu, Scientist, Consultation Cell, completed a 12-week advanced training in "Marine and Estuarine Pollution Control" in U.K., Denmark and Netherlands on a WHO Fellowship.

Information

AUDIO VISUAL ACTIVITIES

(i) Tape-slide Shows

Visitors and trainees who participated in the Institute's training programmes were given an insight of the Institute's research and development activities in the field of environmental pollution and control with the aid of tape-slide shows at the Institute.

(ii) Display Room

It provides a total glimpse of the various R&D activities in progress at the Institute. On display are indigenous equipment and flow sheets developed by the Institute. It is also equipped with miniature working models, charts, transparencies and visual aids.

(iii) Exhibitions

The Institute's work in the field of research and development was projected through various international and national exhibitions including the following :

1. The "Eastern India Science Exhibition and Science Camp-1976" organised under the aegis of the Birla Industrial & Technological Museum at Calcutta from 28 February to 7 March 1976.

2. Exhibition on "Application of Technology to Rural India" organised by the Council for Application & Extension of Technology to Rural India held at New Delhi on 15-25 July 1976.

3. "The World Instrumentation Symposium & International Trade Exposition-76" (WISITEX-76) held New Delhi from 22-28 November 1976.

W.H.O. COLLABORATING CENTRE

The Institute is a WHO Collaborating Centre on Community Water Supply, Waste Disposal and Air Pollution in the South-East Asia Region. Data for which WHO has an interest was furnished regularly to the respective WHO International Reference Centres.

Publications

(i) Indian Journal of Environmental Health

The Eighteenth Volume of IJEH was published during the year. The total number of subscribers were about 950 which include various research and educational institutions both in India and abroad. About 45 issues were sent to various organisations on exchange basis.

(ii) Technical Digest

The following topics were covered in the quarterly issues of the year :

1.	January 1976	...	Solid Waste Management in Indian Cities—Present Status.
2.	April 1976	...	Natural Coagulant Aids

3.	July 1976	...	Wood Charcoal Powder as Filter Aid
4.	October 1976	...	Cellulose Acetate-Reverse Osmosis Membranes

(iii) A Guide to Current Literature in Environmental Health, Engineering and Science

This is a fortnightly publication. It provides up-to-date information on environmental health, engineering and science.

(iv) Special Publications

The following publications were brought out during the year 1976 :—

1. Annual Report — 1975.
2. Directory of Environmental Organisations in India.
3. A leaflet on "Chlorine Tablets, Chlorine Ampoules and Chloroscope" (Hindi). (क्लोरीन टिकियां, क्लोरीन एम्प्यूल और क्लोरोस्कोप)
4. ग्रामीण शौचालय (संशोधित संस्करण)

Documentation & Library Services

(i) Facilities to Outsiders

Library and literature search facilities were made available to colleges, universities, research institutions and industries. Over 100 research workers availed of this facility during the year.

(ii) Current Awareness Service

The Institute continued to bring out "A Guide to Current Literature in Environmental Health Engineering & Science" which is a fortnightly current awareness service. This guide serves as a medium for dissemination of information about currently published literature in the field. As many as 4167 papers of interest culled from 1540 issues of various journals were brought to the notice of the scientists, engineers and technologists through this service during the year. Besides serving as a current awareness tool the guide also serves as an aid for retrieval of relevant information.

(iii) Environmental Engineering-News Index

A number of news items giving environmental information appear in various newspapers. The Institute continues to document these press clippings. Drawing exten-

sively from this documentation, the present index which is prepared contains listed information on as many as 1600 news items.

(iv) Help for building up a collection of Environmental Documents

Over 15 organisations were helped in building their collection of environmental documents by suggesting selected titles. List of surplus and duplicate issues of periodicals and books prepared periodically were circulated to various organisations with a view to help them in completing their sets. This service has been a boon particularly to organisations, which have recently been established.

(v) Literature Search & Bibliographical Services

Scientists were helped to conduct literature search on the topics of their interests. Bibliographical services were also provided in response to the requests received.

(vi) Directory of Environmental Organisations in India

With a view to identify the organisations which are conducting, promoting or encouraging research and development activities in the field of environment, it was thought desirable to compile a comprehensive Directory of Environmental Organisations in India. The Institute has been able to bring out such a directory which includes information on about 219 such organisations. It is hoped that the directory would be useful to achieve well-planned and co-ordinated efforts to undertake activities in the inter-planning collaborative studies and avoid unintentional duplication of research. The 441-page Directory has been very well received.

(vii) CA - Condensates Data Bases

The Institute has been participating in the programme of INSDOC for establishment and evaluation of computer based selective dissemination of information in the field of chemistry, using CA condensates data bases. Scientists were helped in preparing and modifying users profile and sending a feed back to the organisers.

Extension

(i) Demonstration of Nalgonda Technique for Defluoridation of Water at Prakasam District in Andhra Pradesh

Follow-up and extension programme tour was undertaken in the 119 villages of Prakasam District, Andhra Pradesh where fluorosis is endemic. The door-to-door campaign was undertaken during 25 May to 1 June 1976. At the request of the Andhra

Pradesh Government, a Pilot Defluoridation Project for treatment of fluoride bearing water on a domestic scale was undertaken by the Institute's scientists in Prakasam District.

(ii) Training in Demonstration of Nalgonda Technique

Shri O. P. Satya, Superintending Engineer, Public Health Engineering Circle and Shri Premkumar, Executive Engineer of Faridkhot were trained at the Institute in the demonstration of Nalgonda Technique during 19-21 May, 1976.

(iii) Talks/Meetings

(a) Shri A. D. Bhide, Scientist and Head, Solid Wastes Division, delivered a talk on "Pollution by Solid Wastes" over All India Radio, Nagpur on 4 March 1976.

(b) Prof. N. Majumder, Director, spoke on "Rural Water Supply-A Challenge to Water Engineers in India" at a paper meeting convened by the Indian Water Works Association, Nagpur on 27 March, 1976.

(iv) Rural Sanitation Around Nagpur

The research-cum demonstration project in rural sanitation is in progress in the villages around Nagpur and is being conducted in joint collaboration with the Zilla Parishad, Nagpur and the Medical College, Nagpur. Out of the proposal to construct 2000 latrines, so far 1640 hand flushed water seal latrines have been constructed upto the plinth level and of these 400 are in use. The work on the construction of superstructure for the newly constructed latrines is in progress. Sanitary pans for the latrines were fabricated at the Institute and supplied free of cost to the people of Vurujwada, Mahalgaon, Wadoda, Karadi, Wadi, Fetri, Khapri, Khersapar and Kanhan. At Burjwada, near Saoner, Nagpur District a joint function of villagers and the participating agencies to discuss the progress of the programme was held on 23 April, 1976.

Prof. Majumder, Director addressed the inmates of the Paunar Ashram, near Wardha, about 85 kms. from Nagpur and held discussion on a programme of sanitation improvement with special reference to sanitary latrines. Four sanitary latrines have been constructed and the usage of these latrines are being recorded for later study by the Institute.

(v) Supply of NEERI-Chloroscope

Altogether 243 NEERI-Chloroscopes, fabricated by the Institute were supplied to various buyers during the year 1976 and earned the Institute a sum of Rs. 10,935.00. This handy gadget is being used to determine the residual chlorine in desinfected water

when chlorinators are used. It is popular in rural areas where piped water supply is absent.

(vi) World Environment Day

Shri R. K. Saraf, Scientist, TILE Division delivered a talk on All India Radio, Nagpur on "World Environment Day" on 5 June, 1976.

(vii) NEERI Cochin Zonal Laboratory

NEERI Zonal Laboratory at Kalamaserry near Cochin started from 15 June, 1976. This is the Ninth Zonal Laboratory of NEERI and is located at the CSIR Complex, Kalamaserry-683 104, Kerala State.

