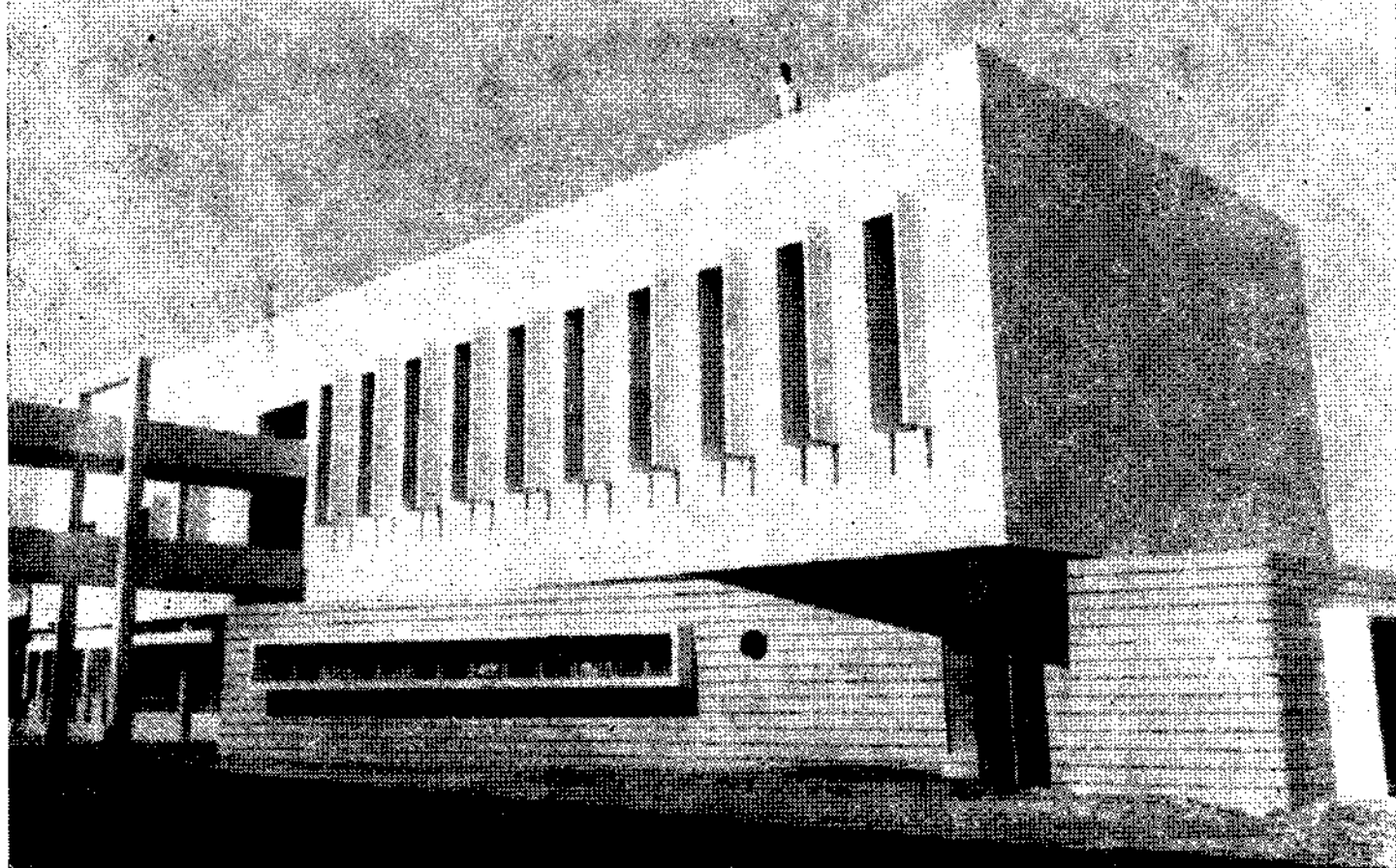


**ANNUAL
REPORT
1970**



**CENTRAL
PUBLIC HEALTH ENGINEERING
RESEARCH INSTITUTE
NAGPUR-3
INDIA**



Auditorium & Library Building

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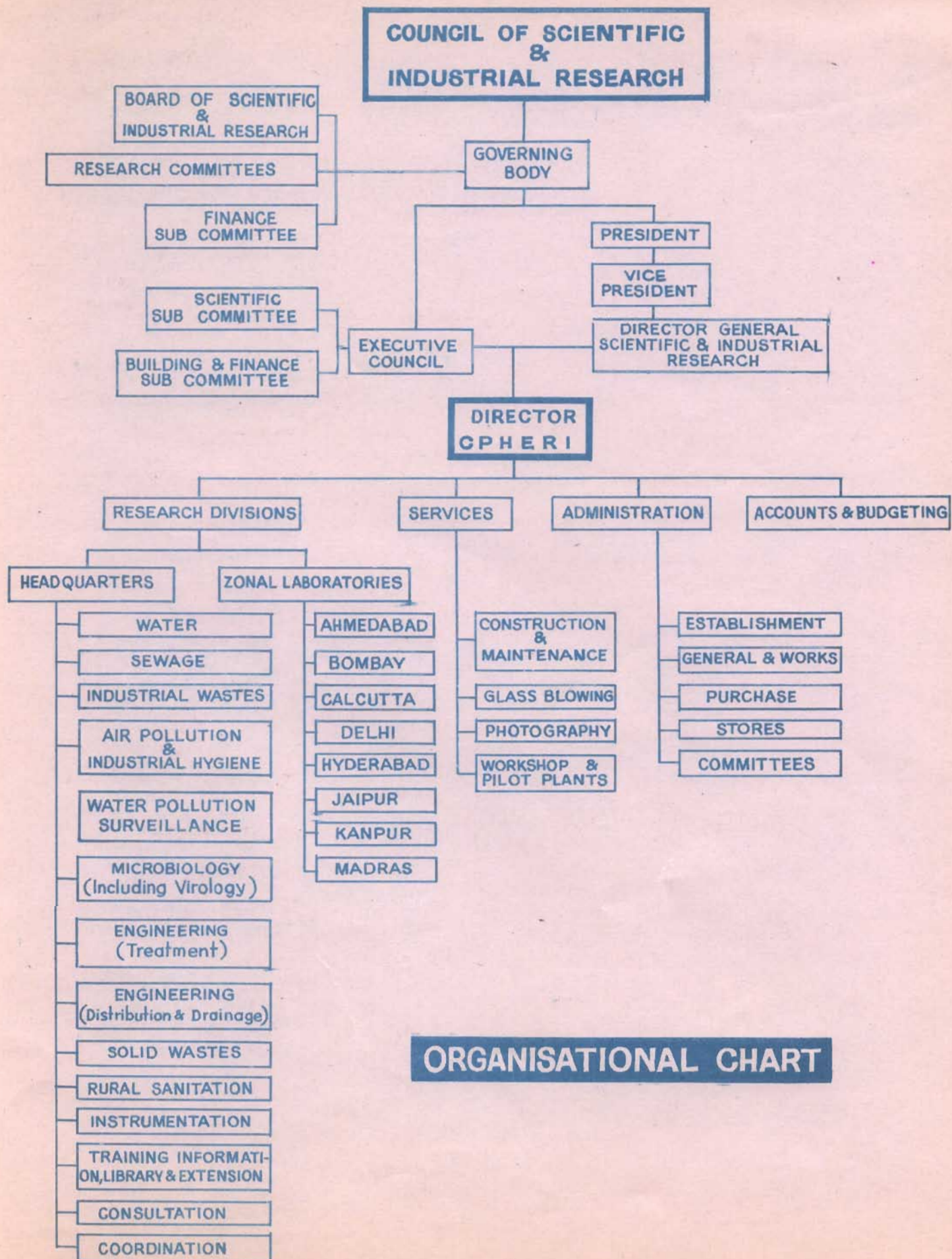
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ORGANISATIONAL CHART

REPORT
OF THE
DIRECTOR

REPORT OF THE DIRECTOR

I have great pleasure in presenting this Annual Report of C-PHERI for the calender year 1970.

Besides the recognition of the Institute as WHO Regional Reference Centre on Air Pollution for five years effective 1969, the Institute was also designated during 1970 as a Collaborating Institute of the WHO International Reference Centres on :

- i) Community Water Supply, and
- ii) Wastes Disposal.

The year 1970 marks the enactment of water pollution control legislation by a State Government in India—The Government of Maharashtra. The Institute is associated with the activities of the Maharashtra Prevention of Water Pollution Board set up for this purpose. The Government of India, in the Ministry of Health also have constituted a Committee each for (i) a draft air pollution control bill, (ii) revision of the manual on water supply, and (iii) Code of practice and comprehensive manual on Sewerage & Sewage Treatment. This Institute has been actively associated with the working of the above committees. In addition to these, the Institute continued to serve on several national and international committees such as the International Water Supply Association, London; National Committee for International Association on Water Pollution Research, Indian Standards Institution, and the Indian Council of Medical Research.

New Developments :

I am happy to record here particularly two new developments for which the Institute filed patents :

- i) Membrane Filter Paper;
- ii) Wind Velocity and Direction Recorder for micro-meteorological studies.

The first will help India to adopt the membrane filter technique for bacteriological analysis which could not be used so far for want of the special filter paper in the country. The other is an apparatus which will greatly help the Institute in its micro-meteorological observations connected with air pollution studies.

Another development worth mentioning is that of "floating aerators" which have a great utility in treatment of sewage and industrial wastes. These aerators have been successfully made by C-PHERI in their own Workshop.

Other developments include the perfection after long trials of a "synthetic medium" capable of replacing the MacConkey or Lactose broth, for bacteriological analysis, and the manufacture of "residual chlorine kits" at a very cheap price. These kits have now found a market in the country as well as abroad.

Research Projects :

In the year 1970, as many as 110 research projects were actively pursued by the Institute's 12 Divisions and 8 Zonal Laboratories. The 3 Divisions concerned with Water, Sewage and Industrial Wastes Treatment had their full quota of work with problems being referred to the Institute from all over the country. Progress on the pilot plants and sponsored projects was continued very satisfactorily.

The Microbiology Division concentrated some special efforts in obtaining data on bacterial and viral die-away in various sewage treatment processes.

The Solid Wastes Division remained busy with various aspects of solid wastes problems in Calcutta mainly. The Engineering Division set up a new laboratory at Nagpur and made good progress with its efforts to bring in two-layer filtration in the country. In Rural Sanitation, the focus of attention in 1970 was on night-soil digestion for which the Ministry of Health helped in encouraging extension work.

The Air Pollution Division increased its activities substantially and concentrated on various field surveys as described elsewhere in this report.

The Instrumentation Division was busy preparing instruments for field use such as in air pollution work and repairs and maintenance of existing equipment.

Some Field Problems :

In 1970, the Institute's work found some application in distant places like Nepal, Assam and Sikkim. At the request of the Lt. Governor of Manipur State the Institute surveyed the water resources and supply system and reported its findings in the form of a preliminary report. In Nepal, the Indian Aid Mission called on this Institute to help in tackling the problems of water treatment at Rajabiraj and other places keeping in view the extreme difficulties in obtaining chemicals and skilled labour at distant sites. The authorities of Sikkim sent one of their engineers to Nagpur to prepare a Master Plan for sewerage and sewage disposal for the city of Gangtok.

Air Pollution Surveys :

Besides the air pollution net-work set up to cover 8 cities in India, the Institute continued detailed air pollution surveys in Bombay, for which additional facilities were set up in 1970. A similar survey was undertaken on behalf of the Durgapur Development Authority in West Bengal. An interesting problem referred to the Institute was to make a micro-meteorological study in the area earmarked for construction of Bombay's "twin" city across the Bombay harbour. This would aid the town-planners and give background data, against which future increases in pollution would be measured as the new city grows.

Solid Wastes :

One of the most interesting studies made by C-PHERI in 1970 was the feasibility study for refuse disposal for the city of Calcutta. The feasibility report was accepted by the Calcutta Corporation Authorities and the work of the Institute commented upon very favourably. Some data on refuse characteristics and costs of its disposal have been assembled for the first time in India with Calcutta as a case study. Data on solid wastes characteristics was also obtained from 6 other cities.

Water Treatment :

The Jamnagar Municipality was assisted to develop designs for conversion of its existing rapid sand filters into two-layer filters. A pilot experimental unit was prepared by C-PHERI and set up at Jamnagar to give realistic information. Work on coagulant aids, deferrisation and defluoridation was continued.

Studies at Bombay :

As part of its programme of work in Bombay, the Institute collaborated with M/s Binnie & Partners, Consultants to the Bombay Municipal Corporation in preparation of a water supply and drainage plan for Greater Bombay to qualify for a World Bank loan. Under this collaboration, the Institute set up various laboratory and field experiments, sampling and analysis work and also participated in some very interesting hydrological surveys (along with our sister laboratory, the National Institute of Oceanography) to obtain data for design of sewage outfalls into the sea at Bombay. Computer programmes for water distribution and storm drainage were also prepared and with this work, the Institute can be said to have entered the computer field. Regular services would now be available to other Corporations and State Governments.

New Divisions at Nagpur :

Preparation were set afoot for creating a new Division at Nagpur called " the Water Pollution Surveillance Division " in order to undertake proper regional and river basin studies and help State authorities and pollution control agencies in planning, forecasting work and developing water quality criteria. This Division would also undertake economic studies and application of system analysis techniques.

Training Facilities :

Training facilities received a considerable boost in 1970 with setting up of a new training laboratory, and constructing a new library and auditorium and a new hostel for trainees. The Institute would now give nearly a dozen short courses each year.

Publications :

In 1970, the Institute launched a one-page " Technical Digest " covering various aspects of public health engineering work in India. This leaflet of which about 3000 copies are brought out every month and distributed free upon request, has been an " instant " success, so to speak. It has been commented upon most favourably by all.

