CPHERI

Annual Report

1969

Central Public Health Engineering Research Institute
Nagpur – (India)

Main Laboratories of the Institute, Nagpur.

C P H E R I

ANNUAL REPORT

1969

CENTRAL PUBLIC HEALTH ENGINEERING RESEARCH INSTITUTE

NAGPUR-3 (INDIA)

CONTENTS

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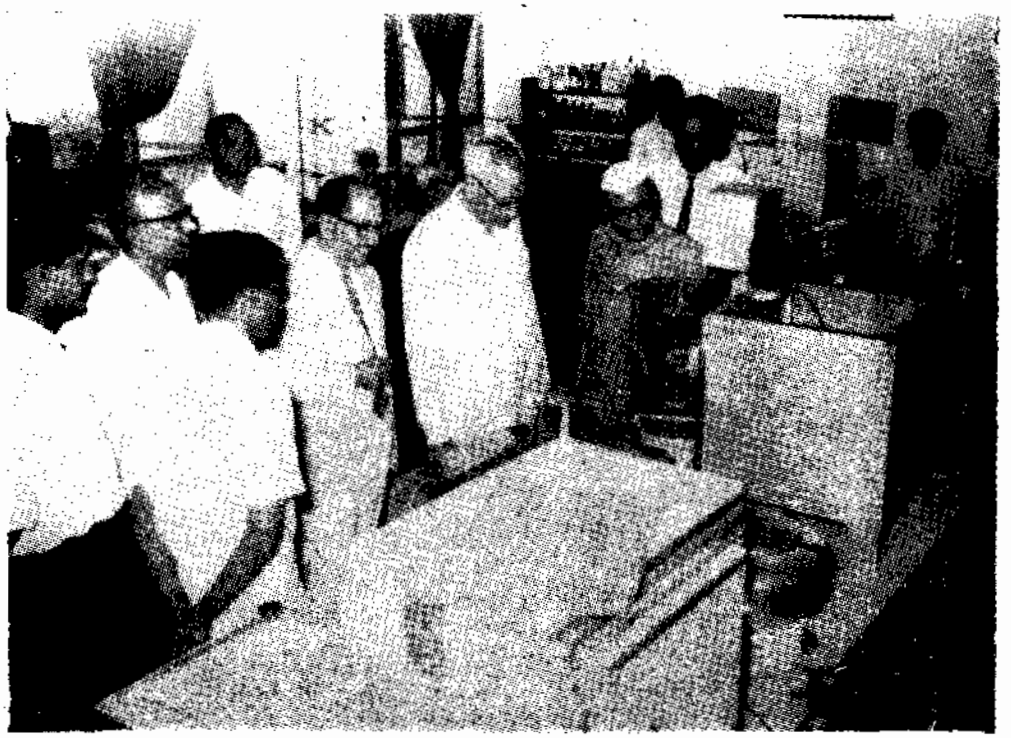
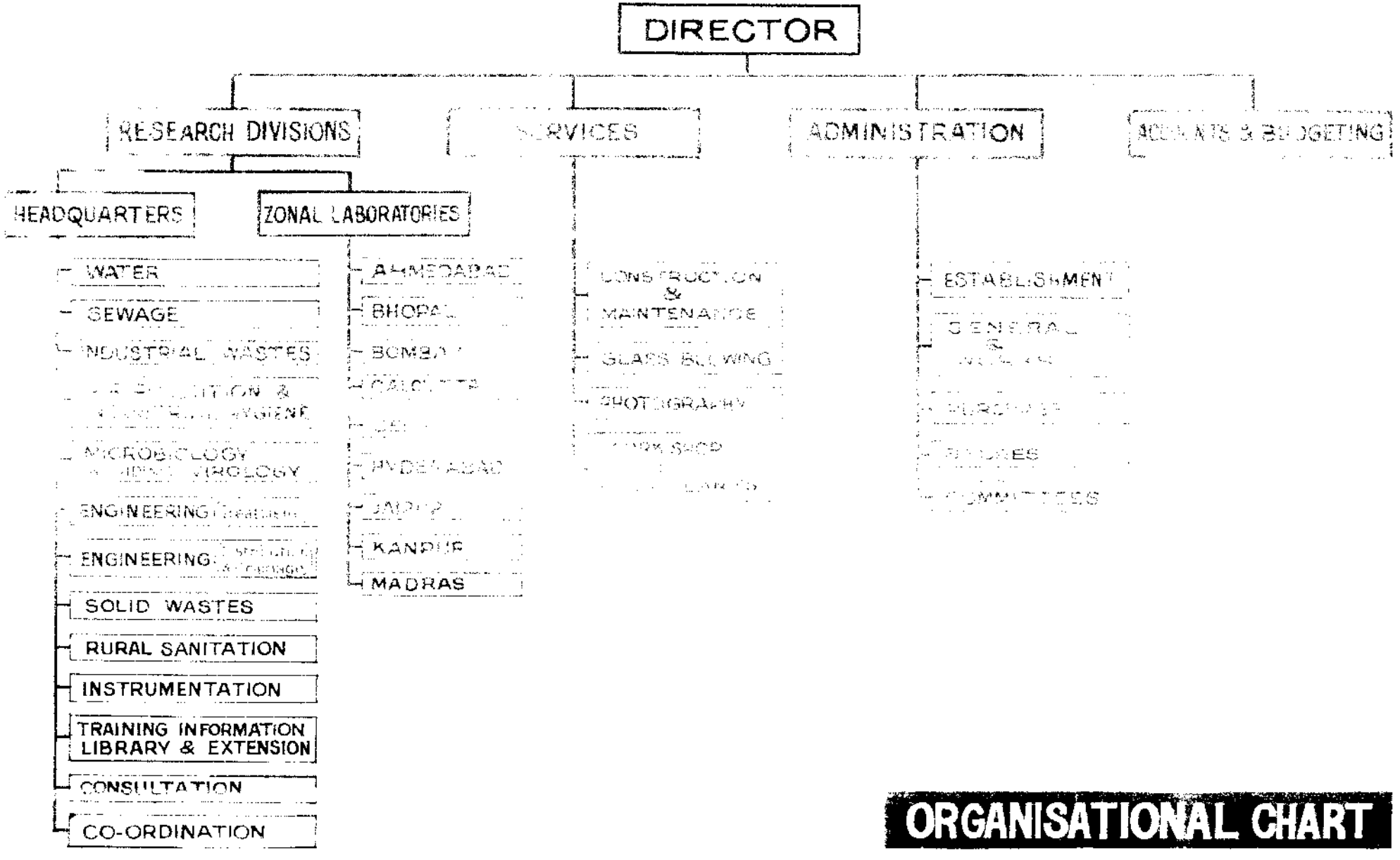


Dr. A. N. Khosla, Chairman, Executive Council and Dr. Atma Ram, D.G.S.I.R. in one of the Research Divisions of the Institute alongwith Prof. S. J. Arceivala, Director.



ORGANISATIONAL CHART

REPORT OF THE DIRECTOR

REPORT OF THE DIRECTOR

I have great pleasure in presenting this Annual Report of CPHERI for the year 1969. The year marks completion of **TEN** years of functioning of the Institute which started in early 1959.

With the generous aid worth over half-a-million dollars from the United Nations Special Fund with WHO as the Executing Agency, as also some assistance from the U. S. Technical Co-operation Mission, the Institute is now well equipped and undertakes research and investigational work on a wide variety of problems in various fields of public health engineering such as, water treatment and distribution; sewage treatment and disposal; industrial wastes treatment; instrumentation; air pollution and industrial hygiene; rural sanitation and solid wastes disposal.

It gives me great pleasure to record here that the research investigations of this Institute in 1968-69 have led to as many as 11 patents : 5 for coagulant aids; 2 on filter aids; 2 on tablets for disinfection of water and one each for defluoridation material and wind direction recorder.

I may briefly refer to some of the highlights of the Institute's work during the year under review :

WATER TREATMENT :

After considerable efforts, this Institute's work on defluoridation met with success. A new medium "Defluoron-2" has now been developed, which is specific for removal of fluorides from water and does not suffer from the handicaps which some of the media developed earlier suffered from. Laboratory tests have been duly supplemented with pilot plant operations in 2 towns and the Institute is now giving assistance in setting up 2 full scale plants in Andhra Pradesh.

Cost of defluoridation, using this new medium, ranges from Re 1/- to Rs. 2/- per 5000 litres, depending on fluoride concentration in the raw water. This cost is mainly due to cost of regeneration with alum. It is hoped that advantage will be taken of this to ameliorate the conditions of thousands of people who are today exposed to fluorosis in India.

SEWAGE TREATMENT :

A manual entitled "Design, Construction, and Operation of Waste Stabilisation Ponds in India" was brought out. The manual covers comprehensive information on this mode of treatment and will serve as a guide and reference book to practising engineers, students and teachers, all alike.

Two new pilot plants viz. "Pasveer-Type" Oxidation ditch and mechanically aerated lagoon were set up in the Institute's campus to investigate the design parameters and scale-up factors of these low cost waste treatment methods.

A symposium on "Low Cost Waste Treatment" was organised during October, 1969 when nearly 300 delegates including 8 from developing countries also participated, besides Dr. A. Pasveer, pioneer in oxidation ditch treatment and Dr. K. J. Ives, expert in water filtration, who attended on special invitation. This symposium was followed by another one on "Water Treatment Practice" at Bombay.

INDUSTRIAL WASTES :

Laboratory and pilot plant work to develop suitable methods of treatment was continued on the following :

Pulp & Paper Mill Wastes

Rayon Grade Pulp Mill Wastes

A flow sheet for treatment of wastes from a dyes manufacturing plant was developed for an industry near Poona

MICROBIOLOGY :

A method for concentration and quantitation of small amount of viruses from large volumes of water and sewage using membrane filter technique was developed. This was a necessary pre-requisite for undertaking any meaningful studies on viruses.

AIR POLLUTION :

Recently the Institute has set up a net-work in 9 cities of India to collect comprehensive air pollution data which, it is hoped, will eventually lead to better control measures and development of permissible limits for various air pollutants under tropical environmental conditions as in India.

The Institute has brought out a guide entitled "How to Conduct Air Pollution Surveys" to help concerned agencies to carry out air pollution investigations by themselves.

SOLID WASTES :

To enable comprehensive studies in composting of city refuse, the Institute has started studies simultaneously at Headquarters and Zonal Laboratories to obtain information on the nature of refuse in Indian cities, cost of transportation and methods of composting. An interesting piece of work done in the year was the conversion of cotton dust into compost. Studies have shown that blow-room cotton dust from textile mills is amenable to composting.

ENGINEERING (TREATMENT) :

This Division concentrated its efforts on filtration of water and its nation-wide search for anthracite or any coal similar to anthracite in its properties. This has led to location of two varieties of coals which have shown good promise. These efforts are being continued with the aim of bringing two layer filtration to India.

	Nos.
Sponsored Investigation/Consultation	12
Sponsored Research	1
Characterisation of wastes	2
Industrial Air Pollution Survey	12

Besides the above, the Institute supplied technical notes and answers to queries from 55 organisations and public bodies.

TRAINING AND PUBLICATIONS :

The Institute gave 3 short courses during 1969. These courses will henceforth be repeated on a yearly basis instead of being given sporadically.

The Institute continued to publish the quarterly research journal "Environmental Health".

NEW ZONAL LABORATORIES/BUILDINGS :

The Institute's new 5-storey building for its Bombay Zonal Laboratory was completed and occupied from October, 1969 and a new Zonal Laboratory was established at Madras to serve the southern region better.

A new library and seminar hall are under construction at Nagpur.

WHO ASSISTANCE :

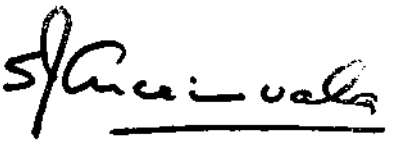
Grateful acknowledgement must be made of the assistance continued to be given by WHO during 1969. The Institute benefitted from the deputation of two leading

world authorities in the field of water and sewage treatment viz. Dr. K. J. Ives and Dr. A. Pasveer, as short-term consultants.

One Fellowship of 6 months duration for a study-tour was made available and WHO brought 8 participants from developing countries to attend the Institute's symposium on "Low Cost Waste Treatment" in October, 1969.

The World Health Organisation has designated CPHERI, as a WHO Regional Reference Centre for Air Pollution for a period of five years effective January, 1969.