(viii) Promotion of Hindi

Use of Hindi has progressively been increased during the year. In addition to bringing out publicity leaflets, booklets etc. in Hindi, as usual, for popularising the Institutes products and process by carrying the information to the common masses specially the rural population, bilingual press releases in Hindi and English have been initiated. Radio talks and extension lectures on various aspects of environmental engineering and sciences in simple and semi-technical Hindi have been a continued activity. General correspondence and technical enquiries from individuals, technical and professional organisations and industries etc. received in Hindi have been replied to in the same language.

(ix) Demonstrations

(a) Member-tanners of the Indian Chamber of Commerce, Kanpur were demonstrated the treatment of Vegetable Tanning Wastes by modified Anaerobic Digester at Kanpur on 17 November, 1976.

(b) Pot Chlorination Method developed by the Institute was demonstrated in rural areas around Nagpur.

(c) Demonstration of Biogas Production from Municipal Solid Wastes at RRL, Hyderabad, on the occasion of the visit of Mr. McNamara, President, World Bank on 8 November, 1976.

(x) Publicity

Research and Development Activities of the Institute were published through the mass media-the All India Radio, Samachar and newspapers. The Press Information

Bureau, Nagpur provided assistance for publicity. A beginning was made by issuing bilingual press releases using English and Hindi. Reports of the Institute were regularly published in the CSIR News, a fortnightly news bulletin of CSIR.

(xi) Information Dissemination

Design and literature on Domestic Iron Removal Unit were supplied to following International Agencies besides many within the country :

1. International Development Research Centre, Box 8500, Ottawa (Canada).
2. Mr. M. G. McGarry, Dr. R. F. Feechem, University of Birmingham (England).
3. Dr. K. Y. Baliga, Department of Civil Engineering, University of Science & Technology, Kumsai (Ghana).

WORKSHOP

The Institute has a well equipped Workshop which undertakes fabrication of gadgets, models, pilot and demonstration plants for use in research and development activities. It ensures the operation and maintenance of essential services such as water supply and electricity to the Institute and staff quarters.

The equipment fabricated during the year included :

1. Bio-Gas collection domes of 18 cubic metre capacity;
2. Stands for high volume sampler;
3. Soil permeameter; and
4. Mini Grinder.

GLASS BLOWING

About 116 jobs which include repairs, alterations and fabrication of glassware were carried out during the year. Thirteen enquiries from outside organisations for specialised glass products were attended to and an amount of Rs. 5711.00 was realised during the year.

A Gas Washer/Absorber was designed and developed by this section, as part of a programme of Development and Import Substitution. This indigenous and low-

cost gadget compares favourably with the Fisher Milligan Gas Washer which is imported from the USA. A few of these units have been supplied on request to outside organisations and one unit is in use at the Institute.

Developmental work on the Glass Rotameter (Tapered Tube type) with ground glass float, is in progress.

PHOTOGRAPHY

The Institute has a well-equipped Photography Section for the preparation of microfilms, photocopies, slides and other photographic work required for research work.

APPENDICES

APPENDIX– I

SPECIAL REPORTS

The following special reports on different sponsored/research and development projects and consultancy schemes were brought out during the year :

1. Standardisation of Sampling Techniques of aerial pollen grains and fungal spores by methods currently used in India.
2. Manganese content in the air-borne dust and health study near Ferro-Manganese Alloy Factory.
3. Air Pollution Survey of Chembur-Trombay Area
4. Assessment of emissions at the Pelletisation Plant at Pale (Goa) and performance study of the de-dusting unit
5. Control of lead fumes from Andhra Prabha Printing Press
6. Atmospheric Pollution Monitoring Survey around the Indraprastha Thermal Power Station, New Delhi
7. Report on Investigation on the cause of epidemic of typhoid at Sangli
8. Feasibility of mechanical composting of Kota City Refuse (Kota Municipal Council)
9. Feasibility of mechanical composting of Jabalpur City Refuse (Jabalpur Municipal Corporation)
10. Project Report for mechanical composting plant at Gauhati (Gauhati Municipal Corporation)
11. Effluent treatment for proposed distillery at Chagallu (Govt. Distillery Chagallu, Andhra Pradesh)
12. Effluent treatment for a distillery (Gujchem Distilleries (I) Ltd., Gujarat)
13. Effluent treatment for the distillery (Bazpur Co-operative Sugar Factory)
14. Effluent treatment for paper mill (Amaravati Sri Venkatesa Paper Mills Ltd., Madathukulam, Tamilnadu)

15. Characterisation of waste water from the Tapioca Products (The Tapioca Products Madathukulam, Tamilnadu)

16. Effluent treatment for a cotton mill (Bowreah Cotton Mills, Baurja, West Bengal)

17. Characterisation of waste water textile mill (Binny Ltd., Bangalore)

18. Effluent treatment for a paper mill (Mandya National Paper Mills, Belagula, Mysore)

19. Effluent treatment for a proposed wool development centre (PHED, Srinagar)

20. Effluent treatment for a paper mill (Star Paper Mill Saharanpur, U.P.)

21. Performance of waste treatment plant (Bank Note Press, Dewas, M.P.)

22. Effluent treatment for paint and varnish works (Modi Paint & Varnish Works, Modinagar, U.P.)

23. Effluent treatment for a synthetics factory (J. K. Synthetics Ltd, Kota)

24. Effluent treatment for a paper mill (Punalur Paper mills, Punalur, Kerala)

25. Sewage disposal for a township (Indian Aluminium Co., Belgaum)

26. Bioassay studies of industrial effluent (Hindustan Organic Chemicals)

APPENDIX– II

PUBLICATIONS

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Flourescent Traces and Measurement of Flourescences. **Indian Journal of Environmental Health,** 18 (3), 1976.

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A Study on the Disposal of Effluent from Milk Bottling Plant. Presented at the All India Seminar on Environmental Pollution Control at Hartcourt Butler Technological Institute, Kanpur, 12-13 March, 76.

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Dhaneshwar, R. S.
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'Treatment of waste waters from organic chemical industry'. Chemical Industry Development, Annual Number.

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Low cost waste treatment methods **"Yojna"**—Journal of the Planning Commission, Government of India, 20, Jan. 1976.

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Rationalisation of Mixing and Aeration Operations in Waste Waters, **Indian Journal of Environmental Health,** 18 (2) 1976.

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Graphical Method of Calculations for Oxygenation Capacity and Oxygenation Efficiency. **Indian Journal of Environmental Health,** 18 (3), 1976.

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'Waste Water Treatment by Anaerobic Contact Filter. **Indian Journal of Environmental Health,** 18 (4), 1976.

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'Characteristics of Wastes from a Textile Mill : **Indian Journal of Environmental Health,** 18 (2), 1976.

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APPENDIX– III

SCIENTIFIC & TECHNICAL KNOW-HOW DEVELOPED BY THE INSTITUTE

The Institute has developed the following products and processes :

Sl. No.	Products/Process	Useful for
1.	Chlorine Ampoules	Disinfection of water
2.	Chlorine Tablets	Disinfection of water
3.	Coagulant Aids	Coagulation
4.	Iron Removal Kit	Removal of excess of iron in water
5.	Membrane Filter of 0.45 micron porosity	Bacteriological Analysis
6.	NEERI-Chloroscope	Estimation of available chlorine in disinfected water
7.	Nalgonda Technique	Removal of excess of fluorides from water
8.	Wind Direction Recorder	Micro-meteorological work
9.	Wind Speed Recorder	Micro-meteorological work

Some of the items have been referred to the National Research Development Corporation of India (NRDC), New Delhi for release to entrepreneurs for commercial exploitation. Some of the entrepreneurs have gone into production. **(See section** on Technology Transferred).