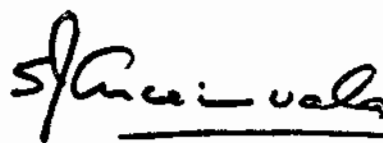
WHO Assistance :

The Institute must continue to remain grateful to the World Health Organization for its assistance and unstinted co-operation during the year. WHO assistance in the form of fellowships,

short-term consultants, literature, etc. has been most valuable. A few of the senior staff members of the Institute participated in WHO activities.

Collaboration with the International Reference Centres of WHO gave a positive stimulus to the Institute's activities.

I express my sincere thanks to all the staff members of the Institute and its Zonal Laboratories for the concerted efforts put in by all of them to raise the general level of activity in every field. I commend their useful team work. Thanks are also due to officials of various State Government Departments and other public bodies whose co-operation and support has been enjoyed by the Institute and all its Zonal Laboratories. I also gratefully acknowledge the fullest support of the Institute's Executive Council, the Scientific Sub-Committee, the Building & Finance Sub-Committee and the officials of the Council of Scientific & Industrial Research.

A handwritten signature in black ink, appearing to read 'S. J. Arceivala', with a horizontal line underneath the name.

(PROF. S. J. ARCEIVALA)
DIRECTOR

Nagpur
The 15th March, 1971.

RESEARCH ACTIVITIES
(DIVISIONS AT HEADQUARTERS)

WATER

The Division has filed two patents in 1970; One for the preparation of Membrane Filters for bacteriological examination of water and the other for Synthetic Poly-anionic Coagulant aid (CA-15).

1. Coagulant Aids

Work on this project was continued and actual field trials were made with one of the natural coagulant aid (CA-3) at Kanhan Water Works, Nagpur, to study its efficiency. The results are encouraging.

Studies carried out with the help of synthetic coagulant aid (CA-15) indicate that with concentration of 0.5 to 3.0 mg/l, the alum requirement is reduced to about 1/3 to 1/16 of the original dose of alum, depending upon the raw water turbidity. This aid has been tested in the laboratory in conjunction with alum, with raw waters having turbidities ranging between 500-3500 units.

2. Development of Defluoridation Media

Studies on pilot plant employing "Defluoron-2" at Nalgonda, near Hyderabad were completed and the State authorities who sponsored this scheme have been supplied with a detailed report including the operational problems and cost of treatment.

A full scale treatment plant, employing "Defluoron-2" has been fabricated and installed at the Central Training Institute, Hyderabad, to treat about 20,000 to 25,000 gpd of water containing fluorides. This plant is expected to be commissioned in 1971.

A total of 7 domestic defluoridation units have also been supplied to various parties on request.

3. Development of Activated Alumina

The technique for preparation of activated alumina, which is one of the efficient media for removal of F^- has been finalised. About 6 litres of this material was prepared for laboratory studies. The results of laboratory studies for removing F^- are encouraging, and it is proposed to extend these studies to field trials.

4. Filter Aids

In all 4 indigenous filter aids were developed and their efficiency was tested in the laboratory. Some filter aids are being imported in order to compare the efficiency of these filter aids with that of imported ones.

5. Development of Membrane Filter

The process for the preparation of membrane filters for bacteriological examination of water and waste water has been finalised. These papers have already been tested by different laboratories in the country and found comparable to the imported ones.

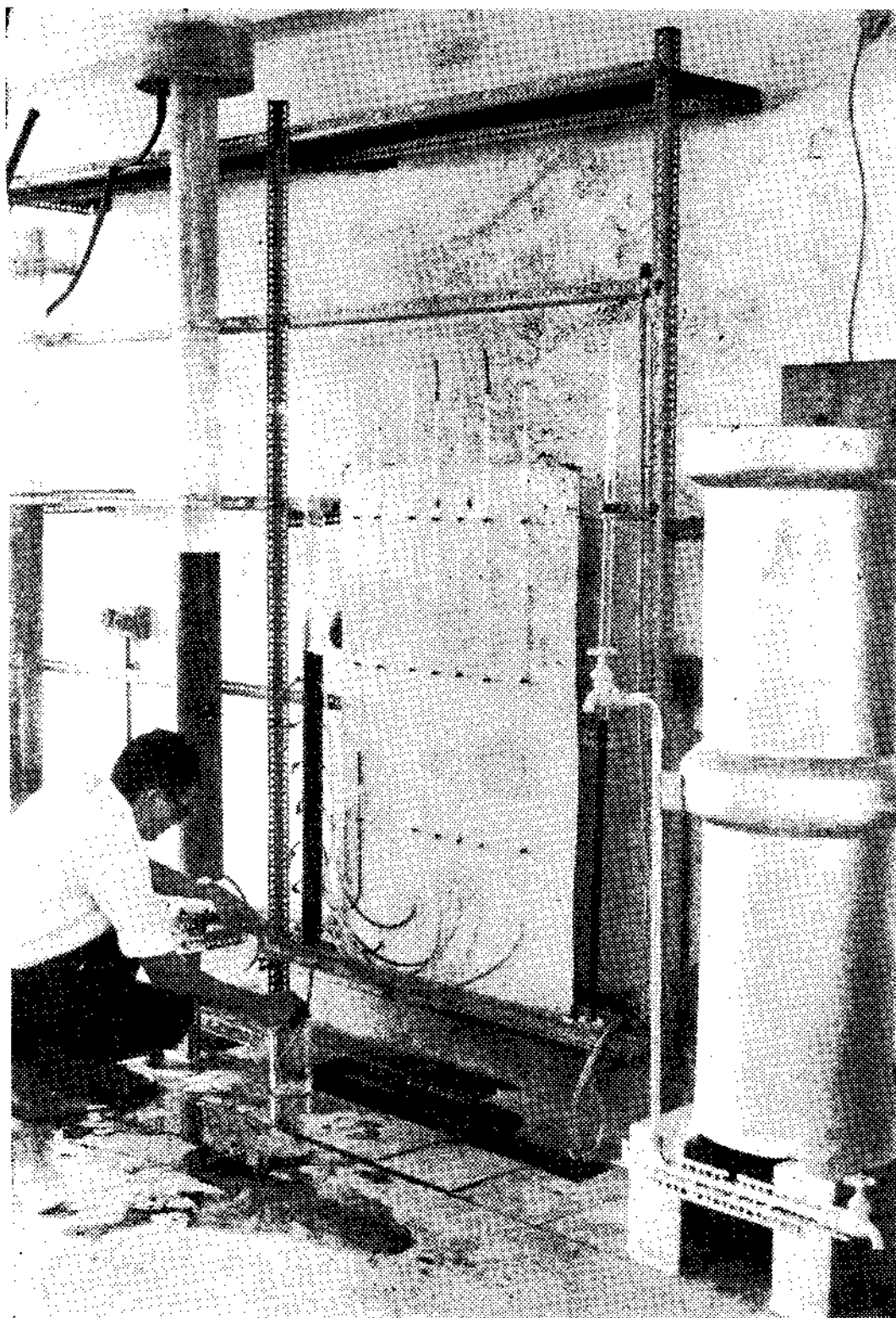
The process of preparation of membrane filter, designated as MF-B, is under patenting.

6. Iron & Manganese Removal

The Institute has developed an iron & manganese removal unit for rural purposes in which aeration over a series of coke beds is followed by slow sand filtration. A catalytic oxidation bed is formed in course of time which hastens the removal. No chemicals are required. The unit can be directly worked off a hand pump on a well and iron & manganese free water obtained. The cost of a typical unit with about 200 litres per hour capacity is Rs 200/-.



An Experimental Set-up for the Estimation of Methane Production in Stabilization Pond



An Experimental Set-up showing Studies on removal of Iron & Manganese from Water

SEWAGE

The emphasis of the investigations by this division has been on evaluation of low cost wastewater treatment methods and utilisation of the effluents. The activities are grouped in two cells which are described below.

SEWAGE TREATMENT AND UTILISATION CELL

1. Stabilization Ponds

Studies were carried out on a 27 x 33 x 1.3 m pilot stabilisation pond. Gases produced due to anaerobic reactions in the facultative pond were collected and analysed for methane. It was found that at BOD-5 loadings of 600 to 700 lbs/acre/day when the pond was working at 80 per cent efficiency methane accounted for 400-500 lbs/acre/day of ultimate BOD satisfied.

Photosynthetic oxygenation by algae was measured at different loading rates. A significant decrease in oxygenation capacity was observed at higher loads.

2. Aerated Lagoons

Earlier studies were continued on performance of an aerated lagoon with a fixed aerator operated on total oxidation basis.

Study of a lagoon with a floating aerator was initiated which is operated on an intermittent basis on a cycle of waste addition, settling and decanting.

3. Oxidation Ditch

A 'Pasveer-type' oxidation ditch pilot plant was operated at different levels of mixed liquor suspended solids concentration. Data on sludge production, sludge drainability and oxygen requirements have been obtained for the various steady states of the system.

4. Oxygenation Capacity of Aerators

Studies were initiated on theoretically correlating the geometry of a mechanically aerated system, oxygenation capacity and power requirement.

5. Biological Disc

The process combines settling and digestion, as in Imhoff tank, but with aerobic stabilization of nonsettleable and dissolved organic matter by biological slime growing on discs rotating within the settling compartment. Studies on a laboratory model were completed. Further studies include evaluation of performance of a pilot plant which is under construction.

6. Design Criteria for Conventional Sewage Treatment Processes

The survey of conventional sewage treatment plants was continued by the zonal laboratories of the Institute. Difficulties in collection of data are encountered as many of the plants are not in proper running condition.

7. Sewage Irrigation

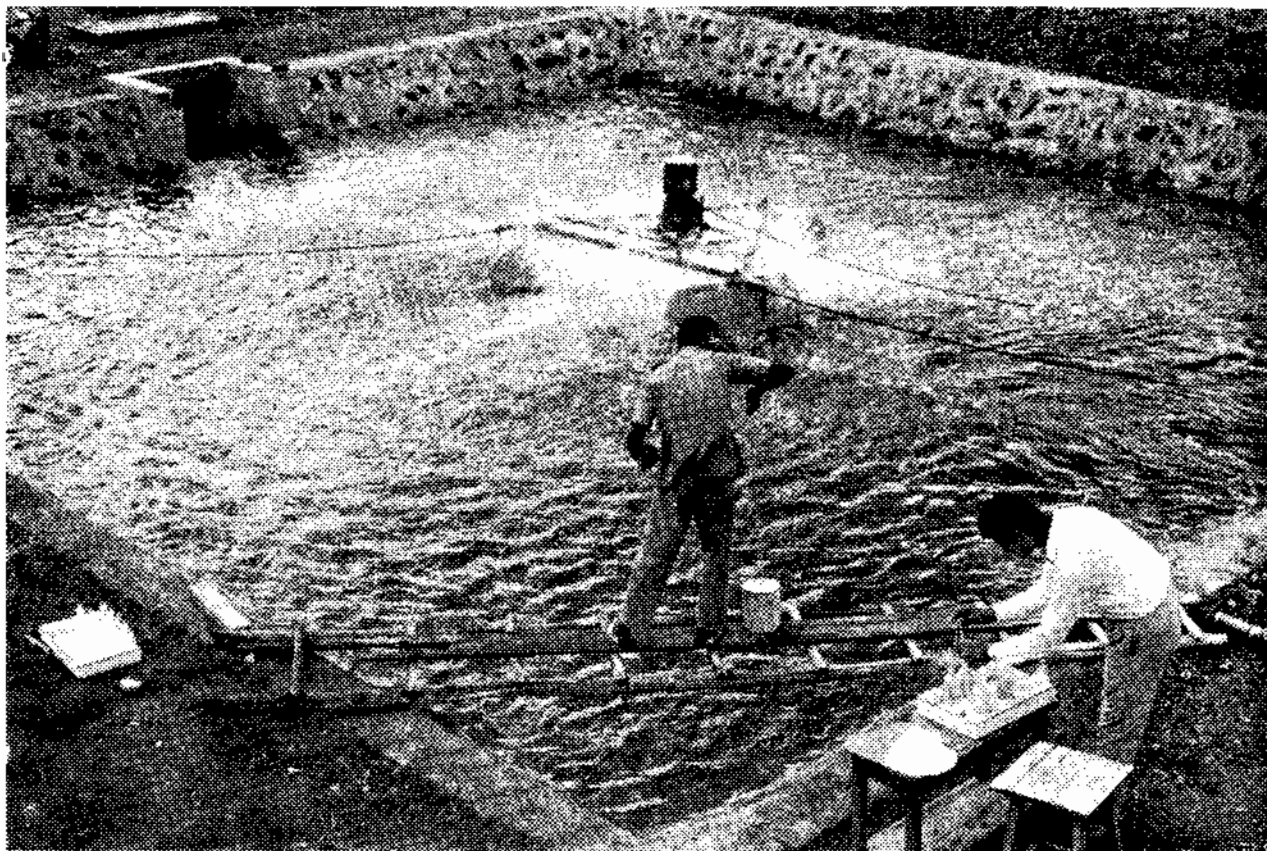
Field experiments using raw sewage, differentially diluted raw sewage and treated sewage effluents, with and without fortification with fertilizers, as irrigants were continued. A new experimental plot was developed and trials for determination of coefficient of variability were conducted.

8. Ad-hoc Advisory Committee on Agricultural Projects

Since a major effort has been undertaken in field experimentation of sewage utilization for farming, an ad-hoc advisory committee has been constituted to review the current research at the Institute and advise on future lines of action from time to time. The committee consisting of experts from ICAR, New Delhi, I I Sc, Bangalore, Medical College, Nagpur, and L. S. G. E. , U. P., met on April 6, 1970 at Nagpur. Research work under various projects was reviewed and suggestions were made for future work.

9. Sewage Farming Practices in India

Twelve sewage farms located in different regions of the country were surveyed. Analyses of soils under sewage irrigation and comparable soils not receiving sewage from various farms are under progress. Other relevant data are also under compilation.