Last but not the least, I must express my sincere thanks to all the staff members of the Institute and its Zonal Laboratories for their unstinted co-operation and genuine efforts to raise the general level of activity in every field and put in useful team work. The various Zonal Laboratories of the Institute continued to enjoy the co-operation and support of all the officials of the concerned States. It was also a matter of great personal satisfaction to have received the fullest support of the Institute's Executive Council, the Scientific Sub-Committee, the Building and Finance Sub-Committee and the Officials of the Council of Scientific and Industrial Research.



(PROF. S. J. ARCEIVALA)
DIRECTOR

Nagpur
The 15th April, 1970

pur (Rajasthan) and Nalgonda (Andhra Pradesh). Prepared entirely out of indigenous materials, the medium is specific for fluorides removal and has better hydraulic properties than some of the media developed earlier by the Institute.

This synthetic carbonaceous sulphonated material in granular form costs about Rs. 1540/- per cu m and cost of defluoridation of water is between Re. 1/- to Rs. 2/- per 1000 gallons, depending upon fluorides concentration in the raw water. Regeneration of medium is a simple process. Four type-designs capable of removing F^- in the range of 2-8 mg/l. have been prepared, which also includes, a home defluoridation unit.

A small unit has been set up to produce the product in moderate quantities for field use.

4. DETERMINATION OF ALUMINIUM IN PRESENCE OF FLUORIDES

Normally, estimation of aluminium concentration is difficult in presence of fluorides. As such, a nomogram was constructed from which **true** aluminium values can be estimated knowing the fluoride concentration and **apparent** aluminium value.

5. DEVELOPMENT OF ACTIVATED ALUMINA

This imported chemical is conventionally used as an industrial absorbent for colour, gases, toxicants, pesticides etc. and also as an efficient defluoridating medium. Indigenous method for its development is, therefore, being worked out. The product of preliminary trials is very similar in performance to the imported variety.

6. DISINFECTION OF WATER

For "on-the-spot" disinfection of individual drinking waters, chlorine and iodine tablets are developed. These stand well and do not lose power for a period of three months under proper care. "Double-action" tablets are also developed which, besides disinfection, takes care of turbidity. One tablet (1 g.) is sufficient to treat about 2 gallons of water containing upto 500 mg/l turbidity. In field trials, the keeping quality of these tablets was not found to be satisfactory and steps are being taken to remedy this defect.

7. FILTER AIDS

Indigenous filter aids FA-1 and FA-2 are developed to substitute imported Diatomaceous earth. These aids give much better filter runs. The aids are under further field trials. This work has been taken up at the request of the Director General, Armed Forces Medical Services, New Delhi.

8. DEVELOPMENT OF MEMBRANE FILTERS

Membrane filters are known for quick bacteriological examination of water. These are, however, imported and hence not frequently used. To overcome this difficulty, several types of membranes were prepared synthetically. Of these, two showed promise and are being further investigated.

9. IRON & MANGANESE REMOVAL

Waters in many parts of the country, notably West Bengal and Assam have high amounts of iron and manganese and conventional plants for their removal do not function properly. The Institute is developing suitable methods for their removal and field trials are being undertaken.

SEWAGE

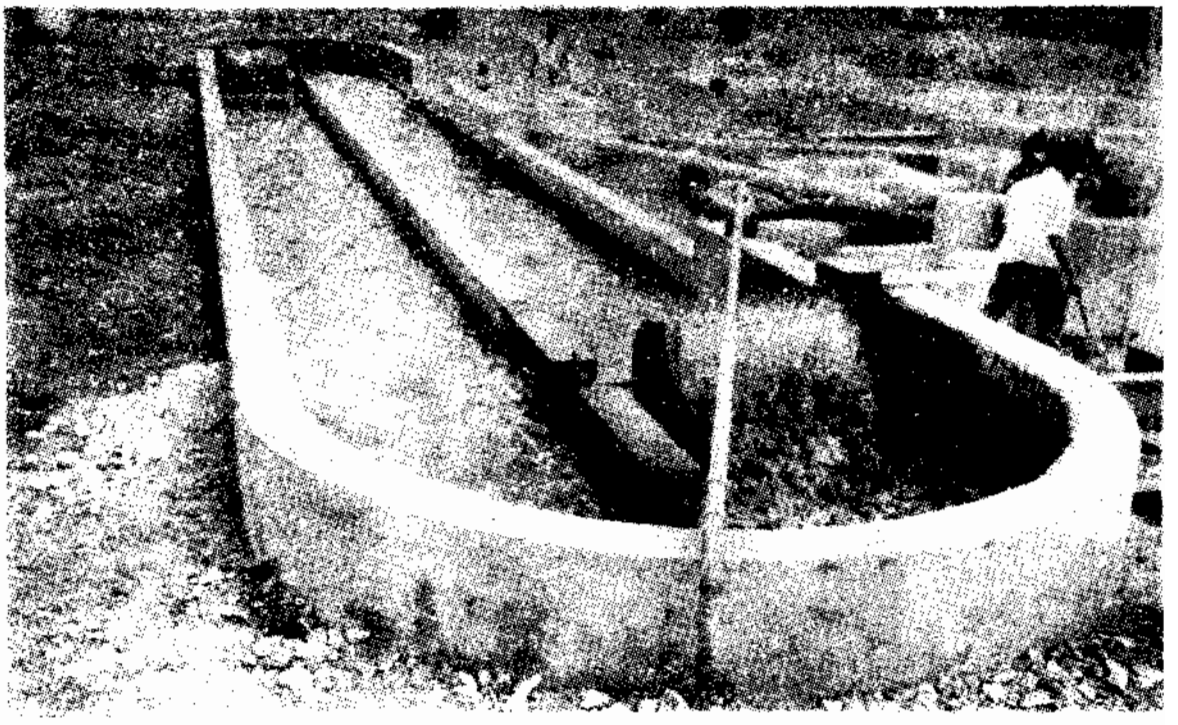
The emphasis of the investigations by this division has been on evaluation of low cost waste water treatment methods and utilisation of the effluents. The activities are grouped in two cells which are described below:

SEWAGE TREATMENT AND UTILISATION CELL

1. STABILISATION PONDS

Two systems of stabilisation ponds, one at Bhandewadi, Nagpur (three cells) and the other at CPHERI campus (two cells) were studied for five years. It is con-

A VIEW OF
LOW COST WASTE TREATMENT PILOT PLANTS
AT CPHERI CAMPUS



(a) An Oxidation Ditch

(b) An Aerated Lagoon

Field experiments are being carried out using raw sewage, differentially diluted raw sewage, and treated sewage effluents as irrigants. Fortification of these irrigants with different doses of nitrogen, phosphorous, potash and compost is also being done as subtreatments. Information is also being collected from various cities regarding the concentration of NPK in the local sewages in order to ascertain their manurial value.

6. CULTIVATION OF ESSENTIAL OIL BEARING PLANTS BY SEWAGE IRRIGATION

One of the economic and safe uses to which sewage effluents can be put to is for cultivation of essential oil-bearing plants like Citronella **(Cymbopogon winterianus)** and Mentha **(peppermint).** These oils are used in medicinal and cosmetic preparations and most of the internal demand today is met by imports.

The results of studies at the Institute show that Citronella and Mentha thrive well under sewage irrigation and the oil yield is increased without impairing its quality.

7. SEWAGE FARMING PRACTICES IN INDIA

The performance of stabilisation ponds in the elimination of human parasitic garding the operation of some typical farms in different parts of the country is being collected. In addition to the details of irrigation practices, etc., survey of farms from public health point of view is also being done. The results will be published in the form of a manual.

BIOLOGY CELL

1. REMOVAL OF HELMINTHS IN STABILISATION PONDS

The performance of stabilisation ponds in the elimination of human parasitic helminths was studied. It was noted that a facultative type of pond is very effective in reduction of helminths. This was attributed to anaerobic conditions in the pond bottom.

2. BIOLOGY AND CONTROL OF CHIRONOMIDAE

The biology and systematics of 3 species of **Chironomus** is worked out together with suitable methods for their control.

3. PREPARATION OF A MANUAL ON "NUISANCE-CAUSING ORGANISMS IN WATER SUPPLIES"

The manual is under preparation. It will serve as a simple and ready reference on faunal and floral forms that occur in water works so as to help operators identify them directly and to give simple eradication measures.

INDUSTRIAL WASTES

1. PULP AND PAPER MILL EFFLUENTS

(a) Work on characterization of different wastes from sections of Orient Paper Mills, Amlai, has been completed. Anaerobic lagoon pilot plant has been in operation for the treatment of pulp mill effluents. The data collected during 9 months period showed a BOD reduction of 75% at a detention period of 10 days. An intermediate size lagoon of 1 MG capacity is being developed. Lignin removal in activated sludge process was not successful.

(b) Laboratory studies were conducted on the digestion of black liquor from Security Paper Mills, Hoshangabad. The results indicated that the waste is amenable to anaerobic treatment after pH adjustment to 9.0 and dilution to 1 : 2 (waste : water or sewage). A loading of 0.075 lb BOD/cu ft/day was found to be optimum and gave a BOD reduction of 90% yielding an effluent with 600-800 mg/l BOD.

2. GWALIOR RAYON PULP MILL WASTES

Prehydrolysate liquor and prehydrolysate wash mixed in proportion to their flows were subjected to anaerobic digestion with and without gas collection devices. The BOD of the mixture was about 25,000 to 28,000 mg/l. Under both sets of experimental conditions, a BOD loading of 0.1 lb/cu ft/day was found to be optimum. This corresponds to a detention time of 15 days. In these studies a BOD reduction of 90% was obtained. Based on the laboratory studies the existing lagoon at the factory is being developed into a full scale treatment unit for treating the wastes.

Torula utilis could be grown in prehydrolyste (P.H.) liquor and reduce the BOD by 50 per cent. Studies were conducted in the laboratory so as to know the optimum pH, dilution, Nitrogen and Phosphorus requirements. An yield of 10 g. of yeast was obtained from a litre of P.H. liquor and the yeast contained 40-45% protein on dry basis. The economics of this process is being worked out.

3. STUDIES ON EXTENDED AERATION SYSTEM

Laboratory investigations were carried out to find out the optimum loading that can be used in extended aeration system under tropical conditions. For this purpose, laboratory model activated sludge units of 8 lit. capacity were used and detention periods of 8, 12, and 16 hr. were maintained. The mixed liquor suspended solids in these units varied between 3500-6000 mg/l. The results obtained so far indicated that at a loading of 0.253 kg BOD/kg MLSS/day, the unit began to throw out sludge in the effluent (8 hr unit). Units maintained at 12 and 16 hr. received loadings of 0.17 and 0.155 kg BOD/kg MLSS/day respectively and worked satisfactorily.

AIR POLLUTION AND INDUSTRIAL HYGIENE

The activities of this Division can be clasisfied as under :

1. Atmospheric pollution studies of industrial cities in India;

2. Air Pollution problems as referred to certain industries as well as large cities in the country; and

3. Methodology and instrumentation in monitoring the air pollution study programme.

1. NATIONAL AIR SAMPLING NET WORK

A short term project on air pollution study was undertaken for a few selected cities in India, namely Bombay, Delhi, Calcutta during 1968-69. The parameters included in the study were : airborne dust, sulfur dioxide, nitrogen dioxide, hydrogen sulfide and ozone. The short term study gave a fairly good idea regarding the status of air pollution. Though not alarming, this was found to be of concern to avoid the increasing danger of the pollution.

The results of these short surveys bore out the necessity to expand the project to a long term one on the scale of national air sampling net-work project. Under this new scheme, eight industrial cities have been taken up where there are CPHERI Zonal Laboratories for conducting air pollution studies on a regular schedule. Presently, air samples are being collected from one single station in each city. Efforts are being made to supply these Zonal Laboratories more equipment, so that they can increase the sampling stations to at least three. Bimonthly samples are collected on 24 hr. basis. Gaseous pollutants such as sulfur dioxide, nitrogen dioxide, hydrogen sulfide and particulates such as airborne dust, settleable dust are being sampled and the record of their existing levels is being maintained. The study would reveal the seasonal variations and the trend of atmospheric pollution in general in various important cities.

2. AIR POLLUTION PROBLEMS AS REFERRED TO CERTAIN INDUSTRIES

Numerous problems are being referred to the Institute every year from different States in the country. These problems are undertaken for study on consultation basis. The investigational work defines the nature of problem, detection of the sources of pollution, assessment of the existing levels of pollution and practical suggestions to control the emissions.

The following investigations were carried out during the year :

Fertilizer Corporation of India, Trombay, Bombay.

Coromondal Fertilizers Ltd; Visakhapatnam, (AP).

Gwalior Rayon Silk Mfg. (Wvg.) Co. Ltd; Mavoor (Kerala).

Lead exposure study in Government Printing Press, Nagpur.

Byssinosis studies in Textile mills.