Filed during 1976

PATENTS

Sl. No.	Title	Inventors	Patent Application No.	Date of filing
1.	Airspora Sampler with Inclined Slide.	1. Dr. S. U. Deshpande 2. Shri S. D. Wachasunder	1438/Cal/76	9-8-1976
2.	Improvements in or related to the Wind Direction Recorder.	1. Shri V R. Bhave 2. Shri J. M. Dave	1443/Cal/76	9-8-1976
3.	Bellows-type Oil Free Vacuum Pump for air sampling.	1 Shri G. T. Kale	1615/Cal/76	2-9-1976

TECHNOLOGIES TRANSFERRED

Sl. No.	Process/Product	Party	Terms
1.	Chlorine Tablets	1. Shri V. R. Bhave 1st Floor, 480/A Tilak Road, PANVEL-410 206 (Distt: Kolaba)	Lumsum Premium : Rs. 1000/- Recurring Royalty : Nil Nature of Licence : Non-exclusive Period of Licence : 10 years
		2. M/s. Vinay Trading Corporation, 433, Tilak Marg, NEEMUCH-458 441 (M.P.)	
		3. M/s. Gudimani Enterprises, N-55 Greater Kailash-1, NEW DELHI—110 048	

Sl. No.	Process/Product	Party	Terms
		4. M/s. M. Arul Jyothi, 13, Arundale Street, MADRAS—600 004	
2.	Chlorine Ampoules	1. M/s. Gudimani Enterprises N-55, Greater Kailash—1, NEW DELHI—110 048	Lumsum Premium : Rs. 1000/- for 5000 ampoules/day and Rs. 500/- for 2500 ampoules/day
		2. Shri A. N. Simha, 390, Gokulam, III Stage, Vani Vilas Mohalla, MYSORE—570 002	Recurring Royalty : Nil Nature of Licence : Non-exclusive Period of Licence : 10 years.
3.	Membrane Filter	1. Shri R. B. Donde C/o Eltec Corporation, 303, Nelam, 108, Worli Sea face Road, Worli, Bombay—400 018	Lumsum Premium : Rs. 5000/- Recurring Royalty : 3% on sales Nature of Licence : Non-exclusive Period of Licence : 14 years.
		2. Shri R. M. Gupta, Micro Filter Corporation 103, New Okhla Industrial Complex, Phase—1, NEW DELHI—110 044	
		3. Shri C. L. Toshniwal, Membrane Filter Corporation, 10/2 Neetinagar, Roorkee-247 667	

APPENDIX– IV

BUDGET

(Rupes in lakhs)

	1975-76 Actual Expenditure		1976-77 Actual Expenditure
RECURRING	58.982	NON-PLAN	57.537
CAPITAL	8.103	PLAN	16.549
TOTAL	67.085		74.086

APPENDIX– V

DEMONSTRATION PLANTS

The following plants were in operation during the year :

Aerated Lagoons with Fixed and Floating Aerators	...	Nagpur
Biological-Disc	...	Nagpur
Effluent Farm Irrigation	...	Nagpur
Mechanical Composting	...	Nagpur
Night Soil Digesters	...	Nagpur
Oxidation Ditch	...	Nagpur
Slow Sand Filter	...	Nagpur
Stabilisation Ponds	...	Nagpur
Trickling Filter	...	Nagpur

MEMBERSHIP OF ORGANISATIONS

APPENDIX– VI

Sl. No.	Name of the Committee	Ministry/Govt. Department/ Organisation constituting the committee		Name of NEERI representative Principal Member (P) Alternate Member (A)
(1)	(2)	3		4
	INDIAN STANDARDS INSTITUTION, NEW DELHI			
1.	Concrete Pipes and Poles Sub-Committee	BDC 2 : 6	ISI, New Delhi	Shri N. M. Narsimhan
2.	Sanitary Applicances & Water Fittings Sub-Committee	BDC : 3	—do—	Prof. N. Majumder (P) Shri J. M. Dave (A)
3.	Domestic & Municipal Water Fitting Sectional Committee	BDC : 3 : 2	—do—	Shri S. R. Kshirsagar (P) Shri V. Raman (A)
4.	Water Meters Sub-Committee	BDC : 3 : 4	—do—	Shri N. M. Narasimhan (P) Shri A. W. Deshpande (A)
5.	Water Works Fitting Sub-Committee	BDC : 3 : 5	—do—	Shri A. K. Seth (P) Shri V. Hanumanulu (A)

(1)	(2)	(3)		(4)
6.	Plastic Pipes Sub-Committee	BDC : 3 : 8	ISI, New Delhi	Shri J. M. Dave (P) Shri R. Paramsivam (A)
7.	Panel for Water Supply & Plumbing	BDC : 13/P4	—do—	Shri Hanumanulu
8.	Fluid Flow Measurements in Closed Conduits Section Committee	BDC : 17 : 3	—do—	Shri R. Paramasivam (P) Shri A. W. Deshpande (A)
9.	Dilution Methods Sub-Committee	BDC : 17 : 7	—do—	Shri D. Raguraman (P) Shri A. K. Seth (A)
10.	Water Supply & Sanitation Sectional Committee.	BDC : 24	—do—	Prof. N. Majumder (P) Shri J. M. Dave (A)
11.	Water Supply & Plumbing Sub-Committee	BDC : 24 : 1	—do—	Shri V. Raman (P)
12.	Drainage Sub-Committee	BDC : 24 : 2	—do—	Shri Y. S. Murty (P) Shri R. Paramasivam (A)
13.	Sanitary Installations Sub-Committee	BDC : 24 : 3	—do—	Shri R. Paramasivam (P) Shri N. M. Narasimhan (A)

(1)	(2)	(3)		(4)
14.	Soil and Waste Pipes above Ground Sub-Committee	BDC : 24/4	ISI, New Delhi	Shri R. Paramasivam (P) Shri N. M. Narasimhan (A)
15.	Waste Stabilization Ponds Panel	BDC : 24/P3	—do—	Shri V. Raman (P) Shri Y. S. Murty (A)
16.	Panel for Draft Code of Practices for Water Supply and Drainage System at High Altitude	BDC : 24/P4	—do—	Shri J. M. Dave (P) Shri R. Paramasivam (A)
17.	Building Materials and Components sampling Sub-Committee	BDC : 31	—do—	Shri A. K. Seth (P) Shri S. K. Gadkari (A)
18.	Public Health Engineering Plants and Equipment Sectional Committee	BDC : 40	—do—	Prof. N. Majumder (P) Shri J. M. Dave (A)
19.	Water Treatment Equipment Sub-Committee	BDC : 40 : 1	—do—	Shri V. Raman (P) Shri S. R. Kshirsagar (A)
20.	Sewage Treatment Equipment Panel	BDC : 40/P2	—do—	Prof. N. Majumder (Convener) Shri V. Raman (P)
21.	Water Treatment Equipment Panel	BDC : 64/P15	—do—	Shri S. R. Kshirsagar (P) Shri S. K. Gadkari (A)

(1)	(2)	(3)		(4)
22.	National Building Code Panel for Plumbing Services	BDC : 64	ISI, New Delhi	Shri V. Raman (P) Shri S. R. Kshirsagar (A)
23.	Panel for Composition of Groups on Plumbing Services (Water Supply & Sanitation) Tall buildings	BDC : 64 : P20	—do—	Shri J. M. Dave (P) Shri R. Paramsivam (A)
24.	Civil Engineering Division Council	CEDC	—do—	Prof. N. Majumder (P) Shri J. M. Dave (A)
25.	Chemical Hazards Sectional Sub-Committee	CDC : 18	—do—	Shri J. M. Dave (P) Shri P. K. Yennawar (A)
26.	Industrial Chemical Hazards Sub-Committee	CDC : 18 : 4	—do—	Shri J. M. Dave (P) Shri P. K. Yennawar (A)
27.	Disinfectants Sub-Committee	CDC : 25 : 1	—do—	Dr. N. M. Parhad (P) Shri M. D. Patil (A)
28.	Water Sectional Committee	CDC : 26	—do—	Prof. N. Majumder (P) Dr. P. V. R. Subrahmanyam (A)
29.	Water Sectional Committee	BDC : 26 : 1	—do—	Shri J. S. Gadgil (P) Dr. P. V. R. Subrahmanyam (A)