A View of the Pilot Plant Aerated Lagoon in the Institute's Campus

Three farms were surveyed to ascertain the health aspects of sewage farm workers. It was found that on an average the incidence of protozoan and helminthic infection for such farm workers was fifty per cent more than that of a control rural population. The work is being continued to include other farms also.

BIOLOGY CELL

1. Fish Culture

Stabilization pond effluents rich in phyto- and zooplankton form an ideal medium for fish culture. Growth patterns of some edible fish in six culture ponds operated in parallel and fertilized to different levels with stabilization pond effluent were observed. Experiments on determination of primary productivity of the culture ponds were also conducted.

INDUSTRIAL WASTES

1. Pulp & Paper Mill Effluents

Work on this project was continued on the lines indicated last year. An inter-size lagoon (1 mg capacity) has been constructed at M/s Orient Paper Mills, Amlai, and is being operated. Presently the lagoon is giving 75% reduction in BOD at a detention time of 40 days.

A report on the characterisation and treatment of these wastes is under preparation.

A report entitled "Pulp Mill Wastes Treatment at Government Paper Mills, Hoshangabad", was prepared and submitted to the authorities.

2. Rayon Grade Pulp Mill Wastes, Mavoor (Calicut)

Based on the laboratory studies, the two existing lagoons, each having a capacity of about 15,000 M³ are being converted into full scale anaerobic lagoons in series for treating the neutralised pre-hydrolysate liquor.

The overflow from the first lagoon is being collected into the second lagoon which is filled to 75% capacity.

Studies on various aspects of treatment of these wastes such as the detention time, the nutrients required etc. are in progress.

3. Treatment of Effluents from Berar Oil Industries, Akola

The wastes emanating from the different manufacturing processes have been characterised.

Studies on treatment of these wastes with different coagulants such as lime, alum and ferric chloride were found ineffective. Studies on adjustment of pH of the wastes to about 2.0 by acid treatment showed that the fatty matter in the oily layer can be separated and re-used.

Based on the laboratory studies, 5 alternative flow sheets have been developed and recommended to the factory authorities in the form of a technical report.

AIR POLLUTION & INDUSTRIAL HYGIENE

1. National Air Sampling Network

The Institute has started to collect air quality data and the problem of air pollution by setting up a national air pollution sampling net work in the nine important cities of the country. The objective is to determine the trends in city air quality over the years in various cities. These stations are chosen in each city to give a representative sample as far as possible. These cities also happen to be the one in which CIPHERI already has Zonal Laboratory and one staff member from each centre is operating the air monitoring programme for the respective station. The cities where the air pollution sampling net work programme is operated are :

- | | |
|--------------|-------------------------|
| 1) Bombay | Heavily Industrial |
| 2) Calcutta | do |
| 3) Delhi | Commercial |
| 4) Madras | Industrial |
| 5) Kanpur | —do— |
| 6) Ahmedabad | Heavily Industrial |
| 7) Hyderabad | Commercial & Industrial |
| 8) Jaipur | —do— |
| 9) Nagpur | —do— |



An Experimental Set-up showing Air Pollution Control Studies

Regular data are being collected since January 1970 from the above cities. Climatological data are also being collected and analysed to study the wind and temperature pattern of these cities.

2. Sponsored City Air Pollution Surveys

As a result of the short-term surveys the concerned authorities in city corporations were made aware of the Pollution problems and concrete proposals for air pollution survey programme were submitted by the Institute to the following, at their request :—

- i) Bombay Municipal Corporation
- ii) Calcutta Metropolitan Organization
- iii) Delhi Municipal Corporation
- iv) Ahmedabad Municipal Corporation
- v) Durgapur Development Authority -Durgapur
- vi) Bombay Twin-City Project (CIDCO)

Of the above, Bombay Municipal Corporation and Durgapur Development authority have agreed to Institute's detailed survey proposals and have also agreed to pay for the surveys.

3. Development & Fabrication of the Equipment

As air pollution survey equipment is not available commercially in this country and in order to avoid imports, this Institute has undertaken development of necessary equipment and to fabricate them for supply.

4. WHO Regional Reference Centre

The Institute has been designated by WHO as a Regional Reference Centre on Air Pollution since 1969. The Institute has already started taking necessary steps to implement the various programmes as laid down under this project.

5. Localised Industrial Air Pollution Surveys

Besides the city air pollution Control work this Institute also carried out local industrial air pollution surveys and industrial hygiene activities, as given below :—

(a)	Industry	Nature of problem
1.	Fertilizer Corporation of India, Trombay.	Atmospheric pollution due to factory emissions in the vicinity.
2.	Gwalior Rayon Manufacturing & Weaving Co. Movoor, Kerala State.	Community air pollution due to Industry.
3.	Coromondal Fertilizer Factory, Visakhapatnam, (AP).	Pollution effect on electrical equipment and health hazard.

(b) Industrial Hygiene Surveys in Working Environments

Industry		Nature of problem
1.	3 Fine Cotton Mills 4 Coarse cotton mills 3 Ginning factories	Cotton dust concentration in working environment and incidence of Byssinosis—
2.	Govt. Printing Press	Evaluation of exposure of workers in printing press to lead fumes.

MICROBIOLOGY (INCLUDING VIROLOGY)

1. Die-away of Bacterial Pathogens and Parasites in Different Sewage Treatment Plants

Studies are being carried out on the performance of Pilot plants, like Oxidation pond (Single cell unit), Oxidation ditch, Aerated lagoon situated in the C. P. H. E. R. I. campus, in eliminating bacterial pathogens and intestinal parasites. Weekly composite samples of influent and effluent were collected from these plants and examined for indicator bacteria, *salmonella* and parasites. Though *Salmonella* were reduced to a considerable degree, the effluent samples were always positive. Indicator bacteria was reduced by more than 90 per cent and parasites by 85 per cent. The work on the performance of some existing full scale oxidation ponds at Bhilai and at Bhandak (Chanda)-in terms of *Salmonella* and parasites removal is also in progress.

2. Development of Synthetic Medium for Bacteriological Analysis of Water

A chemically defined medium containing inorganic ammonium salts as major source of nitrogen was developed in this division. This synthetic medium was compared with standard MacConkey for its performance in the bacteriological analysis of waters. In all, 350 samples from different sources, viz. lakes, wells, rivers and water treatment plants were analysed using MacConkey and Synthetic media in the presumptive test. All the samples were analysed for *Coliforms*, *Fecal Coliforms* and *E. Coli*. It was observed that the number of positive tests were consistently more in the case of Synthetic medium than the standard MacConkey broth. Higher recoveries of *Coliforms*, *Fecal Coliforms* and *E. Coli* were obtained with the synthetic medium. The work on this project is completed and the data is subjected to statistical analysis. The cost of the synthetic medium is Rs. 100/100 litres as compared to MacConkey broth which costs Rs. 250/100 litres.

3. Relative Incidence and Survival of Coliforms and Fecal Streptococci in Soils

About 400 soil samples from different locations like garden, grazing field, hilly tracts and the banks of rivers and lakes, were analysed for the relative incidence of total coliforms, fecal coliforms, *E. Coli*. and fecal streptococci. The data revealed some interesting information.

Coliforms were always occurring in much larger numbers than fecal streptococci in all types of soils. The number of fecal coliforms, E. Coli and fecal streptococci were the highest in the garden soils, as can be expected because of the use of organic manure. Though the fecal coliforms were higher than the fecal streptococci in most of the soils, they were consistently much lower than the fecal streptococci in all the 99 samples of the soils from the banks of rivers and lakes. These two groups of organisms are occurring more or less in similar numbers in the grazing field soils. This shows that wherever there is fecal pollution from warm-blooded animals other than man, the number of fecal streptococci seems to be much higher. This study revealed that the run-off waters from grazing field may be polluted with similar numbers of fecal coliforms and fecal streptococci while from other soils fecal coliforms always out-number the fecal streptococci.

4. Bacteriophage Model Studies for the Concentration of Viruses from Polluted Soils

The effect and ability to concentrate the phage over the membrane filter was studied using four types of cations: sodium, calcium, magnesium and aluminium. Of the four, magnesium at a concentration of 1200 mg/l and Calcium with a concentration of 800 mg/l could retain by 100 per cent of the phage added to water.

Based on the above, soil was contaminated with the phage and the recovery was studied. A procedure to concentrate the phage from small quantities of soils was standardized. A two step centrifugation at 3000 & 10,000 rpm, followed by the addition of Mg^{++} upto 1200 mg/l could retain the phage over the membrane and could be recovered.

5. Survey of Waters for Enteric Viruses

Before testing the efficiency of virus removal from the water in a treatment plant, it is necessary to standardize the method to concentrate viruses from large volumes of waters.

Experiments were carried out to standardize the procedure, using different artificially polluted well-water adjusted to pH 5.0 and with the addition of 800 ppm Mg^{++} . Water was passed through 0.45 millipore membrane filter. The adsorbed virus was eluted with 5 ml. of 3 per cent beef extract. The eluate was inoculated on to monkey kidney tissue culture. Using waters from different wells, lakes and rivers for artificial inoculation of poliovirus, recovery rates from 60 to 99 per cent were obtained. Work is in progress to use larger volumes of water for concentration purposes.

In a survey to assess viral pollution of well waters in Nagpur, only one well out of ten was positive with a viral load of 15 PFU/lit. This survey will be continued.

6. Improved Techniques for Virus Concentration from Sewage

A simple method for routine analysis of sewage and effluents for detecting viruses using adsorption at pH 3 and elution at pH 8 from a 0.45 μ 47 mm diameter membrane filter has been developed and tested on viruses added to autoclaved sewage as well as viruses occurring in natural sewage.

In a six month program of monitoring of raw sewage from a middle income group community in Nagpur, 40 ml samples yielded 124 PFU during monsoon and 480 PFU during winter

High efficiency and reproducibility of the method allowed the use of sample volumes as low as 150 ml of treated effluent for detection of viruses.

7. Virus Removal in Different Sewage Treatment (Pilot) Plants

Studies pertaining to virus removal in two different pilot plants, viz., Oxidation ditch and Aerated lagoon have been continued to cover all the seasons. Studies have also been initiated on a single cell oxidation pond.

ENGINEERING (TREATMENT)

1. Two-Layer Filtration of Water

Two-layer filters consisting of anthracite and sand permit adoption of higher rates of filtration than conventional or produce longer runs and or better quality filtrate when operated at conventional rates.

An intensive search to locate sources of anthracite in the country with a view to promote extensive use of two-layer filters has not been successful so far. However, good quality bituminous coal samples were procured and tested for their suitability as substitute for anthracite. The tests

indicate that bituminous coals, though lower in density (1.3-1.6) and hardness (2-3 Moh's scale) can be used in place of anthracite in the two-layer filters. Trials on a large scale using bituminous coal are to be undertaken to assess the economic and operational aspects.

An on-site investigation was undertaken at Jamnagar Water Works (Gujrat) with the help of a mobile filter unit to suggest necessary modifications to convert the existing rapid sand filters into two-layer filters with a view to augment the present supply. A report incorporating the recommendations has been supplied to the Superintending Engineer, Public Health Circle, Rajkot.

2. Reference Collection of Coals & Sands

With a view to be of assistance to the field engineers in selecting the nearest and the right source of filter material, the Division has started a programme of collecting coal and sand samples from different parts of the country and to classify them with reference to their physical and chemical characteristics such as sp. gravity, acid solubility etc. Few samples of sand and coal have been received and tested for their characteristics.

ENGINEERING

(DISTRIBUTION & DRAINAGE)

1. Leakage Detection & Wastage Prevention

Surveys conducted elsewhere reveal that a sizeable portion of water (even upto 40%) is wasted by way of undetected leaks from buried water mains. No due attention has been paid to this Problem in our country.

In the past about one year, the Institute has been, with the help of electronic leakage detecting equipments, rendering service to municipalities by way of conducting leak surveys from the buried mains of distribution system. Currently such a service is being offered to the Bombay Municipal Corporation on an extensive scale.

2. Extractability of Lead used as a Stabiliser in the Manufacture of uPVC Pipes

In the process of manufacture of uPVC pipes heat stabilisers such as compounds of lead and tin are used. These toxic compounds are reported to leach into the drinking water in varying concentrations when the uPVC pipes are used in distribution systems.

Work is in progress to determine the toxicity potential of uPVC pipes manufactured in the country.

3. Investigations on Burst Failures of Cast Iron Pipes

An investigation was carried out to look into the causes of reports of burst failures of C. I. pipes in new installation. It was concluded from a study of available literature, standards and discussions with manufacturers that the most probable cause of such failures is poor handling of C. I. pipes, especially of large diameter, during the process of transportation and laying.

4. Development of a Field Flush Latrine

With a view to develop a light, durable and easy to maintain flush latrine for use in permanent and semi-permanent camps in place of the present system of using trench latrines with wooden platform and seats, a trial unit was fabricated out of glass reinforced plastic and after inspection, some improvements were found necessary. Efforts are being made to locate a suitable agency that can undertake the work of fabrication on a large scale as per the improved design.

5. Storm Intensity-Duration-Frequency Relationship for Different Regions of India

With a view to provide a rational basis for the design of rain water pipes and storm sewers, storm intensity-duration-frequency relationship has to be established for the different regions of the country.

A computer programme has been developed to establish the intensity-duration-frequency relationship of storm for Bombay city. This programme could be applied to any other region if the rainfall data for the region is available, to arrive at the relationship.

SOLID WASTES DISPOSAL

1. Composting of Blow-Room Cotton Dust

Work on this project has been completed. The cost analysis was worked out for all the cases on the basis that one tonne of raw material gives 0.6-0.7 tonne of finished product. The least net production cost of compost inclusive of labour, land, structures etc. was found to be Rs. 6/- per tonne ex-compost-yard, when turning is done on alternate days.

A Technical Digest was brought out to highlight the work on this project. This has evinced great interest in the utilisation of blow-room cotton dust by many textile industries.