3. AIR POLLUTION CONTROL PROGRAMME FOR LARGE CITIES

Some of the larger cities in India like Bombay, Calcutta, Delhi, Ahmedabad are slowly getting affected with the problem of air pollution and the municipal authorities are interested to establish their own air pollution control units so that they could be in a position to study the nature of atmospheric pollution scientifically and deal with complaints themselves.

Bombay, Calcutta and Ahmedabad Municipal authorities have already approached the Institute for such assistance and Bombay Municipal Corporation have already placed funds at the disposal of the Institute.

4. METHODOLOGY AND INSTRUMENTATION

The Division is also attempting to develop the instruments and methodology which can be adopted to suit our climatic conditions. Efforts are being made to fabricate air sampling equipments such as Gas Impingers, Rotameters and few other important gadgets which would otherwise need import.

5. WHO REGIONAL REFERENCE CENTRE

WHO has nominated CPIIERI as a Regional Reference Centre on Air Pollution with the following objectives :

To collect and evaluate data on air pollution trends in India and other countries of the region;

To initiate in collaboration with national Institutions systematic air pollution programmes, using uniform methods of survey, design and measurements; to provide advice and consultancy services on methods of air pollution control;

To carry out research on behalf of the WHO International Reference Centre on air pollution;

To assist in the collection and exchange of scientific and technical information on air pollution;

To assist in training staff needed in air pollution control programme and in organising national and regional training courses in principles and methods of air pollution control; and

To act as a liaison laboratory betwen the national institutions in the region and the international reference centre on air pollution.

Institute has already started taking necessary steps to implement the above programme of work.

6. THEORETICAL EMISSION INVENTORY FOR DIFFERENT INDUSTRIES IN INDIA

The aim of this project is to collect information regarding gaseous emissions from different industries and evaluate the pollutional load. The assessment of air pollutants is being carried out on about 46 industrial plants spread all over the country and data have been collected. Questionnairs were sent to 14 States where these plants are located.

MICROBIOLOGY

(INCLUDING VIROLOGY)

1. DIE-AWAY OF BACTERIAL PATHOGENS AND PARASITES IN DIFFERENT SEWAGE TREATMENT PLANTS

Studies are undertaken to assess the performance of certain low cost waste treatment (pilot) plants like oxidation pond, oxidation ditch and aerated lagoon in eliminating bacterial pathogens and intestinal parasites. Work is being continued to cover all the seasons round the year.

2. DEVELOPMENT OF SYNTHETIC MEDIUM FOR BACTERIOLOGICAL ANALYSIS OF WATER

No uniform quality and performance has been attributed to commercially available bacteriological media made from biological compounds like peptone, bile salts, and beef extract coming from different sources. As such, results of the presumptive tests for califorms and **E. coli** in water analysis are not likely to be uniform when such media are employed.

A chemically defined medium containing inorganic ammonium salts as major source of nitrogen was developed in this Division and on testing was found to compare favourably with standard MacConkey broth. The efficiency of the synthetic medium will be further evaluated by testing large number of water samples both chlorinated and unchlorinated from different sources viz., lake, well & river.

3. RELATIVE INCIDENCE AND SURVIVAL OF COLIFORMS AND FECAL STREPTOCOCCI IN SOILS

A study of relative incidence and survival of coliforms and fecal streptococci in soils is of considerable importance in determining the possibility and magnitude of contribution of these bacteria from soil to natural waters. Analysis of 320 soil samples in and around Nagpur suggest that the incidence of coliforms is highest whereas that of fecal streptococci is lowest.

Studies on the relative survival of these two groups of organisms in different types of soils are in progress.

4. BACTERIOPHAGE MODEL STUDIES FOR THE CONCENTRATION OF VIRUSES FROM POLLUTED SOILS

Studies on the isolation, grouping and identification of bacteriophages in general have been carried out by different workers but very little information is available on the concentration of viruses from polluted soils.

Preliminary studies using **E. Coli B. phage,** isolated from sewage was carried out using $CaCl_2$ as the electrolyte. The behaviour of the phage particles and their recovery was not very encouraging. Moreover, it was felt necessary to select a suitable phage which was more akin to the enteric virus in soils. For this purpose, bacteriophage (RNA phage MS2) was selected for the concentration of viruses on the millipore membranes.

Further work on the selection of other electrolytes which can give best results on the concentration of viruses from soils is in progress.

5. SURVEY OF WATERS FOR ENTERIC VIRUSES

There is no information available on the degree of viral pollution of natural waters and the efficiency of water treatment processes in removal of enteric viruses in this country.

Experiments were carried out to standardize the procedure for quantitative recovery of viruses from artificially polluted water by Membrane Filter Technique using different concentrations of Magnesium. Studies were also undertaken to carry out a survey of the density of enteroviruses in raw water in river Kanhan (Nagpur) and settled and filtered waters from Gorewara (Nagpur) water treatment plant.

The work is being continued to cover all the seasons round the year.

6. IMPROVED TECHNIQUES FOR VIRUS CONCENTRATION FROM SEWAGE

A quantitative method sensitive enough to detect small numbers of viral particles from sewage effluents is necessary to assess the performance of sewage treatment plants and to determine the amount of enteroviruses entering natural waters.

A method employed by Wallis and Melnick in USA (1967) in which viruses are concentrated on Millipore Membrane was taken up and a combination of all parameters that would give a recovery of 80-90% of enteroviruses introduced into autoclaved sewage in the laboratory have been studied. The feasibility and reproducibility of this method to detect viruses under field conditions is being tested on different types of waste water treatment (pilot) plants in the Institute.

7. VIRUS REMOVAL IN DIFFERENT SEWAGE TREATMENT (PILOT) PLANTS

There is no data available in this country as to the virological quality of the effluent from sewage treatment plants as well as the relative performance of different units of sewage treatment processes in virus removal.

Studies on three different pilot plants, viz. Oxidation pond, Oxidation ditch (activated sludge extended aeration) and an aerated lagoon to determine removal of enteroviruses have been taken up.

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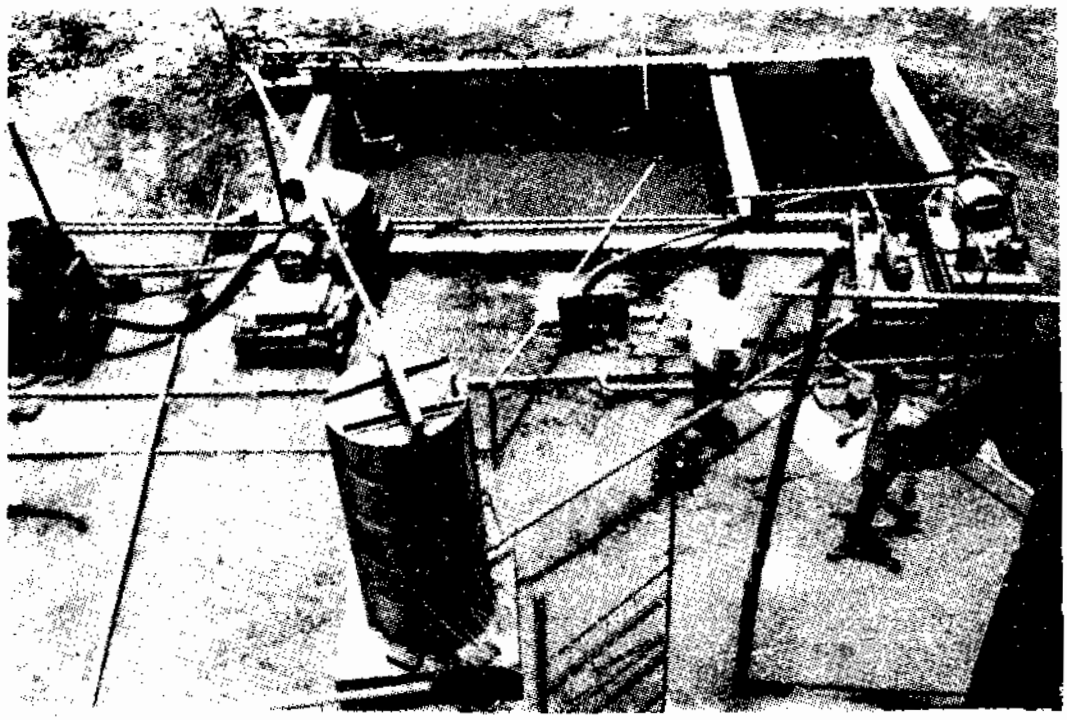

An Experimental Set-up for Water Filtration Studies

ENGINEERING

(TREATMENT)

1. UPFLOW FILTRATION OF WATER

To study the suitability of and to obtain operational data on upflow filters (contact clarifiers) for waters of low turbidity (100-150 mg/l) with addition of alum just prior to filtration, a small pilot unit of 1′×1′ was worked upon at Nagpur. The raw water turbidity was in the range of 100-200 mg/l. The media consisted of 7′ of gravel and 4′-6″ of sand with E. S. 0.7 mm and U. C. 1.2. Different rates of filtration were tried and it was observed that for the above turbidity ranges and media characteristics a rate of 1.5 gpm/sq. ft. is optimum giving a minimum run of 24 hours for a terminal head loss of about 5′-0″. The effluent turbidity remained less than 1 mg/l.

2. TWO LAYER FILTRATION OF WATER

The role of dual media filters in achieving higher rate of filtration and/or improved filtrate quality has been amply proved in the West. An intensive search to locate sources of good quality anthracite in the country was undertaken, with a view to use this material in dual media filters consisting of coal followed by sand.

No anthracite could be located so far in the country, however samples of good quality bituminous coal have been procured. The results of suitability tests on these samples as well as the preliminary laboratory studies using bituminous coal and sand for filtration have been encouraging. The studies indicate that dual media filters consisting of indigenous coal followed by sand can give an output of 2-3 times that of the conventional filters for the same terminal head loss. No significant difference in quality of filterate was observed.

ENGINEERING

(DISTRIBUTION & DRAINAGE)

This Division was formally started sometimes in October, 1969, and research work on the following projects was initiated.

1. LEAKAGE DETECTION AND WASTAGE PREVENTION

It is reported that about 10 to 40 per cent of water is wasted by way of undetected leakes in the buried water mains, based on surveys conducted abroad. Very little importance is attached to this problem in India. It would be the need of the day to take up leakage detection and its prevention work and conserve this commodity. Electronic leakage detecting and pipe locating equipments have been procured from abroad and trial investigations were carried out in the laboratory and also in the field to gain experience in the use of these equipments.

2. DEVELOPMENT OF FIELD FLUSH LATRINES

This problem was referred by the Army as the present wooden trench latrines have a short life and are also cumbersome to transport. This Institute has been working on the development of a suitable design of trench latrines with proper water-seal and also the supporting structure. The material of construction that is proposed for these units is fibre glass reinforced plastic (GRP) which offers high strength and light weight. The plastic used is polyester in the resin forms.

Trial units have been fabricated and the work is being continued till a satisfactory unit is developed.

3. DETERMINATION OF STORM-INTENSITY-DURATION-FREQUENCY RELATIONSHIP IN DIFFERENT REGIONS OF INDIA

The present day assumption of intensity of the storm for storm-sewer designs does not always have scientific background. Establishment of rainfall intensity-duration-frequency relationship for various regions of India is essential to rationalise the design of rain water pipes and storm sewers.

A computer programme is being developed to establish the intensity-duration-frequency relationship of storm of any region, as a first step. Using this programme, the analysis of rainfall patterns of various regions of India is envisaged in the next year.

4. PREPARATION OF A BROCHURE ENTITLED 'PLASTIC PIPES IN WATER SUPPLY AND DRAINAGE'

To guide the engineers, architects, plumbers and others concerned in the proper selection and use of plastic pipes as available in India, a brochure on plastic pipes is being prepared. The brochure is to cover process of manufacture, general characteristics and choice of material, recommendations for laying and jointing, and testing, etc.

5. SHORT COURSE IN PLASTIC PLUMBING

A short course on plastics in plumbing was arranged on September 6 and 7, 1969 in the Bombay Zonal Laboratory. Representatives from the National Buildings Organisation, New Delhi, Central Building Research Institute, Roorkee and from various concerned plastics industries participated in delivering lectures and demonstration on installation details. The candidates for the course were mainly engineers and architects.

SOLID WASTES DISPOSAL

1. COMPOSTING OF BLOW-ROOM COTTON DUST

Considerable amount of cotton dust is produced in the blowing sections of the textile mills. This material is generally disposed off alongwith other sweepings from the mills or some times used as a fuel or a cheap filling in quilt blanket. A detailed analysis of the cotton dust revealed that it is actually richer in nitrogen and phosphorous than the usual city refuse, thus offering a very useful material for compost.