(1)	(2)	(3)		(4)
30.	Panel for Food & Fermentation Industry Wastes	CDC : 26 : 1 : 2	ISI, New Delhi	Shri J. S. Gadgil (P) Shri M. V. Srinivasan (A)
31.	Paper & Allied Industrial Water Analysis	CDC : 26 : 1 : 3	—do—	Dr. P. V. Subrahmanyam (Convener) Shri J. S. Gadgil (A)
32.	Panel for Tanning Industry Wastes	CDC : 26 : 1 : 4	—do—	Dr. C. A. Sastry (P) Dr. K. L, Saxena (A)
33.	Panel for Textile and Allied Industry wastes	CDC : 26 : 1 : 5	—do—	Shri S Rajagopalan (Convener) Dr. C. A. Sastry (A)
34.	Panel for Chemical and Allied Industry Wastes	CDC : 26 : 1 : 6	—do—	Dr. C. A. Sastry (Convener) Dr. P. V. R. Subrahmanyam (A)
35.	Panel for Fertiliser Industry Wastes	CDC : 26 : 1 : 12	—do—	Shri S. Rajagopalan (P) Dr. P. V. R. Subrahmanyam (A)
36.	Panel for Steel Mill Wastes	CDC : 26 : 1 : 13	—do—	Dr. P. V. R. Subrahmanyam (P) Shri V. Hanumanulu (A)
37.	Panel for Oil Refinery	CDC : 26 : 1 : 14	—do—	Shri S. Rajagopalan (P) Shri V. Hanumanulu (A)

(1)	(2)	(3)		(4)
38.	Methods for Test for Water & Effluents (a) Physical & Chemical Test Methods	CDC : 26 : P1	ISI, New Delhi	Dr. P. V. R. Subrahmanyam (P) Dr. S. P. Pande (A)
	(b) Bacteriological & Virological Methods			Dr. V. Chalapati Rao (P) Dr. N. M. Parhad (A)
39.	Panel for Treatment of Water for Industry	CDC : 26 : P7	—do—	Shri K. R. Bulusu (P) Shri B. N. Pathak (A)
40.	Panel for Glossary of terms in use	CDC : 26 : P8	—do—	Dr. C. A. Sastry (P)
41.	Water for Industrial purposes Sub-Committee	CDC : 26 : 2	—do—	Shri K. R. Bulusu (P) Shri B. N. Pathak (A)
42.	Water and Effluents Sub-Committee	CDC : 26 : 3	—do—	Prof. N. Majumder (P) Dr. P. V. R. Subrahmanyam (A)
43.	Panel for Marine Disposal & Effluents	CDC : 26 : 3 : 1	—do—	Shri V. Raman (P) Shri V. Hanumanulu (A)
44.	Sewage Panel	—	—do—	Shri V. Raman (P) Dr. G. B. Shende (A)

(1)	(2)	(3)		(4)
45.	Air Pollutional Sectional Committee	CDC : 53	ISI, New Delhi	Shri J. M. Dave (P) Shri P. K. Yennawar (A)
46.	Terminology Sub-Committee	CDC : 53 : 1	—do—	Shri P. K. Yennawar (P) Dr. V. I. Pandit (A)
47.	Methods of Sampling & Analysis Sub-Committee	CDC : 53 : 2	—do—	Shri P. K. Yennawar (P)
48.	Sub-Committee for Quality Air Standards for Community Air	CDC : 53 : 3	—do—	Shri J. M. Dave (P) Shri P. K. Yennawar (A)
49.	Sub-Committee for Code of Practice for Control of Air Pollutants	CDC : 53 : 4	—do—	Shri P. K. Yennawar (P) Dr. V. I. Pandit (A)
50.	Panel for Emission Standards for Chemicals	CDC : 53 : P2	—do—	Shri J. M. Dave (P) Shri P. K. Yennawar (A)
51.	Panel for Emission Standards for Cement and Ceramic Industries	CDC : 53 : P3	—do—	Shri P. K. Yennawar (P)
52.	Panel for Emission Standards for domestic sources	CDC : 53 : P6	—do—	Shri P. K. Yennawar (P) Shri V. L. Pampattiwar (A)

(1)	(2)	(3)		(4)
53.	Solid Wastes Sectional Committee	CDC 54/A-1	ISI, New Delhi	Prof. N. Majumder (Chairman)
54.	Industrial Wastes Sub-Committee	CDC : 54 : 1	—do—	Shri A. D. Bhide (P) Shri S. K. Titus (A)
55.	Panel for Glossary of Terms relating to solid wastes	CDC : 54 : P1	—do—	Shri A. D. Bhide (Convener)
56.	Panel for Urban Solid Wastes	CDC : 54 : P2	—do—	Shri J. M. Dave (P) Shri A. D. Bhide (A)
57.	Panel for Agricultural Residues and Rural Wastes	CDC : 54 : P3	—do—	Dr. G. B. Shende (P) Shri B. K. Handa (A)
58.	Panel for Methods of Sampling & Test for Solid Wastes	CDC : 54 : P4	—do—	Shri A. D. Bhide (Convener)
59.	Sub-Committee on the health and hygiene aspects of weldings	SMDC : 14 : 5	—do—	Shri V. Raman (P)
60.	Water requirement for irrigation Sectional Committee.	AFDC : 46	—do—	Dr. G. B. Shende (P) Shri C. K. Kale (A)

STATE AND CENTRAL WATER POL UTION CONTROL BOARDS

Sl. No.	Name of the Committee	Authority/Department	Name of the members/ representative
1.	Andhra Pradesh State Prevention and Control of Water Pollution Board, (Technical Sub-Committee).	Govt. of Andhra Pradesh, Hyderabad.	Dr. C. A. Sastry and Shri Y. S. Murthy
2.	West Bengal Prevention & Control of Water Pollution Board, Calcutta.	Govt. of West Bengal, Calcutta.	Dr. A. K. Basu
3.	Central Prevention & Control of Water Pollution Board, Delhi.	Govt. of India, New Delhi.	—
4.	Karnataka State Board for Prevention & Control of Water Pollution, Bangalore.	Govt. of Karnataka, Bangalore.	Dr. C. A. Sastry
5.	Rajasthan State Board for Prevention & Control of Water Pollution, Jaipur.	Govt. of Rajasthan	Shri V. P. Thergaonkar
6.	Punjab Env. Pollution Planning Board, (State High Level technical Sub-Committee).	Govt. of Punjab, Chandigarh.	Shri J. M. Dave
7.	Maharashtra Prevention of Water Pollution Board.	Govt. of Maharashtra, Bombay.	Shri S. R. Kshirsagar (A)

CENTRAL GOVERNMENT COMMITTEES

Sl. No.	Name of the Committee	Authority/Department	Name of the members/ representative
1.	National Council of Environmental Planning & Co-ordination in the Environmental Board of Tripura and Meghalaya State.	Department of Science & Technology, Govt. of India, New Delhi.	Dr. G. B. Shende
2.	Pesticides Research Committee and Central Insecticides Board.	Central Insecticides Board, Ministry of Agriculture, Deptt. of Agriculture), Directorate of Plant Protection Quarantine and Storage.	Dr. G. B. Shende
3.	Panel on Bio-gas plants programme	Planning Commission, Govt. of India and Deptt. of Science & Technology, New Delhi.	Shri M. V. Srinivasan
4	Formation of Expert Group to examine all aspects of Taj Barrage Project (Construction of weir across river Yamuna).	Central Water Commission (Canals Directorate, Govt. of India), Deptt. of Tourism, New Delhi.	—
5.	Extension Programme of Geological Survey of India (Northern Region) with NEERI (KZL) in Banda Distt. U.P.	Geological Survey of India Northern Region, Lucknow.	Dr. H. C. Arora

(1)	(2)	(3)	(4)
6.	Standing Committee of the Construction of Public Enterprises.	Ministry of Finance, Bureau of Public Enterprises (Construction Division), Govt. of India, New Delhi.	Shri A. Raman
7.	Committee on Urban Engineering Services (Norms & Standards review & revision constitution of working group).	Town & Country Planning Organisation, Ministry of Work & Housing, Govt. of India, New Delhi.	Shri A. Raman
8.	Fermentation Panel, Directorate General of Technical Development (Food & Alcohol Dn.).	Ministry of Food & Agriculture, Govt. of India, New Delhi.	Dr. P. V. R. Subrahmanyam (P) Shri J. S. Gadgil (A)
9.	Indian National Committee for International Hydrological Decade, Programme.	CSIR, New Delhi.	Shri A. Raman
10.	Working Group for Drinking Water Supply, Sewerage and Sanitation.	Deptt. of Health, Ministry of Health & Family Planning, Govt. of India, New Delhi.	—
11.	Committee to prepare R & D Plan on Water Pollution Control and Monitoring Water Conservation, Re-use & Research.	National Council of Science and Technology, Deptt. of Science and Technology, Govt. of India, New Delhi.	