2. Refuse Collection Data from Nine Indian Cities

Work on this project is being continued. All the Zonal laboratories are helping in the collection of necessary data on the various aspects as reported in the last year's report.

The per capita refuse production of Calcutta and Bombay cities has been found to be 0.51 and 0.50 kg per day. The Calcutta refuse has been found to be having an average calorific value of 2708 BTU/lb.

3. Short Term Refuse Characterisation of Poona City

The study carried out in October 1970, revealed that per capita refuse production is about 0.32 kg per day. There is a great demand for compost in and around Poona City and it is expected that the Municipal authorities may go in for mechanical composting plant. The Poona City refuse was also observed to be richer in necessary plant nutrients as compared to other Indian Cities.

4. Comparative Study of Windrow and Pit Method of Composting of City Refuse

Work on this project was continued. The work done so far on the Windrow composting of Nagpur city refuse indicated that the shredding and sorting did not appreciably affect the composting process when done in Windrows.

5. Pilot Incinerator for Market Refuse at Khar-Bombay

On the request received from the Bombay Municipal Corporation the design for "In-line" type multi-chamber incinerator for 3 tonne / 8 hr. capacity has already been supplied. Work on the construction of the incinerator is in progress now.

6. Feasibility Studies for Alternate Methods of Disposal of Garbage for Calcutta City

An exhaustive study was undertaken regarding the present methods of refuse disposal of Calcutta City. A thorough economical evaluation of the methods presently being followed was carried out. To enable assessing the feasibility of the various methods of refuse disposal, nearly 308 samples were collected all over Calcutta and were analysed,

On the basis of the field and laboratory investigations that were carried out, it was seen that if some modifications are carried out at three of the present four dumping grounds, sanitary landfilling can be carried out and the sites can be used for atleast 25 more years. On the basis of the assessed demand of compost, it has been recommended that a mechanical composting plant of 200 tonnes per day be constructed at Nawapara.

The report shows that when the above recommendations are followed, the facilities can serve for atleast 25 more years; entailing a running cost which is at the same level as of today.

7. Collaborating Institute of the WHO International Reference Centre for Solid Waste Disposal

The Institute has been nominated and has already started collaboration with the WHO International Reference Centre at Dubendorf, in the exchange of relevant information in the field of Solid waste treatment, disposal and management.

RURAL SANITATION

1. Field Demonstration

As a part of extension work to popularise rural sanitarywares, a ten days' camp was held at Paonar (Wardha District). During the camp period, a provision was made for pumped and chlorinated water to the camp and the village. Grampanchayat representatives and students

as well as staff members of Mahatma Gandhi College of Medical Science, Sewagram were given demonstration and were acquainted with maintenance & operation of the pump and disinfection procedure. An exhibition on "Public Health" was also arranged by the Institute on the occasion where the process/ products developed by the Institute for improving rural sanitation, were displayed. Large number of people both from the village and neighbourhood visited the site and evinced keen interest in the activities. The Chief Minister, Maharashtra State, appreciated the work and gave donations to the local authorities to continue with the sanitation facilities on a permanent basis.

2. Get-Together with Village Representatives

The Institute also organised a get-together during February 1970 to discuss the problems in rural sanitation and devise ways and means to improve upon the present sanitation level. The get-together was attended by local village authorities and provided a useful forum. It was felt that intensified demonstration programme needs to be taken up to acquaint the rural people to the advantages of the developed products / process for improving sanitation.

3. CPHERI Chloroscope

The Institute developed a simple kit "CPHERI Chloroscope" for ease in estimation of residual chlorine in drinking waters. The kit was given a mode publicity and, as a result, large number of requests for the same were met with. The product was kept on sale and over 100 units have been supplied.

4. Night Soil Digestion

As a result of Technical Digest broughtout on "Nightsoil Digestion" which was widely circulated, a number of enquiries were received especially from the Municipalities & Corporations, and these were attended to.

INSTRUMENTATION

This division looks after repairs, maintenance and calibration of all types of electronic, electrical, mechanical and refrigerated instruments available in the Institute. Besides, develop-

mental work on design and fabrication of special equipments and gadgets, instrumental analysis work and modification of existing imported equipments with a view to use indigenously available spares etc. has also been undertaken.

Developmental work completed or in progress include the following :—

- (i) Electronic/ electrical net work analyser
- (ii) Recording anaemometer & wind vane
- (iii) Wind direction activated sampler
- (iv) Leakage detection and wastage prevention
- (v) Temperature inversion studies
- (vi) An apparatus for recording wind velocity

The “CPHERI Chloroscope” developed last year for ease in estimation of residual chlorine in water has been put on sale during the year and over hundred units have been sold out including export of 30 units to East Africa. The performance report on this simple kit is satisfactory and has been adjudged as a novel one by the field personnel in public health engineering.

Facilities of instrumental analyses such as infra-red spectro-photometry have been provided to many outside organisations besides the Institute's own scientists. Similarly, many research/ educational institutions have been extended necessary help in inspection and repairs of their instruments.

ZONAL LABORATORIES

ZONAL LABORATORIES

1. The Bhopal Zonal Laboratory was closed and the staff and equipment were shifted either to Headquarters or to the other Zonal Laboratories.
2. Besides the research projects that are indicated under each Zonal laboratory separately, these laboratories continued to collect and supply data on : (i) long-term city-air quality surveys of the respective cities, (ii) quality & quantity of city refuse and (iii) Survey of the existing sewage treatment plants with a view to develop design criteria for different processes under Indian conditions.

AHMEDABAD

1. Project reports on the treatment and disposal of Industrial wastes from the following Industries were completed and submitted to the concerned Industries for implementation :

- (a) M/s Suhrid Geigy Ltd;
Ranoli, near Baroda.
- (b) M/s CMC (P) Ltd;
Odhav Road, Ahmedabad.
- (c) M/s Indian Electro-chemicals, Ltd;
(Odhav Road), Ahmedabad.
- (d) M/s Cellulose Products Ltd;
Kathwada, Ahmedabad.
- (e) M/s Navsari Oil Products Ltd;
Navsari, Distt : Bulsar.
- (f) Industrial waste survey in
Kalol, Mehsana District.

2. **Characterisation and Treatment of Effluents from
M/s Calico Mills Ltd; Ahmedabad.**

The studies carried out include :

- i) Inplant survey of the sources and quantities of wastes discharged by different sections.
- ii) Characterisation of the different stream of wastes; and
- iii) Treatment by chemical and biological methods.

The studies carried out so far, indicate that the effluents can be treated either by extended aeration or aerated lagoon and the effluent can be discharged into surface water or municipal sewers.

3. Effluent Treatment at M/s Shree Ambika Mills

This study aims at the development of a more efficient and satisfactory method of treatment of textile mill effluents. The classical method practised at present, called the gypsum bed treatment, has been found to be inefficient and unsatisfactory. Laboratory studies carried out hitherto have shown that alum treatment brings about a reduction in the bicarbonate alkalinity and the colour of the effluent.

4. Effluent Characterisation and Disposal at M/s J. K. Synthetics Ltd., Kota, (Rajasthan)

The factory discharges the untreated wastes into a nearby lake causing serious water pollution problem. Studies carried out indicated that the effluents from the factory require suitable biological treatment before discharging into the surface waters to reduce the organic load and protect the quality of surface water.

5. Effluent Disposal and Air Pollution Survey at M/s Navin Fluorine Industries Ltd., Udhna, Surat

The factory produces a variety of organo fluorine compounds from fluorspar, chloroform and carbon tetrachloride and also sulphuric acid. The effluents are highly acidic and contain a very high concentration of fluorides and cause severe air pollution by hydrogen fluoride gas and sulphur dioxide from the acid plant.

A case study and a preliminary project report has been prepared for detailed investigations.

6. Effluent Disposal Problems at M/s Central Pulp Mills, Songarh, Surat

The factory discharges about 3 to 4 mgd of effluent with a high BOD and suspended solids which are in excess of the maximum permissible levels prescribed by the ISI Standards. These require suitable treatment for removal of its colour, BOD and suspended solids. A preliminary project report has been prepared.

7. Effluent Treatment at Gujarat State Fertiliser Co. Ltd; Baroda

Consequent upon the decision of the Government of Gujarat to discharge all industrial effluents in the Mahi River basin, and through it into the sea at Cambay through an open channel, the earlier concept of treatment of these wastes has been suitably modified. Accordingly the Gujarat State Fertilizer Co. has been asked to treat effluents partially so as to remove the toxic constituents only. Work on the revised method of treatment of these wastes is now in progress.

8. Characterisation of Dairy Wastes from Kaira District Milk Producers' Co-operative Union at Anand

The effluent discharged from the Amul Dairy at Anand is in the range of 0.5 to 1.0 mgd resulting from processing of about 350,000 litres of milk daily. These effluents have been analysed with a view to suggest a suitable method of treatment.

9. Characteristics of Effluents from M/s Associated Pulp and Paper Mills, Bavla

The factory produces about 15 tonnes per day of kraft (unbleached) paper from cotton waste and waste paper. About 0.4 mgd of combined effluents from the washing and refinery operation are produced from the paper machines. Work on the characterisation of the waste and their treatment by biological means is in progress.

10. Air Pollution Survey

One sampling station was established in the heart of the city so that the samples collected represented a true picture of the various air pollutants emitted by textile industries, the railways and busy traffic area. The data so far collected is too meagre to arrive at any definite conclusion. However, it may be mentioned that the level of chemical pollutants is quite low; smoke and dust are the predominant constituents of the air pollutants in the city.

11. Characterisation of Refuse

Work on the collection & analysis of representative samples of city refuse from various localities is being continued.

BOMBAY

1. Pilot Filtration Studies at Vaitarna

The project was continued from last year. Experiments were carried out to find out whether the filters would operate satisfactorily if (i) no alum was used; (ii) heavy alum dose was used just at the start of a filter run and then alum dosing was discontinued and (iii) alum dose was added for different lengths of periods from the start of the run.

A model up-flow filter 6" in diam. was made and was fed with artificial turbid waters of different turbidities to find out a suitable size and grading of filter media. It is proposed to translate these results on the pilot up-flow filter.

2. Optimisation in the Design of Water Filtration System

A general programme with the aid of a computer has been developed so as to find out the optimum number size, as well as the arrangement of the filters for any particular treatment capacity that would involve the least cost of construction. This study will be of great use for field engineers.

3. Study of Sewer Ventilation

The aim of this project is to ascertain whether the ventilation columns provided on sewer lines do any useful work and what should be a proper design criteria for them.

A survey of the ventilation columns on a main sewer in the city was taken up and the samples of air from the sewerline were collected to examine the oxygen depletion and increase in the hydrogen sulphide contents. This gave a good idea of the work and use of ventilation columns.

4. Comparison of Standard and Declining Rate of Filtration

In conventional constant rate filtration, expensive filter controllers are required and these are often out of commission either due to improper operation or for want of spares.

Adoption of declining-rate filtration eliminates rate controllers. This process is reputed to yield a better effluent compared to constant rate filtration. Work is on hand to collect comparative data on the constructional, operational and cost aspects of both the systems.

5. Bombay's Water Supply and Sewerage Augmentation Project

The Bombay Municipal Corporation is planning a very large scheme for augmentation of their water supply and sewerage systems. They have asked the CPHERI, to give advice on many aspects of their scheme by working in collaboration with their consultants M/s Binnie & Partners of U. K. Work on the following aspects was done during the period under review :—

- (i) Daily analysis of 5 sets of samples of water supplied by the Bombay Municipal Corporation with a view to decide upon the line of treatment.
- (ii) Planning of leak detection surveys and demonstration of the use of newly developed instrument for leak detection.
- (iii) Analysis of sewage and sludge samples from different sewage treatment plants to know the efficiencies of their operation.
- (iv) Analysis of samples of Creek waters to know the extent of pollution caused by the discharge of sewage and its effluents and the dumping of garbage.
- (v) Study of sea currents and tides with a view to select suitable site for outfall for sewage effluents; and
- (vi) Water distribution system studies.

Work on these aspects is being continued by the Institute on its usual consultancy basis.

6. Air Pollution Survey

The aim of this project is to :

- (i) Conduct a detailed air pollution survey of the city.
- (ii) Recommend suitable measures to the Bombay Municipal Corporation for control of air pollution.
- (iii) Establish an air pollution laboratory for Bombay Municipal Corporation and train its staff in this survey work.

A probe work was done during the period January to June 1970 by establishing 6 sampling stations in the city when the following pollutants were observed :

(i) Dust fall, (ii) Particulate matter in air, (iii) Sulphur trioxide and (iv) Gases like SO_2 , NO_2 , H_2S and Ozone.

In the monsoon it was not possible to take samples of air and the work was stopped. Meteorological data regarding temperature, humidity, wind speeds and directions were collected from the concerned departments of the Government of India and analysed for interpretation of the results.

It is proposed to continue this survey for the next 3 years by establishing additional 25 number of sampling stations in the city. It is also proposed to keep a mobile unit for collection of samples of air at places where pollution is known to be occurring at certain times only; viz. traffic signals at the roads during heavy traffic.

7. Characterisation of Refuse

Samples of the city refuse from various localities were collected and analysed. Studies on the possibilities of incineration of wastes are in progress. The Bombay Municipal Corporation has been persuaded to construct a pilot incineration plant at Khar market in a suburban locality to study the actual problems arising out of this method of refuse disposal,

CALCUTTA

1. Industrial Wastes Survey in Durgapur-Asansol Area

This survey was completed in the year 1969 and a final report in two volumes was submitted to the Damodar Valley Corporation authorities for guidance and follow-up action.

The Technical Sub-Committee on Water Pollution of Damodar Valley Corporation in its meeting held in February 1970, discussed the report in detail in the presence of the representatives of the concerned factories. The factories have been accordingly advised to improve upon their present system of waste water disposal so as to mitigate the pollutional load entering River Damodar. Follow-up action and work is anticipated from the sponsorer and the industries.