Blow-room cotton dust from Empress Mills, Nagpur, was used in these studies. Full scale field trials were carried out by the Division using windrows (4 m long x 2 m wide x 1.5 m high). Different turning intervals such as daily, alternate day, every third day and every fifth day were tried. Moisture contents were maintained throughout at the usual optimum range between 50-60%.

It has been found that a minimum of 20 days at moisture content of 50-60% is needed with turning on every alternate day to produce a good quality compost. The finished product is an attractive and valuable compost with potential for sale to city-dwellers for their kitchen and terrace gardens.

2. REFUSE COLLECTION DATA FROM NINE INDIAN CITIES

Work has been initiated to investigate the following aspects :

The present methods of refuse disposal;

The expenditure involved in the collection and transportation of refuse in terms of cost per tonne per mile; and

Physical and chemical characterisation of city refuse and its conversion to compost.

The information about the above factors has already been collected for Nagpur city. The cost of transportation of Nagpur city refuse is Rs 1.29 per ton per mile (as assessed in 1966). The per capita amount of refuse for Nagpur City was at the rate of 0.27 kg. per day. Similar information is being collected for other cities. Information will also be collected about the present methods of disposal and transportation to assess the economics.

3. COMPARATIVE STUDY OF WINDROW AND PIT METHOD OF COMPOSTING OF CITY REFUSE

Work has been started to study the relative performance of two methods of composting of city refuse. Composting of city refuse was carried out in four windrows (4 m long x 2 m wide x 1.5 m. high) containing unsorted unshredded, unsorted shredded, sorted unshredded and sorted shredded city refuse. At the same time, observations were recorded on composting in pits with similar material. The windrows were turned at an interval of five days. The pits were excavated after six months. The samples of decomposing material were collected every 5th day for che-

mical analysis. This work is proposed to be continued further to decide the optimum turning frequency of windows and to study the survival of pathogens in both of these methods.

4. PILOT INCINERATOR FOR MARKET REFUSE AT KHAR, BOMBAY

Studies have been carried out to assess the possibility of incineration of market refuse at Khar, Bombay and these have indicated that the process can be carried out without addition of any extra fuel. On the request received from the Bombay Municipal Corporation, designs for 'In-line' type of multichamber incinerator for three ton/eight hour capacity have already been submitted to them. As soon as the incinerator is constructed as per our design, the performance of the same will be studied from the point of view of fuel requirement, possibility of heat utilisation, degree of combustion of refuse and efficiency of the incinerator design from the air pollution control point of view.

RURAL SANITATION

1. NIGHTSOIL WHEEL BARROWS AND OTHER SANITARY WARES

The Institute has developed a number of rural sanitary wares, such as night soil wheel barrows, latrine pans, urinals, wash-basins, chlorine dispensers, cow-dung gas plant, night soil digestion plant. Some of the items are manufactured in the Institute's Sanitary workshop.

As a part of extension work, the Institute supplied these sanitary wares to individuals, local bodies, Corporations, Municipalities and some Government departments.

2. NIGHTSOIL DIGESTION

Both laboratory and pilot plant studies on the nightsoil digestion were conducted.

A pilot plant of 210 cu. ft. capacity was operated at 0.01—0.12 lb V.S./cu ft/day loadings and showed a 50% destruction of volatile matter. Further increased loadings are aimed at to determine the optimum loading. Hand operated mixing device has been fabricated and installed in the pilot plant digester.

3. DISINFECTION TECHNIQUES FOR SMALL WATER SUPPLIES

Various disinfection techniques for small community water supplies were studied in order to assess their performance. The disinfectant used in these studies was bleaching powder. One of the techniques developed in this connection consists of a double pot earthenware cartridge in which bleaching powder could be used to continuously disinfect well water for a period of 2 to 3 weeks satisfactorily.

4. HOME DEFLUORIDATION See under Water (item 3)

5. IRON & Mn REMOVAL See under Water (item 9)

6. BLOW-ROOM COTTON DUST COMPOSTING See under Solid Wastes Disposal (item 1)

7. WELL WATER QUALITY SURVEY See under Delhi (item 1)

INSTRUMENTATION

This Division looks after the maintenance and repairs of equipment/apparatus in the research divisions of the Institute both at Headquarters as well as at Zonal Laboratories. The Institute is having most modern and sophisticated equipment received under half-a-million worth of aid from the UNDP (WHO Executing Agency) with well qualified personnel to look after.

In addition, the Division also undertakes developmental work including design and fabrication of special equipment to suit the requirements of research projects of the Institute. Special mention may be made of the following equipments:

CPHERI Chloroscope for ease in estimation of residual chlorine in water;

A conductivity-meter which is a simplified circuit for recording the conductivity of effluents from the deionisation plants;

Electronic/electrical analyser for water distribution network; and

Chlorine tablet dispenser for regulated release of the disinfection tablets in well waters.

Besides, the Division assists in use of sophisticated instruments for analytical work not only to the scientists of the Institute but also to outside research/educational institutions such as Institute of Science, Post-Graduate Teaching Departments and Medical College, Nagpur.

ZONAL LABORATORIES

Besides the research projects that are indicated under each Zonal Laboratory separately, work on the following three projects was taken up jointly by them in order to furnish country-wide data to Headquarters :

Long-term city air quality surveys for nine cities. In this connection it may be mentioned that one Scientific Assistant from each Zonal Laboratory was given two weeks' training at Nagpur in the handling of necessary instruments, collection and analysis of air samples and other related matters.

Collection of data regarding quality and quantity of city refuse from nine Indian cities.

Survey of the existing sewage treatment plants with a view to develop design criteria for different unit processes under Indian conditions.

AHMEDABAD

1. EFFLUENT TREATMENT AT THE STRAW-BOARD FACTORY OF M/S. CELLULOSE PRODUCTS OF INDIA LTD., RAMOL

Laboratory and pilot plant scale studies on the treatment of these wastes by oxidation pond have given encouraging results. Plans are now underway to suggest a full-scale treatment method by oxidation pond to the factory authorities.

2. WASTE CHARACTERISATION AND TREATMENT AT M/S. CELLULOSE PRODUCTS OF INDIA LTD., KATHAWADA

This is the only factory of its kind in Gujarat manufacturing carboxy methyl cellulose (CMC) from cotton linters.

Studies are being conducted on the characterisation of the wastes from different sections of the factory with a view to find out the nature of these wastes and their treatability.

3. WASTES CHARACTERISATION AT M/S. C.M.C. (INDIA) LTD.

This factory produces ultramarine blue by a synthetic chemical process. Work on the characterisation of wastes and to develop a simple and economic treatment method is in progress.

4. WASTES CHARACTERISATION AND TREATABILITY STUDIES AT THE INDIAN ELECTROCHEMICALS LTD.

The factory produces sodium bisulphate by an electrolytic process using zinc and oleum. Although the quantity of waste discharged is not much, yet these are strong and a potential source of water pollution. Work on the characterisation of the wastes with a view to suggest suitable treatment method is in progress.

5. EFFLUENT TREATMENT AT ARVIND BOARD & PAPER PRODUCTS LTD., BILLIMORA

Straw board factory wastes are found to be amenable to treatment by oxidation ponds. It is proposed to adopt this method for treatment of these wastes. However, before a full-scale plant is constructed, the factory authorities have requested to conduct pilot plant studies to treat about 60,000 gpd of these wastes.

6. EFFLUENT TREATMENT AT GUJARAT STATE FERTILIZER CO. LTD., BARODA

Fertilizer factory wastes mostly contain toxic compounds such as ammonia, phosphates, fluorides and arsenic, which are a potential source of water pollution. Not much information is available on the characteristics of these wastes as well as on their amenability to chemical and biological treatment. Laboratory and pilot plant studies have, therefore, been conducted, especially on stripping of ammonia by aeration and by packed towers.

Based on these studies a suitable flow-sheet has been developed and supplied to the factory authorities who are considering construction of the waste treatment facilities.

7. EFFLUENT CHARACTERISATION AT SARABHAI GROUP OF INDUSTRIES, BARODA

The effluents produced by the Sarabhai Group of Industries are of a complex nature and are derived from antibiotic, pharmaceutical, vitamin and fine chemical divisions. The wastes have a high pollutional load. At present, the wastes are settled in primary settling tanks and the sludge recovered is digested. This mode of treatment helps in removal of about 30% of the BOD. A considerable portion of organic load still remains in the effluent which requires further purification before disposal into city sewers.

With a view to reduce the organic pollution still further and achieve better purification of the wastes, the Zonal Laboratory has conducted work on the complete characterisation of the wastes and its amenability to treatment by biological means, by the extended aeration process embodied in the "Pasveer Oxidation Ditch".

8. EFFLUENT CHARACTERISATION AND TREATMENT AT M/S. SUHRID GEIGY LTD., RANOLI

The factory produces highly complex type of liquid wastes consisting of dyes and pharmaceuticals which constitute one of the major sources of pollution of the Mahi

river. The Zonal Laboratory has carried out a detailed survey of the sources of pollution within the factory and their characterisation. Based on the information collected so far, laboratory scale studies have been carried out to find out the most suitable treatment method. A flow-sheet for the treatment of these wastes has been developed and supplied to the industry.

9. AIR POLLUTION SURVEY

One sampling station has been selected in the central city area. The station is a two-storeyed school building. Regular samples are being collected and analysed for the various air pollutants.

10. CHARACTERISATION OF REFUSE

Samples of refuse from 4 representative localities viz. exclusively residential, industrial, market and slum areas, have been collected and analysed. Other related information such as the cost of transport per mile and the per capita contribution have also been collected. Work is being continued to cover all seasons of the year.

BHOPAL

1. POLLUTION OF WATER RESOURCES

Bhopal city gets its water supply from two major sources : a) Upper Lake and b) Wells.

These sources were examined from physico-chemical, biological and bacteriological point of view to assess their suitability as a source of raw drinking water. These studies have shown a definite seasonal variation in the number of coliforms and enterococci present in well waters. Maximum bacterial density occurred in rainy season.

Regarding Upper Lake, the investigations have shown that the lake waters are not grossly polluted except at some isolated points and the degree of pollution is within the permissible limits for a drinking water supply. However, a stringent control is necessary to prevent further deterioration in water quality.

2. REDUCTION OF MICROORGANISMS AT DIFFERENT STAGES OF WATER TREATMENT

A study was carried out to evaluate the effectiveness of different processes in water treatment on the reduction of coliforms, enterococci and phytoplankton from waters in the two water treatment plants of 5 MGD and 12 MGD capacity respectively.

Bacterial reduction from waters in both the plants, due to pretreatment, filtration and post chlorination was found to be about 70-90%, 90-98% and 100% respectively.

3. CONTROL OF AQUATIC WEEDS BY BIOLOGICAL METHODS

Upper Lake, Bhopal was found to be infected with different types of aquatic weeds which create difficulties for navigation, fish netting operation and maintenance of public health. A systematic study of the weeds present in the lake was, therefore, made and the species recorded.

In waters where growth and propagation of aquatic plants is vigorous it was found necessary to use a higher rate of starting fish (grass carp) for effective control of weeds.

BOMBAY

1. PILOT FILTRATION STUDIES AT VAITARANA

CPHERI, approached Bombay Municipal Corporation with a request to hand over their existing pilot plants at Vaitarana to the Institute so that further studies could be carried out for water filtration, in general. These plants have now been handed over to the Institute. Soon after taking charge, these pilot plants are in operation by Institute's staff to gain experience and chalk out further programme of work on various aspects of water filtration.

During the period under review, studies have been initiated on various aspects of filtration including the determination of optimum dose of alum, up-flow filters, up-and-down flow filters and dual-media filters.

2. OPTIMISATION IN THE DESIGN OF WATER FILTRATION SYSTEM

The aim of this project is to formulate a programme for designing a filter plant at the most economical cost.

A number of filter plants are being constructed in India these days. The sizes of the filter units and their arrangements are, however, chosen by the equipment supplying companies It was, therefore, proposed to find out the most appropriate size of the units by employing cost optimisation techniques on a digital computer taking into account all the different costs for construction of filter beds, under-drainage, sand, and other appurtenances.

A computer programme is being written for this purpose.

3. SURFACE WASH OF RAPID FILTERS

A study was undertaken with a view to find out the suitability of surface wash system by comparing the two methods of washing viz. surface wash system and conventional wash system (backwash with air and water) so that the better one can be recommended to other water works as an economical and efficient method.

Studies carried out at an industry (near Bombay) where fortunately filters equipped with both the systems of washings were available, side by side, for comparison, have revealed the following results :

The efficiency of dirt removal is about 25% greater in the case of filters provided with surface wash system and the filter beds are kept cleaner when compared to filters washed by the conventional method.