(1)	(2)	(3)	(4)
12.	Committee on Urban Wastes (Deptt. of Health) Ministry of Health & Family Planning.	Ministry of Health & Family Planning, Govt. of India, New Delhi.	Shri A. D. Bhide
13.	Expert Committee to Review the Manual on Water Supply already brought out by the Ministry of Health & Family Planning.	—do—	Shri V. Raman (P) Shri S. R. Kshirsagar.
14.	Sewerage & Sewage Treatment.	—do—	Shri V. Raman (P) Shri S. R. Kshirsagar (A)
15.	Railway Sanitary Adv. Committee.	Railway Board, Ministry of Railways, New Delhi.	Shri V. Raman (P) Shri B. K. Handa (A)
		OTHER COMMITTEES	
1.	Scientific Advisory Board.	Indian Council of Medical Research New Delhi.	—
2.	Indian National Committee on International Water Resources Association.	Central Board for Irrigation and Power, Government of India, New Delhi.	—

(1)	(2)	(3)	(4)
3.	International Association on Water Pollution Research.	—	(Representative from India)
4.	Technical Association of Pulp and Paper Industry.	Atlanta Ga (USA)	—
5.	Problems of Sanitary & Water Supply Arrangements at High Altitudes and Low Temperature Regions.	Ministry of Defence, Govt. of India, New Delhi.	Shri D. Raghuraman
6.	Rural Sanitation Advisory Committee.	Kasturba Health Society, Sewagram.	—
7.	Expert Group on Legislation on Dairy Effluent Disposal.	International Dairy Federation, Ministry of Agriculture, Govt. of India, New Delhi.	—
8.	Project Management Group for Mechanical Composting Plant.	Planning Committee, New Delhi.	Shri A. D. Bhide
9.	Delhi Smoke Nuisance Commission.	Delhi Administration, Delhi.	Shri A. Raman

STATE COMMITTEES

Sl. No.	Name of the Committee	Authority/Department	Name of the representative/ member
1.	State High Level Tehnial Sub-Committee (Maharashtra).	Govt. of Maharashtra, Bombay.	Shri S. R. Kshirsagar
2.	Committee of Experts to suggest suitable locations for Chemical Industries (M.S.)	—do—	
3.	Environmental Protetion Advisory Committee of Maharashtra	—do—	Shri S. R. Kshirsagar
4.	Committee to consider location of two straw paper mills at Burwah on River Narmada	Govt. of Madhya Pradesh	Shri J. S. Gadgil
5.	Committee to study the nature of effluent of the Paper Mills in Madhya Pradesh and to suggest the treatment	—do—	Shri J. S. Gadgil
6.	Working Group on Pollution of Air & Water (Tech. Committee)	Govt. of Gujarat, Gandhinagar.	Shri S. Rajagopalan
7.	State level Committee for Environmental Planning and	Health & Panchayat Deptt. Govt. of Gujarat	Shri S. Rajagopalan

(1)	(2)	(3)	(4)
8.	Committee to Review effluents standards Baroda Channel Project	—do—	Shri S. Rajagopalan
9.	U. P. Effluent Board	Govt. of U.P.	Dr. H. C. Arora
10.	Technical Advisory Comittee Water Pollution Control Board, Kerala	Government of Kerala.	Dr. C. A. Sastry
11.	State R & D Committee	Govt. of M.P.	Dr. P. V. R. Subrahmanyam
12.	Technical Advisory Committee	M. P. State Board for Prevention & Control of Water Pollution.	

APPENDIX– VII

DEPUTATIONS

1. Shri Y. S. Murthy, Scientist-in-charge, NEERI Hyderabad Zonal Laboratory was deputed to Iraq as WHO Consultant for a period two weeks on 2-15 February, 1976.

2. Dr. N. M. Parhad, Scientist & Head, Bacteriology Cell, Life Sciences Division was deputed for training under a five-month programme on February-June, 1976 on a Fellowship of the Japan International Co-operation Agency, Tokyo.

3. Shri K. R. Bulusu, Scientist & Head, Water Division attended the Task Group Meeting convened by the WHO on "Environmental Health Criteria for Nitrates, Nitrites and Nitrosoamines' at Lyons, France on 16-20 February, 1976.

4. Shri V. Raman, Scientist & Head, Sewage Treatment Division was deputed to Iraq for two-months on a WHO Consultant on "Waste Disposal in Rural Areas during March-April, 1976.

5. Dr. V. I. Pandit of Air Pollution Division returned to the Institute on 21 March, 1976 after completing a sixteen-month advanced training in air pollution control at West Germany on a German Academic Exchange Service Fellowship.

6. Dr. A. K. Basu, Scientist-in-Charge, Calcutta Zonal Laboratory participated as an Expert and Chairman of the Physical and Organic Pollution Group in the "International Workshop on Marine Pollution in East Asian Waters" under the aegis of the International Oceanographic Commission, UNESCO, Paris at Penang, Malaysia, on 7-13 April, 1976.

7. Shri J. M. Dave, Scientist & Head, Air Pollution Division, visited Frankfurt, West Germany for carrying out Consultancy Work on selection of air pollution control equipment being imported by M/s Mandovi Pellets, Ltd., (M/s Chowgule Metal Industries Ltd.) Goa. He also visited the Pelletisation Plant set up by M/s Lurgi and Co. West Germany. The visit was under the Consultancy Agreement between M/s Mandovi Pellets Ltd., Goa and NEERI, Nagpur.

8. Dr. K. L. Saxena, Scientist, Industrial Wastes Division proceeded to New Zealand in June 1976 under a programme of Colombo Plan for a nine-months training in 'Utilisation of Treatment and Disposal of Dairy Wastes'.

9. Shri V. Hanumanulu, Scientist, Consultation Cell, was awarded a three-month advanced training in Marine and Estuarine Pollution Control under WHO Fellowship in June 1976 to visit U.K., Denmark and Netherlands.

10. Dr. N. M. Parhad, visited USA in June 1976 for a period of three months under a WHO Fellowship.

11. Prof. N. Majumder, Director, attended a Workshop in June, 1976 on "Global Information Exchange in Water and Sanitation" at the Hague, the Netherlands and presented a paper on "Some Thoughts on Establishing an Information Exchange Network for Water and Sanitation".

12. Shri S. N. Kaul, Scientist, Sewage Treatment Division proceeded to U.K. on 19 July, 1976 on a Commonwealth Fellowship for carrying out research in the field of Water and Waste Water Treatment Processes for a period of two years.

13. Dr. A. K. Basu, Scientist-in-Charge, Calcutta Zonal Laboratory was deputed as Senior Consultant "Estuarine Coastal and Marine Pollution," to UNEP Regional Office, Bangkok, Thailand from 28 July, 1976 to 27 November, 1977.

14. Dr. P. V. R. Subramanyam, S/Shri V. L. Pampattiwar and S. G. Bhat, visited Malaysia, Singapore and Shri Lanka on 3-27 September, 1976 in connection with the UNEP Project work on "Identification and Preparation of an Inventory of Institutions in the ESCAP Region with capabilities in Monitoring and Assessment of Air and Water Pollution".