2. Effluent Disposal of M/s Tribeni Tissue Ltd; Tribeni

This work is being continued from last year. Since the wastes are being disposed off into the river Hooghly, it has been first of all decided to what extent the river is providing dilution to the wastes. Based on this aspect the degree of treatment needed will be then determined.

A proposal to conduct river survey in the vicinity of the point of discharge of wastes has been put up to the factory management who have readily agreed to bear the cost of this work.

Work on this aspect is now in progress.

3. Survey of Existing Sewage Treatment Plants

In all 7 sewage treatment plants in the eastern region have been selected for this work. The reports on 3 of these plants have been completed. Work on the rest of plants is in progress.

4. Air Pollution Survey

Work on the collection of regular air samples from one of the stations established at a convenient spot in the city was continued. The air samples are being analysed for the common pollutants such as suspended particulate matter, sulphur dioxide, nitrogen dioxide etc. Efforts are being made to set up at least 2 or 3 more sampling stations so as to cover more areas in the city for this survey. In the meantime the Durgapur Development Authorities requested the Institute to conduct air pollution survey of this industrial complex and they also agreed to bear the entire expenses for this work. To facilitate this work a small laboratory was set up in a room provided by the Central Mechanical Engineering Research Institute, Durgapur. 10 sampling stations were set up in this city to collect representative samples of air from different areas. The data are being processed and a report is being prepared to be submitted to the authorities.

5. Characterisation of Refuse

The Municipal Corporation of Calcutta requested our Institute to work out a suitable scheme for the proper disposal of city refuse, as the authorities found that the problem of disposal of the city refuse was becoming very acute on account of paucity of land available for dumping.

The State Government convened a high level meeting of the officials of the Central and State Government in which our Institute was requested to take up this problem and to work out the various alternative methods for disposal of city refuse.

Based on the intensive field and laboratory work the Institute has collected considerable data on various aspects of this vexing problem; including mode of transport, cost of transportation, availability of additional land for dumping, future requirements and the demand for compost. The Institute has prepared a feasibility report which is perhaps the first ever done for an Indian city, giving recommendations with costs on sanitary landfilling, incineration and a mechanical composting plant of 200 Tpd capacity.

DELHI

1. Studies on the Seasonal Variation in Quality of Hand Pump Water

This project has since been completed and report is being got ready.

2. Correlation of COD and BOD for Domestic Sewage and Slaughter House Waste

This project has been completed and a report has been submitted.

3. Algal Blooms in Swimming Pools

Work on this project was continued so as to cover the period April to September 1970. The results of the analysis of water samples collected from the 4 pools showed that phosphates and Nitrates were higher than the threshold values worked out in the case of 8 other swimming pools in the Delhi area, which were surveyed last year.

The data so far collected are being tabulated and analysed with a view to prepare suitable recommendations for prevention of algal blooms in swimming pools.

4. Comparative Studies on Sewage Treatment by Activated Sludge and Trickling Filters

Not much progress could be made in this project as the plants under study were not functioning during the course of the year.

5. Feasibility of Treating Sullage Water of Najafgarh Nallah by Means of Oxidation Ponds

Laboratory studies initiated in this respect have given encouraging results. The results of the studies carried out so far indicate that it is possible to treat the sewage from Najafgarh Nallah by oxidation ponds.

In the meantime the Delhi Municipal Corporation has dug some oxidation ponds near the Cavanatur pillar sewage treatment plant. Work on the installation of pumps for feeding sewage of these ponds is in progress.

6. Characteristics & Treatment of Slaughter House Wastes

Laboratory scale experiments on the treatment of these wastes by anaerobic filter was tried; and based on the data collected during the course of 1969-70 a project report has been got ready and submitted.

7. Assessment of Water Quality from Rajghat Pumping Station

The chemical and bacteriological quality of water from Rajghat Pumping Station has been assessed. At present this untreated water is used for gardening purposes in Delhi area. The possibility of its use as a source of raw water for domestic purposes is being investigated.

8. Air Pollution Survey

Regular fortnightly sampling of suspended particulate matter and monthly sampling of SO_2 levels and total dust fall have been carried out at the one sampling station i. e. at Kishanganj. To this survey, since beginning of this year, gaseous sampling of NO_2 , SO_2 and H_2S are also included every fortnight.

Three more sampling stations have been set up two in Delhi area and one in Gaziabad improvement trust area. Sampling work is being continued.

9. Characterisation of Refuse

Eight sampling points were selected in different parts of the city to represent areas of low, medium and high population density, general marketing centre, wholesale marketing centre area of high income groups, slum area and industrial area. Samples of refuse collected from these areas are being analysed for physical and chemical characteristics as well as for its fertiliser value.

HYDERABAD

1. Treatment of Wastes from the Synthetic Drugs Factory

The Bio-filtration plant for treatment of waste waters from the factory has been in operation for about 2 years now. It has been observed that both the quality and quantity of waste waters are significantly different from the original envisaged values. With a view to cope up with these changes, and to make the treatment effective, it is proposed to introduce some modifications in the existing treatment plant.

One of the modifications proposed is to convert one of the holding (balancing) tanks into an aerated lagoon by fixing a mechanical surface aerator. Thus this tank with a capacity of about 2 lakh gallons will function as an aerated lagoon. This study will enable the Institute to collect criteria for the future expansion of the treatment units.

2. Treatment and Disposal of Instant Coffee Wastes

Based on the flow sheet developed by the Institute after extensive laboratory studies a detailed report has been prepared and submitted to the factory authorities for the treatment of these wastes.

3. Survey of Pollution of G. V. Canal, Tanuku

M/s Andhra Sugars Ltd; Tanuku and Govt. of A. P. have requested the Institute to conduct investigations and submit a report on the pollution of G. V. Canal by the discharge of wastes waters from the sugar factory at Tanuku. A thorough investigation on this problem has been undertaken and a report submitted to the concerned parties.

4. Treatment & Disposal of Effluents from Chemical and Fertiliser Factory, Kovvur

At the request of the factory authorities, investigations have been carried out to arrive at a suitable method for the disposal of the effluents as well as the condensate waters from the factory.

A report has been prepared and is under study by the concerned authorities.

5. Treatment of Wastes from M/s Warner Hindusthan Ltd.

Laboratory studies on the treatment and disposal of wastes from this factory, which contain mainly ammonia & pyridine have been undertaken to suggest a suitable method of treatment. Work is in progress.

6. Pilot Plant for Defluoridation at Nalgonda

Studies on the performance of this pilot plant have been completed. Based on the data collected from the plant, the cost of treatment for treating 1000 gallons of water has been worked out, and this comes to about Re. 1/-. The Govt. of A. P. who have financed this pilot plant have been supplied with all the relevant data regarding the working of this plant.

7. Defluoridation Plant at the Central Training Institute, Hyderabad

After the successful operation of the pilot plant at Nalgonda, using Defluoron-2 for removal of excess F^- from drinking waters, a full scale treatment plant has been erected at the Central Training Institute, Hyderabad, for treating well waters located within the Institute's campus. This plant has been recently commissioned and it is proposed to collect complete data, including the operational difficulties, if any, and the cost of treatment.

8. Preparation of Water Map of Andhra Pradesh

In order to prepare ready reckoner for various constituents of raw water sources in Andhra Pradesh, complete data on the chemical characteristics such as chlorides, dissolved solids, hardness etc. of the different sources of waters have been collected from the entire state except from 4 districts.

This data are now being compiled in the form of comprehensive report.

9. Air Pollution Survey

So far data from one sampling station was being collected. It is proposed to set up a few more sampling stations at various populated and industrial centres to assess the extent of air pollution.

Work is being continued.

10. Characterisation of Refuse

Samples of refuse representing various localities of the city such as commercial-cum-residential and slum areas are being collected daily and analysed.

JAIPUR

1. Studies on Evaporation Control

Two tanks in the Jodhpur district have been selected for conducting these studies. This project is being carried out in collaboration with the Central Desert Development Board; who are financing this investigation.

Work on this project is in progress.

2. Chambal River Survey at Kota

Work on this project is being continued as reported last year. More sampling points have been selected and the samples are being analysed to determine the physicochemical characteristics.

3. Characterisation of Waste Waters from Shri Ram Chemical & Fertiliser Industries, Kota.

At the request of the factory authorities the quantity and quality of liquid wastes discharged by this complex have been determined and a preliminary report to the factory authorities has been supplied.

4. Treatment of Waste Water of M/S Aditya Mills, Kishanganj

The effluents from these mills are being discharged into a near-by tank and the neighbouring people have complained about the nuisance. Further, the factory authorities are experiencing water shortage during the summer months. They have, therefore, approached the Institute to suggest ways and means of re-utilising the waste water.

A preliminary report on this aspect has been prepared.

5. Survey of Wind-Mills in Rajasthan

A regular survey is being conducted to find out the performance of wind mill in Rajasthan. So far four wind mills have been surveyed and it is found that their performance is not satisfactory. The quantity of pumped water also varies considerably from day to day. The wind mills can not pump out water from the wells where depths are more than 80 ft.

6. Air Pollution Survey.

Regular data are being collected from the sampling station which was established last year. It is proposed to add one or two more sampling stations to collect more data from different localities.

At Kota there is a big industrial complex fast developing. With a view to find out the amount of air-pollution in this complex, as compared to the city of Jaipur, sulphation rate candles are installed in Kota. The values obtained for the sulphation rate at Kota are much more than at Jaipur.

7. Characterisation of Refuse

Some more sampling points have been selected to collect refuse samples representing different economic conditions of the city dwellers. These samples are being analysed for N P K values.

Work on this project is being continued.

KANPUR

1. Survey of Water Works in Uttar Pradesh

The draft reports including the Institute's recommendations on ten water works surveyed in the State were completed and submitted to the authorities.

2. Characterisation and Treatability of Chrome Tanning Wastes

In continuation of the work reported last year, laboratory studies were continued to achieve further purification of these wastes by use of coagulants.

Use of activated sludge treatment for purification of the mixed and settled wastes did not give encouraging results.

A report on this project has been prepared for use by the tanneries.

3. Bio-assay Studies of Industrial Wastes and Organic Insecticides with Fish

Work on this project is being continued on the lines indicated in the last year's report. Some more insecticides are being procured and studied for trial on five species of both exotic and indigenous fish of commercial value.

4. Characterisation of the Waste and Evaluation of Efficiency of Waste Treatment Plant of AFD (Meat) Packing Factory-Tundla

Accelerated Freeze Dried (Meat) packing factory is the only one of its type in the country and all the processes are done automatically beginning with slaughtering of goats and sheeps to the finished product of canned meat.

The wastes are rich in organic matter and have a high BOD, nitrogen and sulphur contents.

The wastes are treated by anaerobic digestion followed by bio-filtration. The efficiency of this type of treatment is reported to be quite satisfactory.

5. Treatment and Disposal of Wastes from Synthetic and Chemicals, Bareilly

The factory is the only one of its type in the country manufacturing synthetic rubber using ethyl alcohol, benzene and acetaldehyde as the raw material. From the raw material latex is synthesised which is coagulated with sulphuric acid and brine.

In the existing waste treatment plant oil traps have been provided to arrest oil from the styrene decantors. The oil traps need to be re-designed as these are not giving the required efficiency. A clariflocculator exists for the purpose of arresting rubber particles in the form of flocs. This unit is working satisfactorily. The final effluents is being discharged into a nearby stream where it gets further diluted.

6. Air Pollution Survey

Work on the collection and analysis of air samples collected from the single sampling station is being continued.

7. Characterisation of Refuse

In all 8 sampling sites have been fixed two each for :

- a) Residential,
- b) Slum,
- c) Industrial, and
- d) Market area.

A few samples have been collected from all the sites and are being analysed. Work on this project is being continued.

MADRAS

1. Characterisation and Treatment of Sago Mill Wastes

Sago is a processed edible starch, manufactured from Tapioca root. There are about 450 Sago factories in Salem District of Tamil Nadu producing about 500 tons of sago per day. The

quantity of waste water works out to be about 2000-2500 gallons per ton of the product. The waste is highly putrescible and the BOD is of the order of 1300-2700 mg/l. At present there is no treatment plant for these wastes and these are being let out in open channels causing odour nuisance. Hence there is an urgent need to evolve suitable treatment method.

Representative samples from 5 different factories were characterised and the flow was measured. Sago wastes are found to be deficient in nitrogen and acidic in nature.

Effect of simple settling with and without the coagulants, like alum, ferric chloride, ferrous sulphate and flyash have been studied. Studies on treatment of wastes by anaerobic digestion with and without adjustment of pH to about 7, followed by aerobic treatment have also been carried out. Studies so far carried out indicate that the wastes may be treated by one of the following methods :

- (a) Anaerobic lagoon followed by an aerobic pond;
- (b) Treatment in aerobic or anaerobic pond after adjustment of pH of waste to about 7 with lime;
- (c) Treatment in aerated lagoon before or after adjusting the pH of raw waste to 7.0

2. Characterisation of Sewage from Madras City

Monthly collection and analysis of sewage and other waste waters from Kodungaiyur Nipier Park, Fore-shore estate and Guindy Engineering college was continued.

The samples are being analysed for systems rate constant, k value, BOD, ABS and other characteristics. Grit from sewage in Kodungaiyur was characterised and size analysis and specific gravity of burnt and unburnt samples was determined.

3. Performance of Night-soil digesters in Kerala

The performance of night-soil digesters at Ernakulam and Quilon was studied; and considerable data have been collected.

4. Air Pollution Survey

Two sampling stations have been established, one on the top of the building of Guindy Engineering College, Guindy and the second on the building of General Hospital, in the heart of

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the city, representing heavy motor and vehicular traffic as well as closeness to loco-shed of Central Railway Station.

Systematic fortnightly samples from these two stations are being carried out and these are being analysed for usual parameters. The meteorological data are also being collected.