The percentage wash water requirement is more or less the same for filters having surface wash system (2.68%) and for the conventionally washed filters (2.76%).

The results of these investigations have been compiled in the form of a scientific paper which is under publication.

4. CHEMICAL TREATMENT OF SEWAGE

At Bombay, the final disposal of sewage is into the sea. However, due to various factors, the sewage does not get properly dispersed and/or diluted by sea water, thereby creating the problem of pollution of beaches.

Since secondary or intermediate type of treatment is costly, it was decided to study the feasibility of chemical coagulation followed by sedimentation before disposing it off ultimately into the sea.

Chemical coagulation with alum and $FeCl_3$ have been tried and the results obtained indicate that treatment with $FeCl_3$ is better than that of alum.

5. HYDROGEN SULFIDE REMOVAL BY GAS SCRUBBING

The presence of H_2S in sludge gas is a difficulty faced by many municipalities The cause of this can be attributed either to the discharge of trade wastes containing SO_4 into the sewers or infiltration of sea water into sewers in coastal cities like Bombay.

Studies carried out have indicated that scrubbing the gas with the secondary effluent using venturi type scrubber helps considerably in reducing the H_2S contents. It has been observed that with a single stage unit with gas to liquid ratio of 2 : 1, the H_2S concentration in the treated gas could be reduced to 73 gr/cu ft from the initial concentration of about 440 gr/cu ft in the raw gas.

This method of treatment has been proved to be economical. The cost of treating 100 cu ft of gas works out to about 50 Paise exclusive of labour charges.

6. STUDY OF SEWAGE TREATMENT PLANTS IN AND AROUND BOMBAY

The aim of this project is to collect information on the various types of sewage treatment plants that are in existence in and around Bombay and to study their performance. The information so collected can be useful for designing future plants in the country and also to know the difficulties or otherwise experienced while operating these plants.

So far, information has been collected in the proforma specially prepared for this purpose from plants in Dadar, Colaba and Kalwa.

7. STUDIES ON ACTIVATED SLUDGE

Conventional activated sludge treatment plants given by foreign equipment manufacturing companies normally employ 8-10 hr. aeration periods. It was felt that since

the temperature of both sewage and atmosphere in India are quite high (25-30°C and 30-42°C respectively), the activated sludge when aerated for longer periods may get mineralised and it may be possible to eliminate digestion altogether.

From this point of view studies have been initiated at the Activated Sludge Plants at Colaba and Dadar.

8. STUDY OF REFUSE CHUTES IN BOMBAY

Collection of refuse from multistoreyed buildings especially in big cities like Bombay poses a special problem to the municipal authorities. One of the simple and efficient way of arranging the same is by means of refuse chutes.

Some of the modern sky-scrapers in Bombay have installed such system and hence an inspection-cum-study tour was undertaken to collect information as regards the installations used and their working. Acomprehensive report entitled "Disposal of Garbage from Multistoreyed Buildings", has been prepared for National Buildings Organisation, Govt. of India, New Delhi.

9. AIR POLLUTION SURVEY

Air quality sampling studies have been carried out in the following industries in Bombay :

Fertilizer Corporation of India, Chembur.

Universal Metal Refinery, Goregaon.

Regular data on the various pollutants such as SO_2, NO_2 , H_2S and NH_3 have been collected and recommendations made to the concerned parties.

10. CHARACTERISATION OF REFUSE

Samples of the city refuse from various localities were collected and analysed. Studies on the possibility of incineration of wastes are in progress.

CALCUTTA

1. INDUSTRIAL WASTES SURVEY IN DURGAPUR/ASANSOL AREA

One of the recent and most extensive surveys completed by CPHERI is the survey of river pollution occurring in the Calcutta-Durgapur-Asansol region of the Damodar river. This is one of the most polluted regions in India and the Institute has studied and reported upon a variety of effluents discharged from each and every major industry in this region. The survey has brought out vividly the extent of gross pollution in Damodar Valley which indicated necessity for enforcement of pollution control measures. These measures are likely to require an investment of nearly 2 crores of rupees at present day prices.

A comprehensive report in two parts has been prepared and submitted to the authorities.

2. EFFLUENT DISPOSAL OF M/S. TRIBENI TISSUES PVT. LTD., TRIBENI

This problem was taken up at the instance of the Director of Industries, Government of West Bengal. A preliminary report giving information on the quality and quantity of the wastes has been completed.

Further work on the suitability of treatment of these wastes before disposal into river Hooghly is in progress. The problem is likely to take 2-3 years before completion.

3. SURVEY OF EXISTING SEWAGE TREATMENT PLANTS

The aim of this project is to collect information on the design and performance of existing sewage treatment plants in the eastern region of the country. The survey will help in developing rational design criteria applicable under Indian conditions.

It is proposed to cover 7 treatment plants located at different towns in this region.

So far, 3 treatment plants have been covered and data have been compiled in specially prepared proforma.

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4. AIR POLLUTION SURVEY

Work on the long term air quality survey for the city of Calcutta has been initiated.

One sampling station has been set up and air samples are being collected and analysed regularly.

5. CHARACTERISATION OF REFUSE

Studies were initiated on different aspects of refuse disposal.

DELHI

1. STUDIES ON SEASONAL VARIATION IN QUALITY OF HAND PUMP WATER

Hand pump waters have always been doubted to be contaminated and unfit for drinking. In order to judge the quality of these waters in and around Delhi, a survey was carried out to study the seasonal variations in the chemical and bacteriological quality of water collected from about eleven hand pumps.

Of all the samples collected so far, none was found free from contamination. Work is being continued to survey more hand pumps.

2. CORRELATION OF COD AND BOD FOR DOMESTIC SEWAGE AND SLAUGHTER HOUSE WASTES

The object of this study was to determine the relationship between the COD and the 5-day BOD for settled sewage and other wastes to enable prediction of the 5-day BOD values from the known COD values. In this connection, regular samples of settled sewage and nightsoil and slaughter house waste were collected, analysed and BOD/COD relationship has been worked out in respect of settled sewage (Trickling filter plant); nightsoil; settled sewage (Activated sludge plant); and slaughter house wastes.

The scheme is nearing completion.

3. ALGAL BLOOMS IN SWIMMING POOLS

Algal blooms in swimming pools are apt to prove a nuisance. Human urine seems to be the major contributing factor for this nuisance which contains phosphates and seem to play a critical role in the algal blooms. Threshold values for phosphate, phosphorous and nitrate nitrogen have been found to be 0.015 mg/l and 0.30 mg/l respectively for the production of algal bloom.

A preliminary survey of about 8 swimming pools in and around Delhi was conducted with a view to suggest remedial measures. The survey has revealed that except in two pools, the PO_4 was found to be above the threshold values while in the rest it was below the threshold value during the month of June 1969.

4. COMPARATIVE STUDIES ON SEWAGE TREATMENT BY ACTIVATED SLUDGE AND TRICKLING FILTER

These studies are being undertaken with a view to compare the efficiency of the two processes of sewage treatment at Okhla. Data collected so far indicate that the performance of activated sludge plant in the removal of coliform bacteria and enterococci is superior to that of trickling filter plant.

5. FEASIBILITY OF TREATING SULLAGE WATER OF NAJAFGARH NALLAH BY MEANS OF OXIDATION PONDS

Delhi Municipal Corporation have referred this problem to the Institute with a view to reduce the pollutional load entering the Yamuna river through this nallah which carries a variety of industrial and domestic wastes. Studies have, therefore, been initiated to examine the feasibility of treating these wastes by oxidation ponds and to reduce the pollutional load of these wastes before entry into Yamuna river.

The oxidation ponds are under construction.

6. CHARACTERISATION AND TREATMENT OF SLAUGHTER HOUSE WASTES

Slaughter house wastes are strong in organic matter and highly pollutional in nature. These wastes do not usually respond to conventional treatment methods as other industrial wastes. Anaerobic treatment is helpful in reducing the initial organic

load. The conventional anaerobic treatment is, however, a slow process requiring long period of treatment. A new method, recently developed in U.S.A., shows that such high concentration of organic matter can be suitably treated using anaerobic filter process.

Laboratory scale experiments conducted so far have yielded encouraging results.

7. AIR POLLUTION SURVEY

A short term survey of the level of pollutants revealed that the suspended particulate matter was highest during the hot day period from April to 1st week of July; and lowest during rainy period from July to September. Similarly, sulfation rate was maximum during hot day months of April/May.

8. CHARACTERISATION OF REFUSE

During the year about 42 samples of city refuse from dumping ground and various localities in the old city were collected and analysed for their usual characteristics.

HYDERABAD

1. TREATMENT AND DISPOSAL OF WASTES FROM VANASPATI GHEE (VEGETABLE OIL) FACTORY, KURNOOL

M/s. Tungabhadra Industries Ltd., Kurnool, manufacture ghee and soap. During the process of manufacture, large quantities of objectionable liquid wastes are discharged. The factory authorities have provided some facilities to treat these wastes, but these are not found adequate and hence they referred this problem to the Institute for improvements.

The scientists of the laboratory conducted on-the-spot survey of the problem including collection and analysis of representative samples of the waste waters. Based on this survey, a report has been submitted to the factory authorities and necessary steps are being taken to implement the Institute's recommendations.

2. M/S. AZAMJAHI MILLS LTD., WARANGAL

Due to acute shortage of water supply in Warangal town, the industry is not able to obtain the required quantity of water for its processes. The Management had, therefore, approached the Institute to suggest ways and means to augment the existing water supply by process control and reuse of some of the less polluted effluents in the factory. Based on the survey conducted and with personal discussions with the engineers of the factory, recommendations have been made to improve the situation by adopting certain in-plant control measures.

3. CHARACTERISATION AND TREATMENT OF INSTANT COFFEE WASTES

M/s. Brooke Bond (I) Ltd., Ghatkesar, have recently started manufacturing instant coffee in their factory near Hyderabad. During the process, considerable quantities of liquid wastes are generated as a result of floor washings and cleaning of process vessels. These wastes have a high BOD and colour which are presenting a difficult disposal problem in the surrounding areas.

At the request of the factory authorities, a systematic analyses of the wastes have been made. Laboratory scale experiments on the possibility of anaerobic digestion, followed by aerobic treatment were also carried out.

Based on these studies, a few alternative flow-sheets have been developed with a view to treat these wastes and render these fit for disposal.

4. TREATMENT AND DISPOSAL OF STARCH FACTORY WASTES

M/s. Lakshmi Starch Factory Ltd. have set up a factory in the Nacharam industrial estate area near Hyderabad to manufacture maize starch. During the process, large volumes of putrescible organic wastes would be discharged. The factory is situated in an area where proper disposal facilities are not readily available. Hence, the factory authorities approached the Institute to suggest the most suitable method of treatment under the existing set-up.

Based on the survey carried out and the analysis of the wastes collected from a similar plant in Ahmedabad, a flow-sheet has been developed by the Institute to treat these wastes. The treatment includes anaerobic treatment in deep lagoons followed by aerobic treatment in oxidation pond.

5. NATIONAL INSTITUTE OF NUTRITION, HYDERABAD

On request, the Institute investigated the possibility of disposal of domestic wastes from the additional residential quarters that are likely to be constructed in the near future within the campus of the NIN, Hyderabad. Based on the personal discussions and survey of the existing facilities, a suitable scheme for treatment of domestic and laboratory wastes has been submitted.

6. PILOT PLANT FOR DEFLUORIDATION AT NALGONDA

At the request of the State Government, the Intitute has set up a pilot plant to remove excess F^- from drinking waters which are reported to be present to the extent of about 2.5 mg/l. The plant is designed to treat about 20,000 gpd (out of a total supply of 3.5 lakh gpd) and to reduce the F^- content to about 0.8 mg/l. The cost of the pilot plant has been borne by the State Government. "Defluoron-2" developed by the Institute is being used in these studies.

Regular data on the performance of the plant are being collected to assess the efficiency of this method.