15. The second team of three scientists S/shri R. K. Saraf, P. K. Yennawar and J. S. Gadgil visited Bangla Desh, Thailand, Philippines and Indonesia in September, 1976 in connection with the UNEP Project work.

16. Shri J. M. Dave, Scientist & Head, Air Pollution Division was deputed to Amsterdam, the Netherlands on 4-19 September, 1976 for participating in the International Seminar on "Community Water Supply in Developing Countries on 6-10 September, 1976 and I.W.S.A. World Congress from 13-17 September, 1976. He also presented a paper on "Research and Development on Community Water Supply" and represented NEERI at the Advisory Board Meeting of WHO-IRC.

17. Dr. V. Chalapati Rao, Scientist, & Head, Virology Cell proceeded to USA to take up an assignment with the Food and Drug Administration of USA for a period of one year from 18 September, 1976.

18. Shri J. M. Dave, Scientist & Head, Air Pollution Division attended the Annual Meeting of the American Society on Information Sciences and the First Indo-US Seminar on "Information Resources in the areas of Energy, Environment and Natural Resources" at Washington, USA on 2-20 October, 1976.

19. Shri D. Seethapathi Rao, Scientist, Hyderabad Zonal Laboratory was deputed on a three-month WHO Fellowship to U.K. from 1.11.76.

20. Shri R. Paramasivam, Scientist & Head, Engineering Division represented NEERI at a meeting of participating institutions in the project on "Slow Sand Filtration" sponsored by WHO-IRC for Community Water Supply on 22-30 November, 1976 at the Hague, the Netherlands.

APPENDIX– VIII

HONOURS & AWARDS

1. The paper "Use of Electrical Analogue Model, for Pipe Net-work Analysis" by Shri V. Raman, Scientist was adjudged as the best paper in the session "Instrumentation and Equipments" at the Second National Convention on Environmental Engineering at New Delhi on 21-23 Feb. 1976.

2. The paper "Monitoring Prevention and Control of Viral Pollution of Water" by Dr. V. Chalapati Rao, Scientist, was adjudged as the best paper in the session III on "Monitoring Prevention and Control of Water and Air Pollution" during the Second National Convention on Environmental Engineering at New Delhi on 21-23 Feb, 1976.

3. The thesis by Shri C. K. Kale, Scientist on "Effect of Synthetic Detergent (ABS type) on the growth of plants" has been approved by the Punjabrao Krishi Vidyapeeth, Akola for the award of Ph.D. degree in the faculty of Agricultural Botany.

4. Dr. V. I. Pandit, has been elected as a Member of the Royal Institute of Chemistry, London. Dr. Pandit has been honoured to use the designatory letters "C. Chem. MRIC".

5. Dr. A. K. Basu, Scientist has been elected Fellow of the Chemical Institute of Canada (FCIC), Ontario, Canada in March, 1976. He was also elected Full Member of the Institute of Chemical Engineers, India in August, 1976. Dr. Basu has been recognised as a guide for post-graduate research for Jadavpur University, Calcutta University and the All India Institute of Hygiene and Public Health, Calcutta.

6. Shri J. M. Dave, Scientist has been recognised as a guide for post-graduate research in public health engineering and environmental engineering for the South Gujarat University, Surat and Nagpur University respectively.

7. Dr. K. P. Krishnamoorthi, Scientist has been recognised as a guide for post-graduate research in zoology for Nagpur University.

8. Dr. N. M. Parhad, Scientist has been nominated as a Member of the Board of Studies for biochemistry and microbiology in the Faculty of Science, Nagpur University for a period of three years. He has also been nominated as the Member of the Faculty of Science, Nagpur University.

9. Shri M. Parabrahmam, Scientist has been recognised as a Guide for post-graduate research in pharmacy for Nagpur University.

10. Shri B. K. Handa, Scientist has been recognised as a guide for post-graduate research in public health engineering for Jabalpur University and Nagpur University.

11. Shri A. D. Bhide, Scientist has been recognised as a guide for post-graduate research for the University of Roorkee and Nagpur University.

12. Dr. C. A. Sastry, Scientist has been recognised as a guide for post-graduate research and nominated as a member of the doctoral committee of the Madras University.

13. Shri S. R. Kshirsagar, Scientist has been recognised as a guide for post-graduate research in environmental engineering for the University of Indore.

14. Shri S. G. Bhat, Documentation Officer was assigned the job of writing a text book in Marathi on Documentation for degree students of Library Science by the Maharashtra Universities Book Production Board. This is under the central scheme of production of books and literature in regional languages at the university level and is sponsored by the Ministry of Education and Social Welfare, Government of India. Shri Bhat's book was selected for publication and published under the title 'Pralekhan Parichay' (Introduction to Documentation).

15. Dr. N. M. Parhad, Shri S. R. Joshi and Shri N. Shivaraman have been appointed as Contributory Lecturers in environmental microbiology by the Nagpur University for M.Sc. (Microbiology).

16. Dr. S. U. Deshpande, Pool Officer has been elected Fellow of the Indian College of Allergy and Applied Immunology in November, 1976.

APPENDIX– IX

STAFF *

DIRECTOR

Prof. N. Majumdar**

Shri J. M. Dave, Scientist-In-Charge ***

HEADQUARTERS

AIR POLLUTION

Shri J. M. Dave, Scientist (Incharge)
Shri P. K. Yennawar, Scientist
Shri V. L. Pampattiwar, Scientist
Shri K. Ganesan, Scientist
Shri S. K. Maira, Scientist
Shri H. C. Sharma, Scientist
Dr. V. I. Pandit, SSA
Shri K. M. Phadke, JSA
Shri J. V. Kothari, JSA

ENGINEERING

Shri R. Paramasivam, Scientist (Incharge)
Shri S. K. Gadkari, Scientist
Ku. N. S. Joshi, SSA
Shri R. D. Kamble, SSA
Smt. S. S. Dhage, JSA

EPIDEMIOLOGY

Shri P. V. R. C. Panicker, Scientist (Incharge)

INDUSTRIAL WASTES

Dr. P. V. R. Subrahmanyam, Scientist (Incharge)
Shri N. V. Srinivasan, Scientist
Dr. K. L. Saxena, Scientist
Shri R. C. Trivedi, Scientist (On Deputation)

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* Staff as on 31.12.1976
** Retired on 1.12.1976.
*** from 1.12.1976

Shri J. S. Gadgil, Scientist
Shri K. K. Das, Scientist
Dr. M. Prasad, Scientist (On Sponsored Project)
Dr. Tapan Chakrabarti, Scientist
Smt. Shanta Satyanarayana, SSA
Shri S. N. Khadakkar, SSA
Shri A. N. Deshkar, SSA (On Sponsored Project)
Shri S. D. Makhijani, JSA
Smt. S. A. Patkie, JAS (On Sponsored Project)
Shri S. D. Deshpande, JSA
Shri A. S. Juarkar, JSA (On Sponsored Project)

INSTRUMENTATION

Shri V. R. Bhave, Scientist (Incharge from 20 Sept. 1976)
Shri V. L. Lokre, Scientist (On Deputation)
Shri V. R. Apte, Scientist.
Shri G. T. Kale, SMA (Special Grade)
Shri Amol Singh, Foreman
Shri P. L. Muthal, JTA

LIFE SCIENCES

Dr. K. P. Krishnamoorthi, Scientist (Incharge)

Bacteriology Cell

Dr. N. M. Parhad, Scientist
Shri M. D. Patil, Scientist
Dr. P. M. Phirke, Scientist
Shri P. Kumaran, Scientist
Shri S. R. Joshi, Scientist
Shri N. Shivaraman, SSA

Biology Cell

Dr. M. Vitthal Rao, Scientist
Smt. Rekha Sarkar, Scientist
Smt. A. Gadkari, Scientist
Shri M. K. Abdulappa, SSA (Resigned on 1 Sept. 1976)

Virology Cell

Dr. V. Chalapati Rao, Scientist (Incharge) (On Deputation)
Shri S. B. Lakhe, SSA
Shri S. V. Waghmare, JSA