Work on this project is being continued.

5. Characterisation of Refuse

Five sampling sites were selected representing (a) general market, (b) industrial, (c) residential and (d) sub-urban areas. So far 3 monthly samples have been collected and analysed.

The statistical data on the total quantity of city refuse per day, man power employed, mode of conveyance have been collected from the Corporation authorities

SYMPOSIA & SEMINARS

No Symposium was organised during the year as these are normally held in alternate years. The weekly seminars, however, continued to be a regular feature wherein the Institute's scientists discuss the findings on their respective projects. Seminars by distinguished people in the field are also arranged to provide an opportunity to assimilate recent research trends in the public health engineering field.

During the year, about 35 seminars were arranged.

The Institute actively participated in the symposia organised by other institutions such as Indian Water Works Association, Bombay; Victoria Jubilee Technical Institute, Bombay; Institution of Engineers (India), Nagpur; Metropolitan Regional Planning Board, The Association of Engineers (India), Calcutta; Oil Technologist Association of India, Kanpur; National Buildings Organisation, New Delhi, etc.

TRAINING, INFORMATION, LIBRARY & EXTENSION SERVICES

Short Courses

During this year the Institute conducted the following 3 courses :—

Title	Venue	Duration	No. of participants
1. Sewage Farming	Nagpur	19th November to 21st November 1970.	27
2. City Refuse Disposal	Nagpur	23rd to 26th November, 1970	30
3. Structural Engineering for Public Health Engineers	Bombay	7th December to 18th December 1970	35

In addition the institute continued to participate in the Post-Graduate teaching programme of M. Tech. (PHE) students of Visvesvaraya Regional College of Engineering, Nagpur.

Training facilities in different aspects of public health engineering have also been provided to a number of individuals from industries, and Research/ Educational Institutions.

Students from other Countries

The following students and visiting fellows from other countries visited the Institute to receive training in various aspects of Public Health Engineering :—

Name	Duration	Subject of study
1. Mr. J. A. H. Nusink, Agricultural University, Wageningen, Holland.	4 months	Practical work in Public Health aspects of Sewage Farming, treatment and general environmental sanitation studies in India.
2. Mrs. Nadia Kharchinko, Sanitary Engineer, Environmental Health Laboratory, Tehran (Iran) (On WHO Fellowship)	10 days	Air Pollution and Public Health Labo- ratory work.

3. Mr. Hari Ram Sharma, Assistant Engineer, Sil-kim, P. W. D. Gangtok.	3 months	Sewerage and sewage treatment Scheme for Gangtok.
4. Mr. P. A. Oluwande, Deptt. of Preventive & Social Medicine, University College Hospital, Ibadan, (Nigeria) (on WHO Fellowship)	3 weeks	Water Treatment, Rural Sanitation and Low cost waste treatment methods, Solid waste disposal.

Environmental Health

The Unit continued to publish the Institute's quarterly journal "Environmental Health" which is now in its 12th year of publication. The number of subscribers is about 400. This journal is sent to about 80 educational & research Institutes / Organisations on exchange basis not only in India but also in many foreign countries.

Technical Digest

The Institute has started bringing out a one page "Technical Digest", every month, covering some aspect of public health engineering work in the country. So far a series of 12 leaflets have been brought out and these have been found to be very useful and have been very well received by the readers.

At present these are distributed free of cost to over 3000 people in the country and abroad each month.

The various topics covered so far in the series are :—

Month	Topic
January 1970	Defluoridation
February „	Iceing of Water Samples
March „	Sewage Farming
April „	Surface Wash of Rapid Filters
May „	Cotton Dust makes Excellent Compost
June „	Air Pollution by Auto Exhaust

July	1970	Screw Pump
August	..	Digestion of Night soil and Cow dung
September	..	Fe & Mn Removal in Rural Water Supplies
October	..	Cost of Sewage Treatment
November	..	Air Quality in 4 Major Indian Cities
December	..	Oxidation Ponds

Special Publications

The following special publications were brought out during the year.

1. A book entitled "Stabilisation Ponds—Design, Construction and Operation in India" by Prof. S. J. Arceivala, J. S. S. Lakshminarayana, S. R. Alagarsamy & C. A. Sastry.
2. A booklet on "CPHERI—Glasswares."
3. Annual Report of CIPHERI-1969.
4. A booklet on "Disinfection for Small Community Water Supplies".
5. 'Buyer's Guide' for indigenous products and equipments in the field of water supply and waste water disposal.
6. A leaflet on "CPHERI Chloroscope".

Extension Services

The "Know-how" developed by the Institute through its research schemes, is made available, upon request to the interested parties such as Government Departments, municipalities corporations, Industries in the private and public sectors on usual consultation basis.

During the year two press conferences were held; one at the time of release of Technical Digest on "Sewage Farming" which dealt with the subject of growing Citronella and Mentha by sewage irrigation, and the second on "Air pollution by Auto Exhaust" which dealt with the studies on carbon monoxide emissions by auto-exhaust in Calcutta.

Library

The Institute's library is having a well documented library with over 13,000 volumes in related fields and facilities for micro-filming and photo-copying. The Institute subscribes to about 180 journals and gets another 80 journals on exchange basis from India and abroad.

The library also brings out the following publications:-

1. A Guide to current Public Health Engineering Literature
2. Recent additions to CPHERI Library
3. Information Bulletin

These publications help the scientists in knowing what has been done in the field elsewhere and also facilitate in their search for literature. Besides the above, the library helps the research workers on the following aspects:-

- i) Compilation of project oriented Bibliographies and reading list, indexes etc.
- ii) Preparation of abstracts and information retrieval

Contacts are also developed with overseas libraries for exchange of books, journals reports, etc. through the W. H. O. International Reference Centres on Community Water Supply, Waste Disposal and Air Pollution Control.

CONSULTATION CELL

The Institute continued to render assistance to Government Departments, Municipalities, Corporations, Industries, Local bodies etc., on the basis of "know-how" developed, to solve their problems in water and waste water treatment, air pollution surveys and solid wastes disposal. This assistance has been given on consultation basis.

The consultation works attended to during the year are given below :

(A) Sponsored Research /Investigations :

Sl. No.	Name of the sponsoring authority	Nature of problem
1.	Gwalior Rayon & Silk Mfg. Co. Ltd., Movvur (Kerala)	Effluent disposal
2.	Indian Petro-chemicals Corporation, Ltd., Baroda	Treatment of petro-chemical complex effluents.
3.	Bombay Municipal Corporation	Air pollution survey of the city of Bombay
4.	Durgapur Development Authority	Air pollution survey of Durgapur city
5.	Orient Paper Mills, Amlai	Treatment of pulp and paper mills wastes
6.	Public Health Engineering Department, Govt. of Rajasthan., Jaipur	Pilot plant studies on defluoridation of water at Gangapur.
7.	Government of Andhra Pradesh	Pilot plant studies on defluoridation of water from Nalgonda town
8.	Calcutta Municipal Corporation	Feasibility studies of alternative methods of Garbage Disposal for Calcutta City

(B) Consultation Work :

Sl. No.	Name of Client	Nature of problem
1.	Municipal Corporation of Greater Bombay	Water supply & sewerage Projects for Greater Bombay—(Assisting M/s Binnie & Partners in design report for World Bank Assistance)
2.	Warner Hindustan Ltd., Uppal, Hyderabad-39	Treatment and disposal of chemical plant effluent

Sl. No.	Name of Client	Nature of problem
3.	Shriram Chemical Industries, Shriram Nagar, Kota, (Rajasthan)	Disposal of waste waters
4.	Bhaba Atomic Research Centre (BARC) Bombay	Sewage treatment plant for the F. R. P. Housing Colony at Tarapur
5.	Central Pulp Mills, Songadh, Distt. Surat.	Effluent treatment and disposal
6.	Mohan Meakin Breweries, Ltd., Mohan Nagar, Gaziabad, (U. P.)	Effluent treatment
7.	BARC Heavy Water Project, Rawat Bhata (Kota)	Oxidation pond for housing colony of Heavy Water Project at Rawat Bhata (Kota)
8.	National Mineral Development Corporation Ltd., Donimalai, Iron Ore Project, Sandur, Bellary (Mysore State)	Sewage treatment for the township at Donimalai
9.	Kaira Distt. Cooperative Milk Producers' Union, Kaira, Anand (Gujrat)	Effluent treatment plant for Amul Dairy Anand
10.	Regional Pig Breeding Centre in Bacon Factory, Gannavaram, Krishna Distt.	Water supply and drainage scheme
11.	Shri Ambica Mills Ltd., Near Kankaria Loco Siding, Ahmedbad-8.	Purification plant of waste water
12.	Chief Engineer, North Western Zone, Chandigarh	Treatment plant for sewage disposal for Ambala Cantt.
13.	Chief Engineer, Development & Planning (T & C P) Deptt., CMPO, Calcutta.	Study of slow sand filters at Palta water works
14.	Hindustan Cables Ltd., Distt. Burdwan (W. B.)	Disposal of industrial wastes from copper coated steel wire plant at Rupnarainpur
15.	Ordinance Factories, Calcutta-16.	Disposal of treated sewage from the factory and the township of propellant factory
16.	CSIR Campus, Adyar, Madras	Sewage disposal scheme for CSIR Complex
17.	Chief Engineer, J & K Zone New Delhi	Treatment of sewage in areas of sub-zero temperatures
18.	The Anakapalle Co-operative Agricultural & Industrial Society Ltd., (ACA & IS) Thummapala, P. O. Distt. Visakhapatnam (A.P.)	Distillery effluent treatment & disposal

Sl. No.	Name of Client	Nature of problem
19.	CMC (India) Ltd., Ahmedabad	Effluent treatment
20.	Collector, West Godavari Distt. Eluru (A.P.)	Pollution & natural purification of G. V. Canal
21.	Lt. Governor of Manipur Imphal, Manipur	Water supply problems of Manipur
22.	Calico Mills, Ahmedabad	Treatment of textile mill wastes
23.	Tribeni Tissues (Pvt) Ltd., Calcutta	River survey
24.	Andhra Sugars & Fertilizers, Kovvur (AP)	Treatment of factory effluents
25.	Cellulose Products of India, Kathwada i) Maize factory, Kathwada ii) Straw Board Factory, Ramol	Characterisation and other laboratory investigations
26.	Berar Oil Industries, Akola	Treatment & Disposal of effluent
27.	J. K. Synthetics Ltd., Kota	Effluent disposal
28.	Aditya Mills, Ltd., Kishangarh	Waste treatment
29.	P. H. Circle, Rajkot (Gujarat)	Augmentation of Jamnagar Water Supply by two-layer filtration
30.	National Newsprint & Paper Mills, Nepanagar	Effluent disposal from paper mills
31.	Associated Paper Mills, Bavla, Ahmedabad	Effluent disposal
32.	Navsari Oil Products, Navsari	Effluent disposal
33.	Central Railways	Corrosion of transmission line fittings in acid fume area between Kalyan & Titwala area

Besides these, the Institute supplied technical notes and answers to queries from about 65 Organizations and public bodies.

COORDINATION CELL

During the year, the cell finalised reports on each of the 10 water works in U. P. surveyed by the Institute as an investigation sponsored by the Local Self Government Engineering Department, U. P., Lucknow.

The Cell acts as a link between the Headquarters and a chain of eight zonal laboratories and coordinates their research activities. The cell assists the Director in expeditious implementation of research schemes.

WORKSHOP

The Institute has a well equipped workshop which attends to fabrication of pilot plant and other equipments as per needs of the various research programmes of the Institute. Mention may be made of the two-layer filtration Unit which was fabricated to conduct on-the-spot trials for augmentation of water supply at Jamnagar and also of defluoridation plant fabricated for the Central Training Institute, Hyderabad. A variety of other equipment/apparatus were fabricated at the workshop as required by various research divisions at the Headquarters.

GLASS BLOWING SECTION

The Section undertakes fabrication of specialized types of glasswares such as Microelectrophoresis cell, Cataphoresis cell, Sedgwick rafter funnel, Microkjeldahl distillation unit, Sedgwick rafter cell, Air sampling bubbler, Sintered glass diffuser etc. This facility has obviated the loss of time in procurement of these glasswares and thus contributed to speedy research programmes. A number of educational/research institutions have also been supplied with these items of glasswares.

During the year, a brochure on "CPHERI Glasswares" has been brought out and circulated widely. As a result, there is a considerable response in procurement of the glasswares which is being attended to from time to time.

SPECIAL REPORTS

The following special reports were brought out during the year. These include:

- (i) Reports submitted to the WHO on functioning of the Institute as a regional reference centre on Air Pollution and as collaborating institute in Community Water Supply and Waste Disposal
- (ii) Feasibility studies on garbage disposal for Calcutta City-the first comprehensive study ever made for an Indian City, and
- (iii) Report on consultation problems covering nature of the problems, Institute's work thereon and the emerging conclusions alongwith recommendations.

All the special reports brought out during the year are listed below :

CPHERI as a WHO Regional Reference Centre on Air Pollution.

CPHERI as a Collaborating Institute of the WHO International Reference Centre on Community Water Supply.

CPHERI as a collaborating Institute of the WHO International Reference Centre on Waste Disposal.

Investigations on the performance of ten Water Works in Uttar Pradesh:

1. Agra
2. Varanasi
3. Nainital
4. Kanpur
5. Lucknow
6. Allahabad
7. Babina
8. Deharadun
9. Jhansi

and 10. Jaunpur

Summary & Recommendations on Water Supply Problems at Manipur (Assam)

Water Treatment Problems at Rajbhiraaj (Nepal)

Preliminary Report on Effluent Treatment and Disposal at
Cellulose Products of India Ltd; Kathwada.

Disposal of Instant Coffee Plant Effluents of Brooke Bond India Ltd; Ghatkesar, Near
Hyderabad.

Effluent Treatment at Sarabhai Common Services, Wadi Wadi, Baroda.