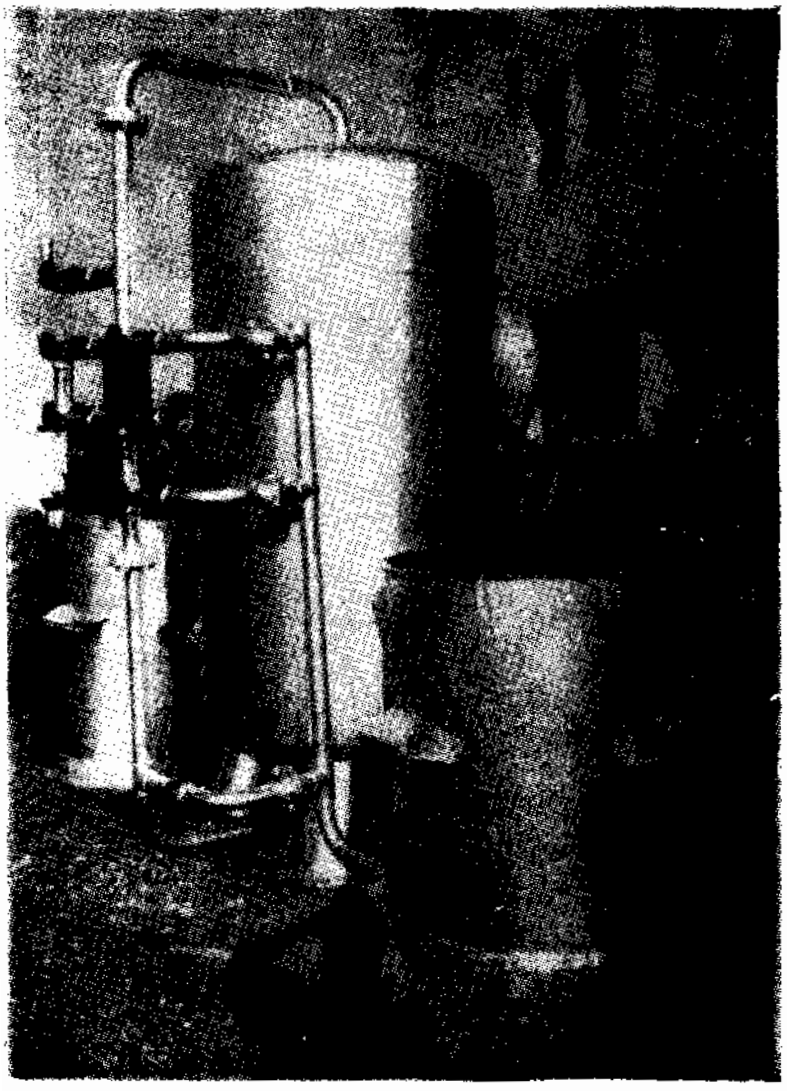
7. PILOT PLANT HIGH RATE SLUDGE DIGESTER

Work on this project was completed during the year. The data are being compiled in the form of a technical report which will be submitted to the Hyderabad Municipal Corporation, who had shared the cost of conducting these investigations on 50-50 basis.

8. PREPARATION OF WATER MAP OF ANDHRA PRADESH

One of the immediate requirements for starting a new industry relates to the quality of raw water available in the vicinity.

With a view to provide this information in advance to the prospective industrialists, work on the collection and compilation of water quality map for the entire State has been initiated. So far, data for nine districts of the State have been collected and recorded with the help of the State authorities.



An Assembly of Pilot Defluoridation Plant

9. AIR POLLUTION SURVEY

One sampling station on the top of the Osmania Medical College building, Sultan Bazar, has been set up to collect air samples from this locality. More sampling stations are proposed to be set up in due course to collect samples from industrialised areas also. The samples are being regularly analysed and data are sent to the Headquarters.

10. CHARACTERISATION OF REFUSE

A few samples of the city refuse collected from the dumping grounds at Amberpeth were collected and analysed.

JAIPUR

1. STUDIES ON EVAPORATION CONTROL

The Institute has carried out evaporation suppression studies in big tanks, but do not have data for smaller tanks of about 1 to 10 acres water spread. The aim of this project is to collect data for smaller tanks which serve as a source of water supply in the desert areas which tend to dry during summer months. The experiments so far carried out by the Institute were done with cetyl alcohol, which is an imported item. It is now proposed to substitute "Noigene 101" for these studies and find out its efficiency and economics.

2. CHAMBAL RIVER SURVEY AT KOTA

At the request of the Chief Engineer, a survey of the Chambal river has been taken up with a view to find out the pollutional load and its effects on the physico-chemical quality of river water at Kota, where a big industrial complex is fast coming up.

So far, 8 sampling stations have been set up on the course of this river and survey has been carried out during the summer and monsoon months.

3. SOLAR DISTILLATION PILOT PLANT

In the Western Rajastnan, the water quality is very poor due to high mineral contents and potable water is transported by trucks and railway wagons, thereby adding to the cost of supply to the consumers. Sometimes the well water is diluted with the tank water which is collected during rainy season. Even then, the total dissolved solids in the water are upto 2000-3000 mg/l. Studies have, therefore, been initiated to develop a suitable design of a solar still with a capacity of 10 gpd (sufficient for a family), which may prove to be more efficient and economical to the existing water supply system in this region.

4. STUDIES ON THE EXISTING WATER TREATMENT PLANT AT LAXMAN DOONGRI

In the year leaches were reported in the Ramgarh lake and size of leaches was so small that they could pass through the filterbeds and were detected in the distribution system. A detailed study is being undertaken to evaluate the different units of the water treatment plant and suggest improvements.

5. TAXONOMY, ECOLOGY AND CULTURAL STUDIES OF SEWAGE FUNGI

Role of algae, bacteria and other micro or macro-organisms (protozoa) in sewage treatment plants is well-known. However, not much information is available on the role of fungi in sewage purification.

Sewage samples from different parts of Jaipur city as well as from the Malviya Regional Engineering College, Jaipur have been collected and analysed for the fungal flora, under different stages of sewage treatment.

So far, 15 to 20 species of fungi have been isolated from the city sewage.

6. AIR POLLUTION SURVEY

Due to dust storms during summer months and added to it the rapid increase in population and urbanisation the air pollution is peculiar. It is, therefore, proposed to collect comprehensive data on the various factors contributing to air pollution load of the city. One sampling station has been set up to collect the necessary information. More sampling stations are proposed to be established so as to cover the industrial areas also.

7. CHARACTERISATION OF REFUSE

The refuse of Jaipur city is dumped at Jamroli, Gopalpura, Hadmora and Bandi Ghat. From the initial samples collected, the per capita contribution appears to be higher than the usual figures in other cities. This may be attributed to lot of sand in the refuse.

KANPUR

1. SURVEY OF WATER WORKS IN UTTAR PRADESH

At the request of the Local Self Govt. Engineering Department, Uttar Pradesh, investigations on certain water treatment plants in Uttar Pradesh were undertaken; with a view to assess their performance and make suitable recommendations for better performance.

In all 10 plants were surveyed scientifically and draft reports have been prepared including the Institute's recommendations.

2. CHARACTERISATION AND TREATABILITY OF CHROME TANNING WASTES

Industrial wastes containing chromium are both toxic as well as difficult to treat by conventional biological means. It is, therefore, imperative that Cr^{+++} ions be removed before subjecting the wastes to either secondary treatment or direct disposal into a nearby sewer or stream.

Studies have been taken up to devise ways and means of removing Cr^{+++} from chrome tanning wastes. Investigations carried out so far indicate that in chrome tanneries, the hyde processing wastes are 20 times that obtained in the chrome tanning section. When these are mixed in this proportion, the resultant waste has almost a neutral pH and helps in the precipitation of Cr^{+++} in the form of $Cr(OH)_3$ thereby reducing the Cr^{+++} concentration in the supernatant to about 95-97 per cent.

Further purification of the supernatant by activated sludge in admixture with domestic sewage is being studied.

3. BIOASSAY STUDIES OF INDUSTRIAL WASTES AND ORGANIC INSECTICIDES WITH FISH

Wide and indiscriminate use of insecticides (both chlorinated hydrocarbons and organic sulphur and phosphorous compounds) has been the cause of mortality both of aquatic vertebrates (particularly commercial fishes) and birds which feed on dead insects killed by the insecticides. Toxicity thresholds are being evaluated even for human beings. The physico-chemical characteristics of waters containing these insecticides greatly influence the degree of toxicity.

In tropical countries like India, where generally temperatures are much higher than in western countries, the toxicities are expected to be of higher degree. The aim of this project, therefore, is to study the TLm values of different commercial fishes to these insecticides. Similarly, the toxicity thresholds of certain industrial wastes containing salts of toxic metals can also be evaluated so that the limits of the concentrations of these salts can be laid down.

Four organic insecticides Malathion, Thiodon, Morocide and Ekatin have so far been tried on **Cyprinus carpio, Labeo rohita, Catla catla, Sirrhana mrigala** and **Puntius sophore.** The median tolerence limits have been studied.

More insecticides are proposed to be tried on similar lines.

4. AIR POLLUTION SURVEY

One sampling station has been fixed up on the roof of about 40 ft high building in the city. Regular samples are being collected and analysed for the various air pollutants. More Sampling stations are proposed to be set up especially in the industrial areas of the town.

5. CHARACTERISATION OF REFUSE

Two samples each have been collected from residential, slum, market and industrial areas and have been analysed.

MADRAS

This Zonal Laboratory was established in September/October 1969 with a view to serve the southern region better. The Laboratory started functioning in the temporary accommodation provided in the Guindy Engineering College but will ultimately shift to its own building which is being constructed alongwith the new CSIR Complex at Madras.

During the short period of 3 months, the Zonal Laboratory has started work on the problem of treatment and disposal of sago wastes prevalent in the Salem district of Tamil Nadu.

OTHER ACTIVITIES

A view of the Symposium

From L to R : Air Vice Marshal H. C. Devian, Dr. K. J. Ives, Shri A. K. Roy, H'ble Justice Vivian Bose (Chief Guest), Prof. S. J. Arceivala and Dr. A. Pasreer.

SYMPOSIA & SEMINARS

SYMPOSIUM ON "LOW COST WASTE TREATMENT"

CPHERI organised symposium on "Low Cost Waste Treatment" during October 27-29, 1969 which highlighted the various available low cost waste treatment methods for the disposal of sewage and industrial wastes. The symposium was well attended by public health engineers within the country as well as from abroad and a cross section of scientists from various disciplines. Delegates from developing countries like Burma, Nigeria, Afganistan, Iran, Ghana, Kenya, U.A.R. and Thailand attended the symposium as special invitees of the World Health Organization. Dr. A. Pasveer, Public Health Engineering Research Institute, Delft, The Netherlands, a pioneer of oxidation ditch treatment and Dr. K. J. Ives of London University attended the symposium on special invitation. The Regional Sanitary Adviser for WHO, New Delhi also attended the symposium on behalf of the World Health Organization.

In all 34 papers were presented during the three days in eight technical sessions covering important aspects such as design principles, construction and operational details and economics of various low cost waste treatment processes. The technical sessions were presided over by Shri A. K. Roy, Chief Engineer, Local Self Government Engineering Department, Uttar Pradesh; Shri T. Durairaj, Dy. Adviser, Ministry of Health; Dr. T. R. Bhaskaran, Chief Technologist, Geo-Miller & Co. (Pvt.) Ltd.; Shri V. K. Paranjapye, Chief Engineer, Maharashtra; Shri D. R. Singal, Chief Engineer, Punjab; Shri M. Miakhan, Chief Engineer, Madras and Prof. S. V. Patwardhan, University of Roorkee, who guided the deliberations. The concluding session was conducted under the Chairmanship of Shri P. Arunachalam, Chief Engineer, Assam.

The deliberations of the symposium provided a useful forum for the discussion and helped scientists and engineers to come on a common platform and exchange ideas on various aspects of low cost waste treatment methods.

SYMPOSIUM ON "WATER TREATMENT PRACTICE"

Organised jointly by CPHERI, the Indian Water Works Association (IWWA) and the Victoria Jubilee Technical Institute (VJTI), a three day symposium was held at VJTI, Bombay during November 2-4, 1969. Nearly 100 delegates attended the symposium. In all eleven papers were presented of which three were presented by Dr. K. J. Ives, Expert in Water Filtration.

SEMINARS

The Institute holds weekly seminars when the Scientists belonging to various research divisions present an account of their latest research activities. These seminars are well attended. At times when Foreign/Indian dignitaries visit the Institute, a special seminar is arranged for the benefit of the staff.

During the year, about 40 such seminars were held.

The Institute also co-sponsored the Seminar on "Water Pollution & Industrial Waste Treatment" organised by the Institution of Engineers (India) at Bangalore, during the year.

TRAINING, INFORMATION, LIBRARY & EXTENSION SERVICES

SHORT COURSES

During 1969, the Institute conducted following three training courses :

Title	Venue	Duration	No. of participants
Water and Waste Water Analysts	Nagpur	August 4 to September 26, 1969	15
Plastic Plumbing	Bombay	Sept. 6 to Sept. 7, 1969	51
Sewage Treatment Plant Operators	Bombay	Nov. 24 to Dec. 6, 1969	15

In addition, the Institute continued to participate in the post graduate teaching programme for M. Tech. (PHE) studies 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.