RURAL SANITATION

Shri B. K. Handa, Scientist (Incharge)
Shri K. G. Nimbalkar, Jr. Engineer

SEWAGE TREATMENT

Shri V. Raman, Scientist (Incharge)
Shri M. Parabrahamam, Scientist
Dr. G. B. Shende, Scientist (Sponsored Project)
Shri S. N. Kaul, Scientist
Dr. C. K. Kale, Scientist (Sponsored Project)
Shri A. N. Khan, Scientist
Dr. K. P. Rai, SSA (Sponsored Project)
Shri D. Y. Ratnaparkhi, JSA
Shri D. G. Kshirsagar, JSA (Sponsored Project)
Smt. C. Chakrabarti, JSA (Sponsored Project)
Smt. V. T. Nashikkar, JSA (Sponsored Project)

SOLID WASTES

Shri A. D. Bhide, Scientist (Incharge)
Shri S. K. Titus, Scientist
Shri A. V. Shekhdar, Scientist
Shri B. Z. Alone, SSA
Shri R. C. Dixit, SSA
Shri M. S. Olaniya, SSA
Shri A. D. Patil, STA
Shri R. V. Bhoyar, JSA
Shri L. M. Motghare, JSA (On retention of lien)
Shri P. P. Pathe, JSA

WATER

Shri K. R. Bulusu, Scientist (Incharge)
Shri B. N. Pathak, Scientist
Shri A. S. Bal, Scientist
Shri M. V. Nanoti, Scientist
Dr. S. P. Pande, Scientist
Shri D. N. Kulkarni, SSA
Smt. M. V. Vaidya, JSA
Shri W. G. Nawlakhe, JSA

CONSULTATION

Shri D. Raghuraman, Scientist (Incharge)
Shri V. Hanumanulu, Scientist
Shri H. J. Patil, Scientist

CONSTRUCTION & MAINTENANCE

Shri N. M. Narasimhan, Clerk-of-Works (Incharge)
Shri B. V. Kale, Junior Engineer

PREVENTIVE MAINTENANCE

Shri A. W. Deshpande, Scientist (Incharge) (On study leave)
Shri S. K. Pathak, JSA
Shri S. G. Dave, Jh. Engineer,

GLASS BLOWING

Shri N. Narayana, Scientist

PHOTOGRAPHY

Shri E. P. I. Sundersingh, Scientist

TRAINING, INFORMATION, LIBRARY & EXTENSION (TILE)

Shri S. B. Dabadghao, Scientist, (Incharge from 30 Aug. 1976)
Shri R. K. Saraf, Scientist
Shri S. G. Bhat, Documentation Officer
Ku. K. W. Chaudhari, Scientist
Shri S. K. Kesarwani, Library Officer
Shri C. M. Freitas, Publications Officer
Shri Y. N. Murty, Scientist
Shri K. M. Nandgaonkar, STA
Shri R. S. Sharma, Hindi Translator
Dr. G. H. Pandya, STA
Smt. R. A. Thakre, SSA
Ku. S. S. Pande, JTA
Shri G. G. Pardhi, Artist

WORKSHOP

Shri N .G. Swarnkar, Workshop Superintendent (Incharge)
Shri P. A. Balkrishnan, Electrical Assistant
Shri S. K. Nimkhedkar, Foreman (Mechanic)

ZONAL LABORATORIES

AHMEDABAD

Shri S. Rajagopalan, Scientist (Incharge)
Dr. (Smt.) I. S. Jayangouder, Scientist
Shri Prabhakar Nema, Scientist

BOMBAY

Shri S. R. Kshirsagar, Scientist (Incharge)
Shri R. K. Pandit, Scientist
Shri N. S. Phadke, Scientist
Smt. J. M. Deshpande, Scientist
Shri G. Ramkumar, SSA (On Sponsored Project)
Shri A. L. Kulkarni, Scientist
Smt. A. A. Chandorkar, Scientist
Shri N. S. Manthapurwar, SSA
Smt. N. A. Ainapure, JSA
Shri S. V. Deshpande, JSA
Shri K. E. Rosario, JSA
Smt. M. M. Patil, JSA
Shri Y. V. Subrahmanyam, JSA

CALCUTTA

Dr. A. K. Basu, Scientist (Incharge)
Shri R. S. Dhaneshwar, Scientist
Shri S. S. Mudri, Scientist (On Sponsored Project)
Shri C. S. G. Rao, Scientist ,,
Shri S. B. Deshmukh. Scientist ,,
Smt. D. Roy, Scientist ,,
Shri P. M. Pimparkar, Scientist ,,
Smt. G. Mukherjee, S.S.A. ,,
Shri R. C. Parekh, J.S.A. ,,
Shri M. K. A. Kutty, J.S.A. ,,
Shri S. K. Srivastava, J.S.A ,,
Smt. S. Chatterjee, J.S.A. ,,
Shri M. H. Ansari, J.S.A. ,,
Shri S. C. Andharmulai, J.S.A. ,,
Shri S. H. Molla, J.S.A. ,,

DELHI

Shri A. Raman, Scientist (Incharge)
Shri R. P. Mishra, Scientist
Shri J. S. Jain, (On Leave Abroad)

Shri A. K. Seth, Scientist (On Deputation)
Shri N. Dutta, Scientist
Shri S. K. Shrivastava, Scientist
Shri L. N. Sharma, Scientist
Shri J. L. Nagpal, J.S.A.

HYDERABAD

Shri Y. S. Murty, Scientist (Incharge)
Shri D. Seethapati Rao, Scientist
Shri R. Swaminathan, Scientist
Shri L. Shantikumar, SSA
Shri K. Srinivasan, SSA
Shri S. I. Elyas, SSA
Smt. Kanchana Swaminthan, JSA

JAIPUR

Shri V. P. Thergaonkar, Scientist (Incharge)
Shri S. N. Bakde, JSA

KANPUR

Dr. H. C. Arora, Scientist (Incharge)
Shri S. N. Chattopadhyay, SSA
Shri V. P. Sharma, SSA
Shri Tapan Routh, JSA
Shri S. L. Govindwar, JSA

MADRAS

Dr. C. A. Sastry, Scientist (Incharge)
Shri T. K. Shrinivasan, Scientist
Shri B. V. S. Gurunadha Rao, Scientist
Shri V. Kothandaraman, Scientist
Shri K. Subbarao, Scientist
Shri K. M. Aboo, SSA
Shri P. Murhari Rao, JSA (On Sponsored Project)

ADMINISTRATIVE & HOUSE-KEEPING STAFF

Shri Kartar Singh, Administrative Officer
Shri A. V. Subba Rao, Accounts Officer

Shri Kuldip Rai, Section Officer
Shri S. K. Roy, Section Officer
Shri V. M. Kamble, Section Officer
Shri R. Narayanan, Stores Officer
Shri Thomas Joseph, Purchase Officer
Shri K. Muthuswamy, Senior Personal Assistant
Shri P. A. Chandekar, Assistant
Shri M. P. Gharote, Assistant
Shri Santosh Kumar, Junior Accountant
Shri B. Y. Badge, Senior Stenographer
Shri Hamid Khan, Senior Stenographer
Shri B. Damodaran, Senior Stenographer
Shri V. K. Sankaran, Senior Stenographer
Shri G. Swaminathan, Senior Stenographer (Sponsored Project)
Shri H. V. Garde, Laboratory Supervisor
Shri U. G. Deshmukh, Stores Supervisor
Shri G. L. Banerjee, STA,
Shri M. P. Vyas, JTA
Smt. I. D'Souza, Receptionist
Shri J. H. Govind, Watch & Ward Assistant

APPENDIX– X

PERSONNEL

Staff

The Institute's total staff as on December 31, 1976 was 426 which excludes Class IV. The break-up includes 133 Scientific, 196 Technical and 97 Administrative. This excludes nine Research Fellows and three Pool Officers.