Arrangement for Disposal of Trade Wastes of Suhrid Geigy Ltd., Ranoli, Baroda.

Pulp Mill Waste Treatment at Government Security Paper Mills, Hoshangabad (M. P.)

Pollution & Natural Purification of G. V. Canal (West Godavari District).

Survey of the Effluent Disposal Problem at CMC (India) Ltd., Ahmedabad.

Report on Augmentation of Jamnagar Water Supply by Two Layer Filtration.

Report on Effluent Treatment at Berar Oi Industries, Akola

Poona—Short term refuse characterisation Composting of blow-room cotton dust.

Investigations on Feasibility of Garbage Disposal for Calcutta City.

Air Pollution Survey Programme for greater Bombay (1970—73)
for the Bombay Municipal Corporation.

PUBLICATIONS

1. Arceivala S. J.
Report on the Eighth General Assembly of International Water Supply Association
Journal IWWA, II, 2, 123—124 (1970)
2. Arceivala S. J., Bhalerao B. B. & Alagarsamy S. R.
Cost Estimates for Sewage Treatment Processes.
The Materials Management Journal of India, XI, 4, 76-83 792 (1970)
3. Anwikar, A. K.
Some aspects of rural water supply, Jour. Christian Med. Assoc. India. April, 1970
4. Apte, V. R.
Infra-red method for estimation of pp'-DDT with benzene as solvent.
Environmental Health 12, 4, 329-333 (1970)
5. Arora, H. C., Chattopadhyaya, S. N. & Sharma, V. P.
A probable occurrence of fish mortality in Renusagar, Renukoot, due to chlorine bearing wastes,
Environmental Health 12,3, 260-272 (1970).
6. Basu A. K.
Contribution a l'etude du traitement des eaux residuaires de distilleries.
La tribune dee CEBEDEAU, March 1970, No. 316 Vol. 23, pp. 127-136.
7. Basu A. K.
Environmental Disruption in Japan—Spot Studies.
Journal of the Association of Engineers. Vol. XLV, July-Sept, 1970. No. 3.
pp. 98-106.
8. Basu A. K.
International Co-operation—A plea to control the pollution problem.
(Proceedings of International Symposium on Environmental Disruption, Japan,)
9. Basu A.K., Ghosh B. B. & Pal R. N.
Comparison of the polluted Hooghly estuary with the unpolluted Matlah Estuary
India.
JWPCF, October 1970, Vol.42 No. 10 pp. 1771-1781.

10. Basu A. K. & Ghosh B. B.
Observations in Diurnal Variations in some selected stretch of the Hooghly estuary (India)
Schweizerische Zettschrift Fur Hydrologie, Birkhauser Verlag Basel, Vol, 32, Fasc-1
pp. 272-283, (1970)

11. Bhalerao, B. B. & Jain, J. S.
Field trials for evaporation control using monomolecular films at Gorewara Lake.
Environmental Health, 12, 1, 48—65 (1970).

12. Bhawe, V. R.
Liquid level controlling using the conductivity probes.
Environmental Health, 12, 1, 24—27, (1970)

13. Dhaneshwar, R. S., Rajagopalan S., Basu, A. K. & Rao C. S. G.
Characteristics of Wastes from pulp and paper mills in Hooghly estuary.
Environmental Health 12, 1, 9—23 (1970)

14. Hanumanulu, V.
Performance of deep trickling filters by five methods,
JWPCF, 42, 8, 1446—1457 (1970)

15. Jayangoundar (Mrs) I. S, Kothandaraman, V., Thergoankar, V. P. & Shaikh, S. G.
Rational process design standards for aerobic Oxidation ponds in Ahmedabad, India
JWPCF 42, 8, 1501 —1514 (1970)

16. Khare, G. K. & Sastry, C. A.
Studies on characterisation and pollutional effects of viscose rayon wastes.
Environmental Health 12, 2, 99—109 (1970)

17. Lokre, V. L.
A new method of counting and sizing of particles.
Science Reporter : Nov. 1970.

18. Mitra, (Ku.) Rekha.
Effect of chlorine on chironomus larvae,
Jour. I W W A, II, 1, 64—68 (1970)

19. Mohanrao, G. J., Subrahmanyam, P. V. R., Deshmukh, S.B. and Saroja, (Ku.) S.
Waste treatment at a synthetic drug factory, JWPCF, 42, 8, 1529-1543 (1970).

20. Mukherjee Giti
Biological response of *Scenedesmus*.
Science and Culture, Vol. 36, No. 7, 416-418 July 1970
21. Mukherjee Giti
Some observations on the removal of H_2S from waste water
Annual Journal of the State Public Health Engineers' Association—1970
22. Mudri, S. S., Kulkarni, A. L., Subrahmanyam, P. V. R. & Mohanrao, G. J.
Treatment of wastes from a dye factory,
Environmental Health, 12, 3, 201-217 (1970).
23. Nawlakhe, W. G., Padhye (Ku.), S. B. & Kulkarni, D. N.
Laboratory studies on defluoridation using Defluoron—2.
Jour. IWWA, II, 1, 69-73 (1970).
24. Paramasivam R., Gadkari S. K., Joshi (Miss) N. S., Deshpande A. W., Bulusu K. R. & Kshirsagar S. R.
Research on Filtration at CIPHERI—Nagpur,
Journal IWWA, II (4), 272-276 (1970)
25. Pathak, B. N., Thergaonkar, V. P., Kulkarni, D. N. & Bulusu, K. R.
CIPHERI—developed anionic polyelectrolytes as coagulant aids in water treatment.
Environmental Health, 12, 1, 28-38 (1970).
26. Pathak, B. N., Kulkarni, D. N., & Thergaonkar, V. P.
Studies on the improvement in coagulation by lime addition during monsoon at
Kanhaw Water Works, Nagpur.
Jour. I W W A II, 1 33-36, (1970)
27. Rajagpalan, S., Basu, A. K., Dhaneshwar, R. S. & Rao, C. S. G
Pollution of river subarnarekha at Ranchi-A survey,
Environmental Health 12, 3, 246-259 (1970)
28. Rao, P. B., Ishwar Singh & Sharma, S. K
A rational approach to the design of water closet bowls.
Environmental Health 12,1,33-47 (1970)
29. Rao, C. S. G.
Occurrence of iron bacteria in the tubewell water supply of Howrah,
Environmental Health 12, 3, 273-280 (1970)

30. Ray (Mrs) D., Kutty M. K. A., Rao C. S. G., & Trivedi R C.,
Sewage Treatment-A growing need for the developing community.
Annual Journal of State Public Health Engineers ' Association West Bengal, 37--42,
(1970).
31. Sachan, P. C., Siddiqi, R. H., & Sehgal, J. R.
Per capita contribution of constituents of waste water from a residential community,
Environmental Health **12**, 1, 1-8 (1970)
32. Sastry, C. A., Aboo, K. M. & Khare, G. K
Reduction in micro-organisms at different stages of water treatment,
Environmental Health **12**, 1, 66-80 (1970)
33. Sastry, C. A., Aboo, K. M., Bhatia, H. L & Rao, A. V.,
Pollution of Upper Lake and its effect on Bhopal Water Supply.
Environmental Health **12**, 3, 218-238 (1970)
34. Sharma, V. P., Verma S. R., & Seth, A. K
Some comparative studies on the clarifiers at Chandrawal Water Works, No. II,
Delhi.
Journal IWWA, II (3), 183-190 (1970)
35. Subrahmanyam, P. V. R., & Mohanrao, G. J.
Paper & Pulp Mill Wastes,
Public Health Engineer, V, 1, 1-12 (1970)
36. Saxena, K. L., Nagbhushana, R. S., Kumaran, P., Olaniya, M. S. and Nawlakhe, W. G.
Diurnal Variation in the physico-Chemical Characteristics of sewage at Jaipur,
Environmental Health **12**, 4, 311-322 (1970)
37. Shrivastava, S. K. & Dixit R. C.
Effect of mixing on BOD test,
Environmental Health, **12**, 4, 334-339 (1970)
38. Seth, G. K., Shrinivasan, K., Raguraman, D. & Shantikumar, L.
Pilot Plant studies on the high rate sludge digester at Hyderabad.
Environmental Health, **12**, 4, 340-354, (1970)

39. Thergaonker V. P., Kulkarni D. N., Pathak B. N. & Bulusu K. R.
Full Scale Plant trials using Coagulant Aid "CA-3".
Journal IWWA II (2) 125—130 (1970)
40. Trivedi, R. C.
Industrial Waste-Water Survey in Durgapur-Asansol Region.
Journal of Association of Engineers. Vol. XLVI, No. 4, October-December, 1970
41. Yennawar, P. K., Dixit, S. N., Pampattiwar, V. L., Dave, J. M. & Arceivala, S. J.
Short-term air quality surveys in 4 major cities of India.
Environmental Health, 12, 4, 355-384 (1970)

PATENTS

During the year, the Institute filed three patents. The consolidated position of the patents filed by the Institute so far is given below :

PATENT SEALED

108437	A process for the manufacture of medium for removal of fluoride from drinking water.
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PATENT ACCEPTED

115574	Coagulant aid CA--3
116997	Iodine tablets
116648	Chlorine tablets
107912	Refrigerated vessels for maintaining biological tissues and cultures for minimum of 24 hours & maximum upto 48 hours for continental and intercontinental despatches.
117025	Coagulant aid CA--7
122997	An apparatus for recording wind direction.

PATENTS FILED

116953	Coagulant aid CA--4
116996	Coagulant aid CA--5
118995	Defluoron--2
123577	Synthetic polyanionic coagulant aid CA--11

PATENTS APPLIED

123209	Filter aid FA 1
123644	Filter aid FA 2
129070	Coagulant aid CA--15
129055	Membrane Filter
129109	An apparatus for recording wind velocity.

BUDGET

ACTUAL EXPENDITURE

(Rs. in Lakhs)

	1969—70	1970—71
RECURRING	30. 620	35. 636
CAPITAL	4. 981	7. 756
PILOT PLANTS	2. 161	3. 713
	<hr/>	
TOTAL	37. 762	47. 105
	<hr/>	

PILOT PLANTS

The following pilot plants were in operation during the year :

Aerated Lagoons with fixed & floating aerators.	(Nagpur)
Oxidation Ditch	(Nagpur)
Effluent Farm Irrigation	(Nagpur)
Mechanical Composting Plant	(Nagpur)
Biological Disc	(Nagpur)
(Under construction)	
Trickling Filter	(Nagpur)
(Under Construction)	
Water Filtration Plants	(Bo mbay)

MEMBERSHIP OF ORGANISATIONS

PROF. S. J. ARCEIVALA, DIRECTOR

ISI COMMITTEE/ SUB-COMMITTEE/PANEL

Water Supply & Sanitation Sectional Committee	BDC 24
Fluid Flow Measurements in Closed Conduits Sectional Committee	BDC 17 : 3
Building Materials & Components Sampling Sub - Committee	BDC 31
Sanitary Appliances & Water Fittings Sectional Committee	BDC 3 (Chairman)
Public Health Engineering plants & Equipment Sectional Committee	BDC 40
Civil Engineering Division Council Plastic Pipes Sub-Committee	CEDC BDC 3 : 8 (Convener)
Water Treatment Equipment Panel	BDC 40/ P1
Sewage Treatment Equipment Panel	BDC 40/P2 (Convener)
Water Sectional Committee	CDC 26
Rural Water & Industrial Effluents Sub Committee	CDC 26 : 1
Panel for Fertilizer Industry Wastes	CDC 26:1:12 (Convener)
Drainage Sub Committee	BDC 24 : 2

OTHER ORGANISATIONS

Expert Panel Member, Environmental Health, World Health Organisation, Geneva.

Member of the Executive Board of the International Water Supply Association, London.

Member of the Executive Board of the International Association on Water,
Pollution Research, Pretoria, South-Africa.

Member, Expert Committee Set up by the Ministry of Health,
Government of India to prepare a Manual on Water Supply,
Sewerage & Sewage Treatment.

Member, Governing Body of the Indian Council of Medical Research, New Delhi.

Member, Water Pollution Prevention Board of the Government of Maharashtra.

SHRI J. M. DAVE, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE / PANEL

Air pollution Sub-Committee	CDC 18:5
Chemical Hazards Sectional Committee	CDC 18
Industrial Chemical Hazards Sub-Committee	CDC 18 :4
Water Meters Sub-Committee	BDC 3:4
Water Works Fittings Sub-Committee	BDC 3 : 5
Rubber Joint Rings Panel	BDC 24 /P1
Water Supply and Sanitation Sectional Committee	BDC 24 (Alternate)
Waste Stabilisation Ponds Panel	B C 24/P3 (Convener)
Soil & waste Pipes above ground Sub-Committee	BDC 24 : 4
Public Health Engineering Equipment Sectional Committee	BDC 40 (Alternate)
National Building Code— Panel for Plumbing Services	BDC 64 : P16

OTHER ORGANISATIONS

Member of Expert Panel on Air Pollution
Control. WHO (1968-1972)

Problems of Sanitary & Water Supply Arrangements
at High Altitudes and Low Temperature
Regions (Ministry of Defence)

Member, Ad-hoc Committee set up by the Ministry of Health,
Government of India to prepare draft Air
Pollution Control bill.

DR. G. J. MOHANRAO, SCIENTIST

ISI COMMITTEE /SUB-COMMITTEE /PANEL

Industrial Wastes Sub-Committee	CDC 26 : 1 (Alternate)
Panel for Food and Fermentation Industry wastes.	CDD 26 : 1 : 2 (Convener)
Panel for Chemical and Allied Industry Wastes	CDC 26 : 1 : 6 (Convener)
Panel for Steel Mill Wastes	CDC 26 : 1 : 13

OTHER ORGANISATIONS

Member of the International Association on Water Pollution Research,
Pretoria, South Africa.

Treatment Plant Committee for Tertiary Treatment.
Water Pollution Control Federation, U.S.A.