ENVIRONMENTAL HEALTH

The Unit continued to publish the Institute's quarterly journal "Environmental Health". The number of subscribers to the journal is about 300. The journal is sent to about 80 Educational/Research Institutions/Organisations on exchange basis not only in India but also in many foreign countries.

SPECIAL PUBLICATIONS

The following special publications were brought out during the year :

Draft manual on "Design, Construction and Operation of Waste Stabilization Ponds in India", which has received appreciation from experts in the field all over the World.

How to Conduct Air Pollution Surveys.

Defluoridation.

Annual Report 1966-67 and 1967-68.

The Unit also helped in the compilation of various technical reports, proceedings of symposium and other special publications.

EXTENSION SERVICES

A large number of technical enquiries are received from various Government Departments, Municipalities, Corporations and other private organisations and solutions to their respective problems are offered. The Unit also helped in disseminating the results of research work carried out in the Institute and its various Zonal Laboratories by holding press conferences and publications in the well-known newspapers of the country.

LIBRARY

Besides procurement of books, journals, microfilms, photocopies etc., the Library helps other Institutes/Organisations in building up their library facilities by suggesting basic reference material including books, journals and special reports related to the public health engineering field.

The Library participated in the compilation of 'Union Catalogue' as well as other activities connected with the INSDOC and the National Science Library.

A new project of compiling a "Buyer's Guide" for products and processes useful for water supply and waste water treatment and disposal was undertaken. The publication is intended to serve as a ready guide for all those requiring information on the availability of products and processes in the field.

CONSULTATION CELL

The "know-how" developed by the Institute through its research schemes oriented primarily towards providing economic solutions for water & waste water treatment and disposal, is made available, upon request, to the interested clients such as Government Departments, Municipalities, Corporations, Industries in the Private & Public Sectors and other local bodies, on consultation basis.

Wherever the need may be, laboratory experiments and pilot plant investigations are carried out, after determining characteristics of the water and waste water under question, and suitable flow-sheets alongwith the design specifications are provided to the clients.

Upon request, air pollution surveys of industrial premises and environs and also of the cities are undertaken and suitable recommendations for air pollution control are made.

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

(A) SPONSORED RESEARCH/INVESTIGATIONS

Name of the sponsoring authority	Nature of problem
Chief Engineer, Local Self Government Engineering Department, Lucknow (U.P.)	Survey of water works in Uttar Pradesh
Public Health Engineering Department, Government of Rajasthan, (Jaipur)	Defluoridation of water
Government of Andhra Pradesh	Defluoridation of water at Nalgonda

Name of the sponsoring authority	Nature of problem
Orient Paper Mills, Amlai	Treatment of pulp and paper mill effluents
National News Print and Paper Mills Ltd., Nepanagar	—do—
Gwalior Rayon Silk Mfg. (Wvg.) Co. Ltd., Kozhikode, (Kerala)	Treatment of rayon pulp mill wastes
Durgapur Development Authority, Durgapur	Industrial waste survey
Damodar Valley Corporation	Industrial waste survey
Fertilizer Corporation of India, Bombay	Air pollution survey
Coromandal Fertilizers Ltd., Visakhapatnam	Air pollution survey
Gwalior Rayon Silk Mfg. (Wvg.) Co. Ltd., Movvur (Kerala)	Air pollution survey
National Buildings Organization, New Delhi	Designs of chute for disposal of garbage in multistoreyed buildings

(B) CONSULTATION WORK

Name of Client	Nature of problem
Indian Co-operation Mission, Kathmandu	Water treatment at Rajbiraj, Nepal
Tribeni Tissues Pvt. Ltd., Tribeni, West Bengal	River Survey
Central Training Institute, Hyderabad	Defluoridation of water
Municipal Corporation, Nandigama, Krishna District	Defluoridation of water
Commander Works Engineer, CWE, Shillong, Assam	Iron/manganese removal from water

Name of Client	Nature of problem
Chief Engineer, North Assam Zone, Tezpur, Assam	—do—
Chief Engineer, Maligaon Gauhati, (Assam)	—do—
Indian Institute of Petroleum, Dehradun	Treatment of corrosive waters
M. N. Dastur & Co; Pvt. Ltd; Consulting Engineers, Calcutta	Sewage treatment plant for nuclear complex township, Hyderabad
Secretary, Khandesh Education Society, Amalner, Distt: Jalgaon	Design of oxidation ponds
Director General, Naval Base, Vishakapatnam	Sewerage scheme and sewage treatment
Chief Engineer, Mangalore Project, Mangalore	Design of oxidation ponds
Military Engineer Services, Fort, St. Georges, Madras	Sewage treatment by oxidation pond
National Mineral Development Corporation, Donnimalai	Sewage treatment for township
Superintending Engineer, CPWD, Seminary Hills, Nagpur	Sewage treatment and disposal
Chief of Naval Staff, Naval Headquarters, Delhi	Sewage treatment and disposal from Naval Base, Cochin
Cambay Municipal Committee, Cambay (Gujarat)	Design of oxidation ponds
Fertilizer Corporation of India, Ltd., Gorakhpur	Treatment of fertilizer wastes
Gujarat State Fertilizer Co. Ltd., Baroda	Treatment of fertilizer wastes
Hindustan Organic Chemicals Ltd., Rasayani	Treatment of organic chemical wastes
Cellulose Products of India Ltd., Kathawada :	
i) Maize Products Factory, Kathawada	Effluent treatment

Name of Client	Nature of problem
ii) Straw Board Factory, Ramol	Effluent treatment
Indian Electro-chemicals Ltd., Ahmedabad	Effluent treatment
Laxmi Starch factory Ltd., Hyderabad	Effluent treatment
The Director, Arlabs Ltd., Bhor (Poona)	Treatment of factory effluents
Suhrid Geigy Ltd., Ranoli, (Baroda)	Treatment of factory effluents
Sarabhai Common Services, Wadi-Wadi Baroda	Treatment of chemical wastes
Calico Mills, Jamalpur Gate, Ahmedabad	Treatment of textile mill wastes
Brooke Bond (India) Ltd., Ghatkesar, Hyderabad	Treatment of Instant Coffee wastes
Azamjahi Mills Ltd., Warangal, (A.P.)	i) Reuse of waste water ii) Base exchange water softening Plant
Secretary, Agriculture & Co-operation Department, Government of Maharashtra	Effluent treatment for Bacon Factory, Borivli
Tungabhadra Industries Ltd., Kurnool, (A.P.)	Characterisation of soap & vanaspati factory effluents
Fertilizer Corporation of India Ltd., Barauni	Treatment of fertilizer effluents
Arvind Boards & Paper Products Ltd., Billimora (Gujarat)	Treatment of paper mill effluents
C.M.C. (India), Ltd; Ahmedabad	Effluent treatment
Manager, Nagpur Milk Scheme, Nagpur	Treatment of dairy wastes
Director of Health Services, West Bengal, Calcutta	Disposal of Mycellia wastes from Standard Pharmaceutical Works, Serampore, West Bengal
Secretary, Effluent Board, Kanpur	Treatment & disposal of various industrial effluents
Indian Oil Corporation Ltd; Barauni (Bihar)	Characterisation of phenolic wastes

Name of Client	Nature of problem
Andhra Sugars and Fertilizers Ltd., Kovvur	Effluent treatment
Synthetics & Chemicals Ltd., Bareilly	Characterisation and treatment of synthetic rubber wastes
Security Paper Mills, Hoshangabad	Treatment & disposal of paper mill wastes
Superintending Engineer, CPWD, New Delhi	Treatment and disposal of waste from hydrogen gas generators
Director, Regional Meteorological Centre, Indian Meteorological Department, Nagpur	—do—
Universal Metal Refinery, Goregaon	Air quality survey
Govt. Printing Press, Nagpur	Investigations on lead poisoning
Textile mills from Nagpur, Akola, Pulgaon, and Bombay	Byssinosis studies

Besides, the Institute supplied technical notes and answers to queries from 55 Organisations and public bodies.

COORDINATION CELL

The Cell assists the Director in proper implementation of research schemes by way of coordinating research activities at Zonal Laboratories.

Requirements of the Zonal Laboratories are promptly attended to by this Cell so that the research work being carried out there does not suffer for want of adequate facilities. The Cell also maintains monthly progress reports and keeps the Director informed about the research activities from time to time.

The Cell acts as a link between the Headquarters and Zonal Laboratories of the Institute.

Screw Pump for lifting sludges fabricated in the Institute's workshop

WORKSHOP

The Institute has a well-equipped workshop with facilities for fabrication of pilot plants and special equipment required for research work.

Pilot Plant equipment fabricated and installed by this Division during the year, include :

Oxidation Ditch Rotors	2 Nos.
Aerated Lagoon surface aerator (Fixed type)	1 No.
Aerated Lagoon surface aerator (Floating type)	1 No.
Floating type oxidation ditch rotor	1 No.
Screw Pump.	1 No.
Coagulant Aid Mixer	1 No.

The workshop also fabricates a variety of equipment/apparatus required by the various Research Divisions at the Headquarters.

GLASS BLOWING SECTION

While working on any research project, it is not uncommon in India to face difficulties in procuring some minor items of either equipment or glassware. In order to help the researchers in the Institute as well as different laboratories and engineering colleges in the country, the Institute has started to fabricate important glasswares.

Special mention may be made of the important glasswares which are now fabricated and sold by the Institute at the following prices :

Item	Price (Rs.)
Microelectrophoresis cell (Briggs type)	800/-
Cataphoresis Cell (Northrup Kunitz-type)	775/-
Microelectrophoresis cell (Riddick type)	332/-
Sedgwick Rafter Funnel	155/-
Micro Kjeldahl distillation unit	100/-
Sedgwick Rafter Cell	85/-
Fume Exhaust Manifold	33/-
Air sampling bubbler	16/-
Sintered glass diffuser (cylindrical)	10/-

SPECIAL REPORTS

The Institute brought out the following special reports during the year. These cover, in general, the nature of problem, Institute's work on the particular problem and the emerging conclusions alongwith recommendations :

Air Pollution in Chembur-Trombay area in the vicinity of Fertilizer Corporation of India, Trombay Unit, Bombay.

An Investigation into the Environmental Exposure to lead in a printing press.

Investigations on the Disposal of Garbage from Multi-storeyed Buildings.

Disinfection Techniques for small Community Water Supplies.

Report on Damodar Valley Survey of Industrial Wastes and Water Pollution (Two Volumes). Part I: Durgapur Region Part II: Asansol Region.

Report on the treatment of wastes from ARLABS Factory Ltd., near Poona.

Preliminary Report on treatment and disposal of effluents from Gujarat State Fertilizer Co. Ltd., Baroda.

Preliminary Report on Treatment and Disposal of Effluents from the Fertilizer Corporation of India Ltd., Namrup, Assam.

Survey of the Waste Treatment Facility and Proposal of Phenol Waste Treatment for Oil Refinery, Barauni.

Preliminary Report on the Effluent Disposal from Tribeni Tissues Pvt. Ltd., Tribeni, West Bengal.

Report on the Treatment and Disposal of Domestic and Laboratory Wastes from National Institute of Nutrition, Hyderabad.

Preliminary Report on the Waste Disposal Problem of Andhra Sugars & Fertilizers Ltd., Kovvur, (AP).

Water Treatment Plant at Indian Institute of Petroleum, Dehra-Dun.

Septicity Correction for Sholapur Sewage Treatment Plant.

Preliminary Report on the Treatment of Fertilizer effluents from Fertilizer Corporation of India, Ltd., Barauni, (Bihar).

Report on Effluent Treatment from M/s Arvind Boards and Paper Products Ltd., Billimora.

Report on the investigations carried out at the Gwalior Rayon Silk Mfg., Co., Ltd., Movvur (Kerala).

Report on Base Exchange Water Softening Plant at Azamjahi Mills Ltd., Warangal, (AP).

Report on the Reuse of Waste Waters at Azamjahi Mills Ltd., Warangal, (AP).

Sewage Disposal Scheme for Residential Quarters of CPWD at Seminary Hills, Nagpur.

Report on Treatment of Milk Processing Plant Wastes at Nagpur.

Report on the Treatment of Domestic Sewage at Naval Base, Visakhapatnam.

Report on the Treatment of Hydrogen Gas Plant Effluents from Indian Meteorological Department, Nagpur.

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R. P. Mishra, N. M. Parhad, and N. U. Rao, "Bacteriological Standards and Water Quality" Environmental Health, 11 (2), 146-163 (1969).