Appointments

The following Scientists/Officers joined the Institute during the year :

1. Dr. S. P. Pande, appointed as Scientist B in Water Division on 18.2.1976.
2. Shri K. K. Das, appointed as Scientist C in Industrial Wastes Division on 30.4.1976.
3. Shri C. M. Freitas, appointed as Publications Officer in TILE Division on 6.5.1976.
4. Shri A. Raman, appointed as Scientist E-1 and as Scientist-in-Charge, Delhi Zonal Laboratory on 11.5.1976.

Promotions

The following Scientists/Officers were promoted during the year :

1. Shri K. R. Bulusu, Scientist and Head, Water Division, promoted under assessment from Scientist E-1 to Scientist E-2 on 17.12.1976.
2. Shri V. Raman, Scientist & Head, Water Division, promoted under assessment from Scientist E-1 to Scientist-E 2 on 17.12.1975.
3. Shri S. G. Bhat, TILE Division, as Documentation Officer on 18.2.1976.
4. Shri V. L. Pampattiwar, Air Pollution Division as Scientist C on 18.2.1976.
5. Shri A. S. Bal, Water Division as Scientist C on 18.2.1976.
6. Shri M. V. Nanoti, Water Division as Scientist B on 18.2.1976.
7. Shri C. K. Kale, Sewage Treatment Division as Scientist A on 24.2.1976.
8. Shri A. L. Kulkarni, Bombay Zonal Laboratory as Scientist A on 24.2.1976.
9. Smt. A. S. Gadkari, Epidemiology Cell, as Scientist A on 24.2.1976.
10. Shri T. N. C. Ramaprasad, Industrial Wastes Division as Scientist A on 24.2.1976.
11. Shri K. Subba Rao, Madras Zonal Laboratory as Scientist A on 1.3.1976.
12. Shri A. V. Subba Rao, as Accounts Officer on 6.5.1976.
13. Smt A. A. Chandorkar, Bombay Zonal Laboratory as Scientist A on 15.4.1976.
14. Ku K. W. Chaudhari, TILE Division as Scientist C on 20.7.1976.
15. Shri S. B. Dabadghao, as Scientist E-1 and Scientist & Head TILE Division on 30.8.1976.

16. Shri S. R. Joshi, Life Sciences Division as Scientist B on 19.11.1976.

Transfers

1. Shri R. K. Sharma, Section Officer at Headquarters was transferred to the Central Building Research Institute, Roorkee (U.P.) on 12.1.1976.
2. Shri V. K. Bhatnagar, Accounts Officer at Headquarters was transferred to the National Geophysical Research Institute, Hyderabad on 5.5.1976.
3. Shri T. K. Srinivasan, Scientist B, TILE Division at Headquarters was transferred to NEERI Madras Laboratory on 2.7.1976.
4. Shri R. C. Maheshwari, Assistant at Headquarters was transferred to the National Botanical Gardens, Lucknow on 16.9.1976.

Resignation

1. Dr. N. U. Rao, Deputy Director, Scientist & Head, Life Sciences Division (who was on leave for two years as a WHO Microbiologist at Papua, New Ginnea) resigned from the Institute on 31.12.1976.

Leave

2. Shri V. L. Lokre, Scientist, Instrumentation Division has been granted leave till January 1976 while he is Principal Scientific Officer, Explosive Research Defence Laboratory, Pune.
2. Dr. R. H. Siddiqi, Scientist E and Head, Sewage Treatment Division has been granted leave from 4.6.1976.
3. Shri S. N. Kaul, Scientist 'C', Sewage Treatment Division has been granted study leave from 19.7.1976 for a period of two years.
4. Dr. V. Chalapati Rao, Scientist & Head, Virology Cell, Life Sciences Division has been granted leave for one-year from September 1976 as Visiting Scientist to the Food & Drug Administration of the United States Public Health Services.

Retirement

1. Dr. A. W. Anwikar, Scientist E and Head, Epidemiology Cell, retired from service on 30.1.1976.
2. Prof. N. Majumder, Director, retired from service on 1.12.1976.

Obituary

1. Shri Omprakash, Field Assistant, Delhi Zonal Laboratory, Delhi expired on 31.1.1976.
2. Shri S. Kapuswamy, Laboratory Bearer (Skilled) at Headquarters expired on 23.2.1976.
3. Shri I. P. S. Prasadrao, Scientist 'A', Tile Division expired on 15.12.1976.

APPENDIX– XI

DISTINGUISHED VISITORS

1.	Shri S. K. Mitra	Member-Secretary West Bengal Prevention and Control of Water Pollution Board, Calcutta.
2.	Dr. D. Djurich	W.H.O. Consultant
3.	Md. Giasuddin	W.H.O. Fellow from Bangla Desh,
4.	Prof. F. Green	Asstt. Administrator Environmental Protection Agency, U.S.A.
5.	Dr. B. L. Dybern	F.A.O. Consultant
6.	Dr. J. C. Dodd	M/s Caldwell & Connell Engineers Pvt. Ltd., Australia.
7.	Dr. C. R. V. Raman	Dy. Director-General India. Meteorological Department Delhi.
8.	Dr. M. S. Swaminathan	Director-General Indian Council of Agricultural Research, New Delhi.
9.	Dr .D. C. Kantawala	Environment Engineering Consultant, Bombay.
10.	Mr. N. W. Higgins	Metcalf & Eddy International, Massachusetts, U.S.A.
11.	Shri C. Subbarayudu	Hon'ble Minister for Municipal Administration, Andhra Pradesh.
12.	Shri R. Naidu	Chief Engineer (Public Health) Andhra Pradesh
13.	Shri Ramratan Janorkar	Mayor, Nagpur Municipal Corporation, Nagpur.

14.	Mr. John Haines	U.N.E.P., Paris.
15.	Dr. M. G. McGarry,	Programme Officer, Population & Health Science, International Development Research Centre, Canada.
16.	Mr. S. Sha Kong	Bostwana (Africa)
17.	Mr. R. A. Boydell	Bostwana (Africa)
18.	Col. A. D. Venkateswaran.	E.M.E., Kamptee
19.	Mr. W. Martin,	W.H.O. Consultant
20.	Mr. Weng Lee Lum	W.H.O. Fellow from Malaysia
21.	Mr. H. Mohd. Masdriki	W.H.O Fellow from Indonesia.
22.	Dr. R. Perry	W.H.O. Consultant Imperial College London.
23.	Mr. G. E. Eden	Assistant Director, Water Research Centre, Stevchage Laboratory Stevenage, U.K.
24.	Dr. P. Ker Khoven	W.H.O., I.R.C. The Netherlands.
25.	Dr. D. Rondia	W.H.O. Consultant
26.	Mr. J. Finch	W.H.O. Consultant
27.	Dr. B. D. Nagchaudhari	Vice-Chancellor, Jawaharlal Nehru University New Delhi
28.	Dr. A. K. Ganguly	Director, Chemical Group, B.A.R.C., Bombay.

29.	Dr. J. Schweitzer,	Assistant Education Adviser (Science) British High Commission, British Council, Bombay.
30.	Prof. Nilay Chaudhari	Chairman, Central Board for the Prevention & Control of Water Pollution, New Delhi.
38.	Mr. S. Yang	W.H.O. Fellow from Korea.
32.	Prof. P. L. Knoppert	W.H.O. Consultant
33.	Mr. S. Barabas	Coordinator, W.H.O. International Coordination Centre, Inland Waters & Ground Water Quality, Canada Centre, Ontario (Canada)
34	Dr. M. G. McGarry	Programme Officer, Population & Health Science, International Development Research Centre, Canada.
35.	Mr. C. K. John,	Officer in Charge, Crop Protection & Microbiology Division The Rubber Research Institute of Malaysia, Kaula Lumpur.
36.	Shri C. Satkunanathan	Chief, Scientific Programme UNEP, International Register of Potentially Toxic Chemicals, W.H.O. Geneva.
37.	Mr. Richardus Harjoko	W.H.O. Fellow from Indonesia.
38.	Mrs. Sutehai Champa	W.H.O. Fellow from Thailand.