Member, Water Resources Committee of the South-East
Resource Region, Constituted by the Govt. of India.

DR. N. U. RAO, SCIENTIST

ISI COMMITTEE /SUB-COMMITTEE /PANEL

Disinfectants Sub-Committee	CDC 23 : 1
Panel for River Water & Waste Waters	CDC 26 : 1 : 11

DR.G. K. SETH, SCIENTIST

OTHER ORGANISATIONS

Member of the International Association on Water
Pollution Research, Pretoria, South-Africa.

SHRI V. RAMAN, SCIENTIST

ISI COMMITTEE / SUB-COMMITTEE / PANEL

Domestic & Municipal Water Fittings Sub-Committee	BDC 3 : 2 (Alternate)
Water Works Fittings Sub -Committee	BDC 3 : 5 (Alternate)
Plastic Pipes Sub-Committee	BDC 3 : 8 (Alternate)
Panel for Draft code of Practice for Water Supply and Drainage System at High Altitudes.	BDC 24 /P4
Sanitary Installations Sub-Committee	BDC 24 : 3
Soil & Waste Pipes above Ground Sub-Committee	BDC 24 : 4 (Alternate)

SHRI K. R. BULUSU, SCIENTIST

ISI COMMITTEE /SUB-COMMITTEE /PANEL

Water for Industrial Purposes Sub-Committee	CDC 26:2
Panel for Treatment of Water for Cooling Systems	CDC 26:P7

SHRI Y. S. MURTY, SCIENTIST

ISI COMMITTEE /SUB-COMMITTEE /PANEL

Fluid Flow Measurements in Closed Conduits Sub-Committee	BDC 17:3 (Alternate)
Dilution Methods Sub-Committee	BDC 17:7

DEPUTATIONS, HONOURS & AWARDS

- * C-PHERI has been nominated by WHO as a collaborating Institute of the WHO International Reference Centre on "Community Water Supply"
- * C-PHERI has been nominated by WHO as a collaborating Institute of the WHO International Reference Centre on "Waste Disposal"
- * Prof. S. J. Arceivala, Director, C-PHERI has been abroad on deputation to the following countries :

Bangkok	Visit in the capacity of WHO Temporary Adviser to assist in conducting WHO seminar on "Rural Water Supply" at Khon-Kaen during March, 1970.
Yugoslavia	Represented India at the International Conference on "Research & Development in Community Water Supply" organised by WHO at Dubrovnik during October, 1970.
The Netherlands	To participate in the Working Seminar of the International Courses in Hydraulic & Sanitary Engineering at Delft during October, 1970.
Geneva	As an Adviser to WHO in the preparation of a publication on "Water Quality Management" during November, 1970.
Japan	As WHO Temporary Adviser to deliver lectures at the Inter-Regional training course on "Public Health Aspects of Environmental Pollution Control" organised by WHO at Osaka during December, 1970.

- * Shri J. M. Dave, Scientist, on invitation, had been to U. S. A. from November 30 to December 16, 1970 (i) to participate in the Second International Clean Air Congress in Washington and (ii) attend colloquium for International Air Pollution Scientists being sponsored by NAPCA and the Triangle Universities Consortium on Air Pollution in Durham.
- * Dr. A. K. Basu, Scientist, was granted deputation to attend International Conference on Environmental disruption sponsored by the UNESCO & Japan Science Council held in Tokyo, Japan during March 1970. Following this, Dr. Basu attended International Seminar on Problems of Human Environment held at Osaka, Japan.
- * Dr. V. Chalapati Rao, Scientist was invited by the Bureau of Water Hygiene as a WHO Short-term consultant in Virology during October 25 to November 22, 1970 to U. S. A. to evaluate the various methods under investigation in U. S. A. for concentration & detection of Viruses in waters.
- * Shri S. B. Dabadghao, Scientist proceeded on deputation for training in the field of Electronic Instrumentation in U. K. for a period of 5-6 months from May, 1970.

- * Shri R. P. Mishra, Scientist, has undertaken training in Health & Sanitation and Sanitary Microbiology in Paris, France, for a period of 5 months from June, 1970 under the Indo-French Technical Co-operation Agreement.
 - * Shri D. Raguraman, Scientist, proceeded on deputation, to U. K. for a period of 3 months from October, 1970 for training in "Treatment of Industrial Wastes" under the Exchange of Scientists Programme between the CSIR and the British Council.
 - * Shri J. M. Tuli, Scientist proceeded on deputation for training in treatment of water, particularly filtration of water such as up-flow filtration, bi-flow filtration and multi-media filtration and its practical as well as theoretical aspects at the Imperial College, London, under the Colombo Plan for a period of 1 year from October, 1970.
 - * Dr. K. P. Krishnamoorthi, Scientist, has been awarded Ph. D. degree in the Faculty of Science by the Nagpur University.
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STAFF

HEADQUARTERS

DIRECTOR : PROF. S. J. ARCEIVALA

WATER TREATMENT

Shri K. R. Bulusu, Scientist-in-Charge
Shri B. N. Pathak, Scientist
Shri V. P. Thergaonkar, Scientist
Shri A. S. Bal, Scientist
Shri M. V. Nanoti, S.S.A.
Shri D. N. Kulkarni, J.S.A.
Shri R. C. Dixit, J.S.A.
Miss M. B. Bhatghare, J.S.A.

SEWAGE TREATMENT

Dr. R. H. Siddiqi, Scientist-in-Charge
Shri R. P. Mishra, Scientist
Dr. K. P. Krishnamoorthi, Scientist
Shri M. Parabrahmam, Scientist
Dr. G. B. Shende, Scientist
Shri S. N. Kaul, Scientist
Shri A. N. Khan, S.S.A.
Miss Rekha Mitra, S.S.A.
Shri C. K. Kale, J.S.A.
Shri M. K. Abdulappa, J.S.A.
Miss M. G. Deshpande, J.S.A.

INDUSTRIAL WASTE TREATMENT

Dr. G. J. Mohanrao, Scientist-in-Charge

Dr. P. V. R. Subrahmanyam, Scientist

Shri M. V. Srinivasan, Scientist

Shri J. S. Gadgil, Scientist

Shri S. S. Mudri, Scientist

Shri S. B. Deshmukh, S.S.A.

Shri T. N. C. Ramprasad, J.S.A. (On deputation to Ahmedabad Municipal Corporation, Ahmedabad)

Shri S. N. Khaddakar, J.S.A.

Mrs. S. Satyanarayana, J.S.A.

AIR POLLUTION & INDUSTRIAL HYGIENE

Shri J. M. Dave, Scientist-in-Charge

Shri P. K. Yennawar, Scientist

Shri V. L. Pampattiwar, S.S.A.

Miss J. M. Deshpande, S.S.A.

Shri V. I. Pandit, J.S.A.

Shri S. N. Dixit, J.S.A.

MICROBIOLOGY (including VIROLOGY)

Dr. N. U. Rao, Scientist-in-Charge

Dr. V. Chalapati Rao, Scientist

Shri N. M. Parhad, Scientist

Shri P. M. Phirke, Scientist

Shri M. D. Patil, Scientist

Shri P. V. R. C. Panicker, Scientist

Shri P. Kumaran, S.S.A.

Shri S. Subba Rao, J.S.A.

Shri S. R. Joshi, J.S.A. (on study leave)

Shri S. B. Lakhe, J.S.A.

Shri S. I. Elyas, J.S.A.

Shri N. Shivaraman, J.S.A.

ENGINEERING (TREATMENT) & (DISTRIBUTION & DRAINAGE)

Shri R. Paramasivam, Scientist-in-Charge
Miss N. S. Joshi, J.S.A.

SOLID WASTES DISPOSAL

Shri A. D. Bhide, Scientist-in-Charge
Shri S. K. Titus, Scientist
Shri B. Z. Alone, J.S.A.

RURAL SANITATION

Dr. A. K. Anwikar, Scientist-in-Charge

INSTRUMENTATION

Shri V. L. Lokre, Scientist-in-Charge
Shr S. B. Dabadghao, Scientist
Shri V. R. Bhawe, Scientist
Shri V. R. Apte, Scientist

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Dr. G. K. Seth, Scientist-in-Charge
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Miss K. W. Choudhary, Scientist
Shri S. G. Bhat, Scientist
Shri Y. N. Murty, S.T.A.
Shri K. M. Nandgaonkar, J.S.A.
Shri S. K. Kesarwani, J.T.A.

CONSULTATION CELL

Shri B. B. Bhalerao, Scientist-in-Charge
Shri S. R. Algarsamy, Scientist
Shri R. S. Negabhushana, J.S.A.

COORDINATION CELL

Shri D. Raguraman, Scientist-in-Charge

WORKSHOP

Shri G. T. Kale, Workshop Superintendent

Shri C. Vedantiah, Scientist

Shri H. J. Patil, Scientist

Shri P. S. Tallewar J.M.A.

CONSTRUCTION & MAINTENANCE

Shri N. M. Narasimhan, Clerk-of-Works

GLASS BLOWING SECTION

Shri N. Narayana, S.M.A.

PHOTOGRAPHY

Shri E. P. I. Sunder Singh, S.T.A.

ZONAL LABORATORIES

AHMEDABAD

Shri S. Rajagopalan, Scientist-in-Charge

Dr. (Smt) I. S. Jayangounder, Scientist

Shri S. G. Shaikh, J.S.A.

BOMBAY

Shri V. Raman, Scientist-in-Charge

Shri S. R. Kshirsagar, Scientist

Shri R. K. Pandit, Scientist

Shri S. K. Gadkari, Scientist

Shri H. B. Singh, Scientist

Shri N. S. Phadke, Scientist

Shri V. Hanumanulu, Scientist

Shri A. W. Deshpande, Scientist

Shri A. L. Kulkarni, J.S.A.

Shri S. V. Deshpande, J.S.A.

Mrs. A. S. Gadkari, J.S.A.

Mrs. Chandorkar, J.S.A.

Mrs. N. A. Ainapure, J.S.A.

CALCUTTA

Shri R. C. Trivedi, Scientist-in-Charge
Dr. A. K. Basu, Scientist
Shri R. S. Dhaneshwar, Scientist
Shri C. S. G. Rao, Scientist
Mrs. D. Roy, J.S.A.
Mrs. Gitti Mukherjee, J.S.A.

DELHI

Shri J. M. Tuli, Scientist-in-Charge (On deputation to U. K.)
Shri J. S. Jain, Scientist (On Study Leave)
Shri A. K. Seth, Scientist
Shri N. Dutta, Scientist
Shri S. K. Shrivastava, Scientist
Shri L. N. Sharma, S.S.A.

HYDERABAD

Shri Y. S. Murthy, Scientist-in-Charge
Shri D. Seethapati Rao, Scientist
Shri I. P. S. Prasad Rao, Scientist
Shri K. Srinivasan, J.S.A.
Shri L. Shantikumar, J.S.A.

JAIPUR

Dr. K. L. Saxena, Scientist-in-Charge
Shri H. C. Sharma, S.A.A.
Shri M. S. Olaniya, J.S.A.

KANPUR

Dr. H. C. Arora, Scientist-in-Charge
Shri S. N. Chattopadhyaya, J.S.A.
Shri V. P. Sharma, J.S.A.

MADRAS

Dr. C. A. Sastry, Scientist-in-Charge
Shri T. K. Srinivasan, Scientist.
Shri V. Kothandaraman, Scientist
Shri K. M. Abboo, J.S.A. (On leave for study)

ADMINISTRATIVE & HOUSE-KEEPING STAFF

Shri P. K. Gokhale, Administrative Officer
Shri V. K. Bhatnagar, Accounts Officer
Shri Mangal Prasad, Section Officer
Shri Kuldip Rai, Section Officer
Shri R. Narayana, Stores Officer
Shri Thomas Joseph, Purchase Officer
Shri G. L. Banerjee, S.T.A.
Shri U. P. Chattopadhyaya, Senior Accountant
Shri S. K. Shrivastava, Jr. Accountant
Shri O. P. Verma, Assistant
Shri Kishorilal, Assistant
Shri Santosh Kumar, Assistant
Shri T. K. K. Nair, Assistant
Shri B. Y. Badge, Senior Stenographer
Shri Hamidkhan, Sr. Stenographer
Shri B. Damodaran, do-
Shri H. V. Garde, Laboratory Supervisor
Shri U. C. Deshmukh, Stores Supervisor
Shri J. H. Govind, Watch & Ward Assistant
Mrs. I. D'Souza, Receptionist

DISTINGUISHED VISITORS

- | | |
|------------------------------|-----------------------------------------------------------------------------------------------|
| 1. Mr. C. H. Atkins | Chief Sanitary Engineer, World Health Organisation, Geneva. |
| 2. Dr. Paul Kabler | Adviser, Bureau of Water Hygiene, USPHS. Cincinnati, Ohio, USA. |
| • 3. Dr. Richard Hammerstrom | Sanitary Engineering Director, USPHS, Gulf Coast Water Hygiene Laboratory, Alabama, USA. • |
| 4. Prof. P. C. G. Issac | Dean, Faculty of Engineering, University of New Castle Upon Tyne, UK. |
| 5. Dr. R. G. Allen | Director.
Water Research Association, UK. |
| 6. Mr. G. P. Persson | Swedish Environmental protection Board, Solnu, Sweeden. |
| 7. Mr. V. Pinto | Regional Adviser, World Health Organization, African Region, Brazzaville. |
| 8. Dr S. C. Pillai | Department of Bio-chemistry, Indian Institute of Sciences, Bangalore. |
| 9. Mr. H. Nanjundiah | Secretary to the Government of Maharashtra,
Public Health Department, Sachivalaya, Bombay. |
| 10. Dr. Y. Goldshmid | Head, Water Quality Control Department, Mekorot Water Co., Tel AVIV (Israel). |
| 11. Dr. K. K. Bose | Senior Medical Officer, Eastern Railway, Calcutta. |



Guest House & Hostel