P. M. Phirke, R. Balasubrahanyam, and S. R. Verma, "Studies on the quality of Hand-pump Water in Delhi" Environmental Health, 11 (4), 323-334 (1969).

S. R. Alagarsamy and (Ku.) S. W. Shende, "Performance Study of an Aerated Lagoon Pilot Plant at CPHERI, Nagpur" Presented at the Symposium on 'Low Cost Waste Treatment' CPHERI, Nagpur, October 27-29, (1969).

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Harishchandra and K. L. Saxena, "Anaerobic Digestion of Cheese Waste" Environmental Health, 11 (1), 41-53, (1969).

T. S. Bhakuni, (Ku.) S. Saroja and K. R. Bulusu, "A modified method for estimation of aluminium in presence of Fluoride" Environmental Health, 11 (3), 270 (1969).

S. N. Dixit and S. B. Dabadghao, "Aluminium interference in Fluoride estimation by Eriochrome Cyanine R-Method" Environmental Health, 11 (3), 248-269 (1969).

V. R. Bhave, "Simply Constructed Aeration Device Working Without Power" Laboratory Practice, 654, June (1969).

B. K. Handa, P. V. R. Subrahmanyam & G. J. Mohanrao, "Preliminary Studies on Performance of Oxidation Ditch at Nagpur" Presented at the Symposium on 'Low Cost Waste Treatment', CPHERI, Nagpur October 27-29, (1969).

K. P. Krishnamoorthi, "Industrial Waste Pollution & Fisheries" Presented at the First Symposium on Industrial Wastes, IIT, Kanpur, February, 14-16, (1969).

K. P. Krishnamoorthi, "Succession of ciliates in a Puddle at Nagpur" Paper included in the Progress in Protozoology, III, International Protozoology Congress, Leningrad, USSR, 197-198 (1969).

S. R. Joshi, N. M. Parhad & N. U. Rao, "Estimation of Salmonella in Oxidation Ponds" Presented at the Symposium on 'Low Cost Waste Treatment', CPHERI, Nagpur, October 27-29, (1969).

Abhakumari, M. K. Abdulappa and J. S. S. Lakshminarayana "Nematodes in Water Supplies" Jour, IWWA, 1, 3, 133-142 (1969).

M. S. Olaniya K. L. Saxena, N. Dutta & R. K. Bhargava, "Well Water Quality in Jaipur City" Environmental Health, 11 (4), 378-391 (1969).

A. K. Basu, "A Note on the preliminary studies of industrial pollution in and around the Damodar River Basin between Bokharo and Panchet Hill Dam" VIZYGYI KOZKEMENYEK—a Hungarian Journal of Hydraulic Engineering, January, (1969).

A. K. Basu, "Design of a New Water Sampler" La tribune du CEBEDEAU, Belgium, 22, 306, May (1969).

A. K. Basu, "Probablems d'eaux residuaires industrielles dans la zone du Hooghly Estuary (Inde), notamment des fabriques de pate a papier et d' huile vegetale hydrogenee", La tribune du CEBEDEAU, Belgium, 22, 309, 452-456, August, (1969).

P. Kumaran & K. L. Saxena, "Some Research Activities of CPHERI", Souvenir, 49th Annual Convention of Institution of Engineers, Jaipur, p. 103, (1969).

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K. L. Saxena, M. S. Olaniya and R. S. Nagabhushan, "An industrial waste survey report of Ball Bearing Factory" Presented at the First Symposium on Industrial Wastes, IIT, Kanpur, February 14-16, (1969).

R. N. Chakrabarty, A. Q. Khan, K. L. Saxena and S. N. Chattopadhya, "Studies on Raw Water Quality and Performance of Kanpur Water Works", Presented at the 1st Annual Convention of IWWA, Bombay, January 19-21, (1969).

S. G. Bhat, "Better Library Service for the Scientists", Nagpur Times, The Hitavada, 26th March, 1969.

A. Neelameghan & S. G. Bhat, "Choice of a classification Model in the design of a scheme for classification—A case study", 6th Seminar, Documentation Research & Training Centre, Bangalore, (1969).

M. N. Rao & C. A. Sastry, "Studies on the nature of clays & clay minerals affecting coagulation of turbid waters" Jour. Institution of Engineers, 49, 10, Pt. PH3, 141 (1969).

M. N. Rao & C. A. Sastry, "A Study of Coagulant Aids" Jour. Indian Engineer, 10, 120 (April 1969).

PATENTS

The Institute has filed the following patents so far:

PATENT SEALED

108437	A Process for the manufacture of medium for removal of fluoride from drinking water.

PATENTS ACCEPTED

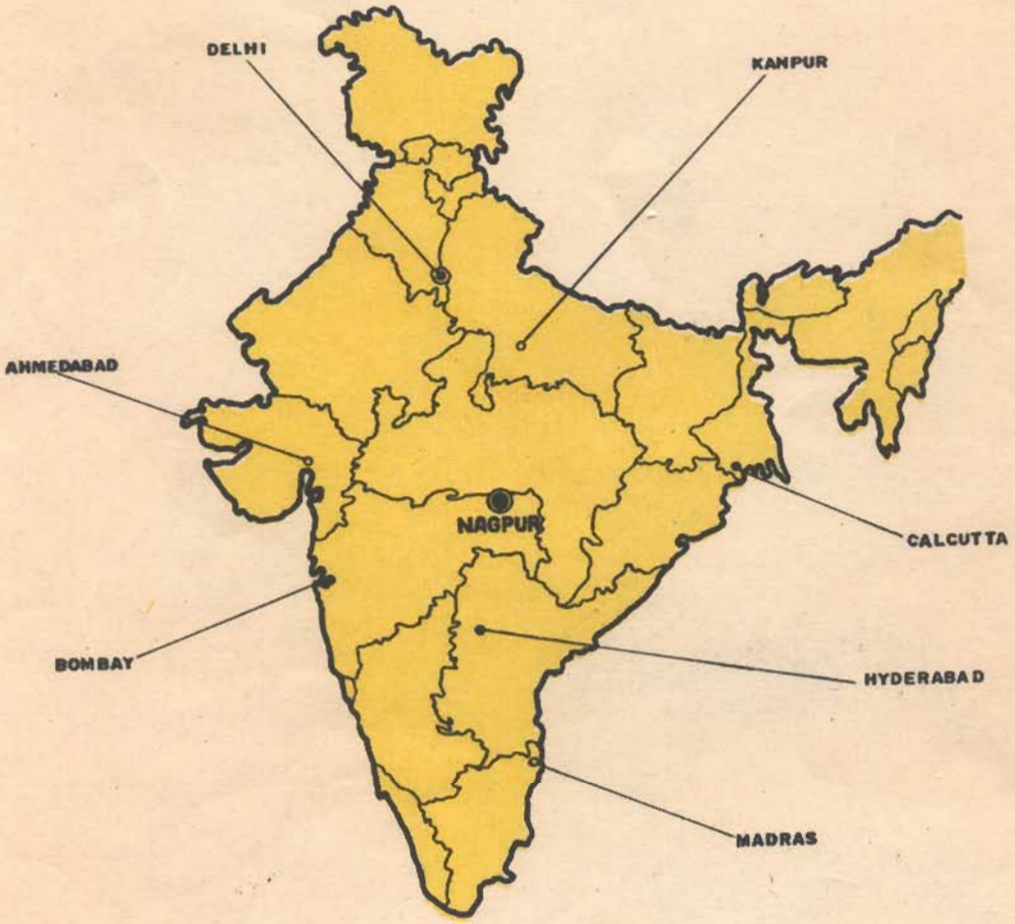
115574	Coagulant Aid CA-3.
116997	Iodine Tablets.
116648	Chlorine Tablets.
107912	Refrigerated vessels for maintaining biological tissues and cultures for minimum of 24 hours & maximum upto 48 hours period for continental & intercontinental despatches.

PATENTS FILED

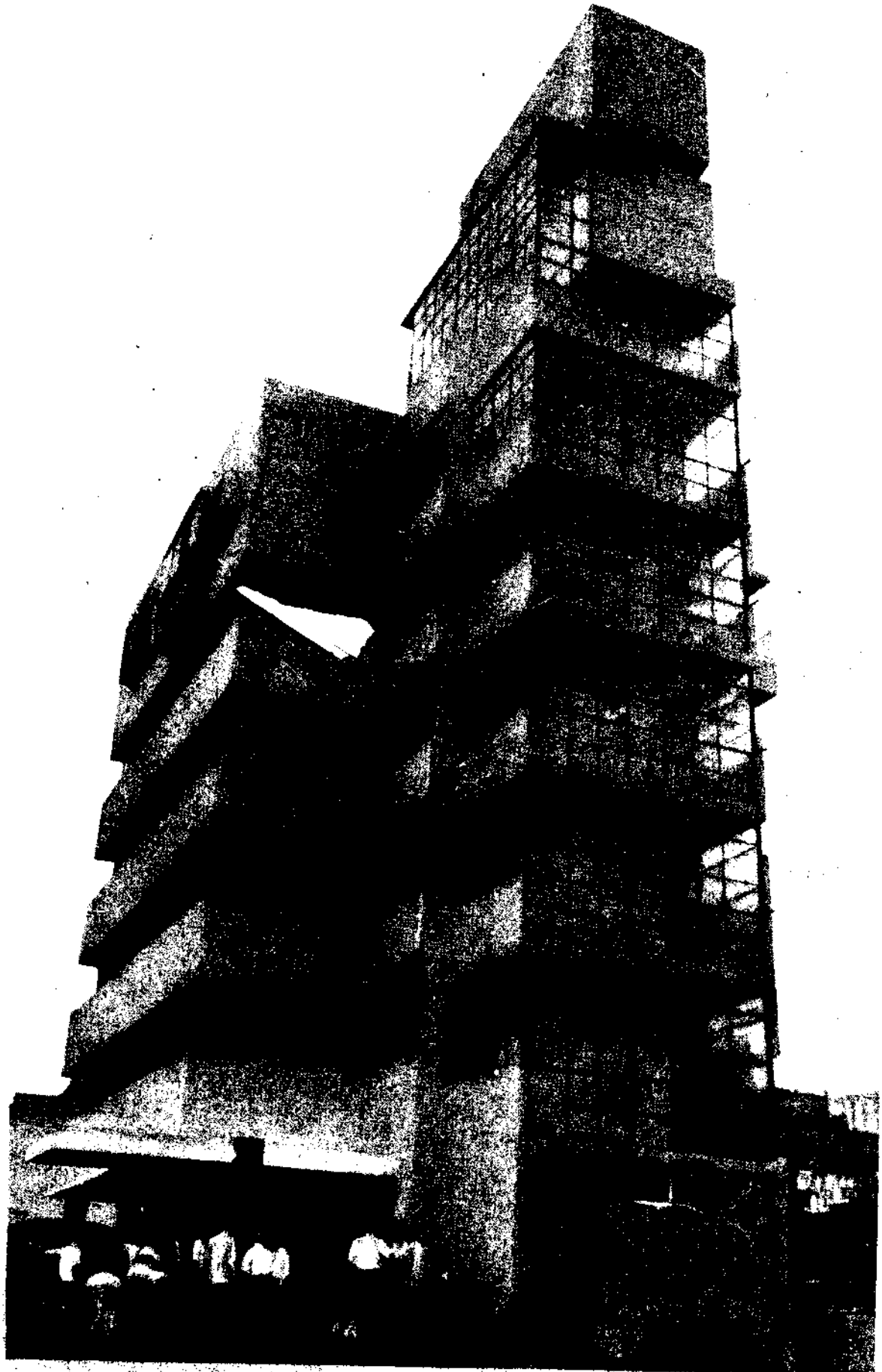
116953	Coagulant Aid CA-4
116996	Coagulant Aid CA-5.
117025	Coagulant Aid CA-7.
118995	Defluoron-2.
122997	An apparatus for recording Wind Direction.
123577	Synthetic polyanionic coagulant aid CA-11.

PATENTS APPLIED

123209	Filter Aid FA-1.
123644	Filter Aid FA-2.



The Institute serves the Nation through Nagpur & Zonal Laboratories.



Bombay Zonal Centre

BUDGET

ACTUAL EXPENDITURE

(Rs. in lakhs)

	1968-69	1969-70
RECURRING	29.945	30.620
CAPITAL	6.080	4.981
PILOT PLANTS	1.393	2.161
TOTAL	37.418	37.762

PILOT PLANTS

The following pilot plants were in operation during the year.

Water Filtration Plants	(Bombay)
Aerated Lagoons	(Nagpur)
Oxidation Ditch (with settling tank and Archimedean screw pump)	(Nagpur)
Effluent Farm Irrigation	(Nagpur)
High Rate Sludge Digester	(Hyderabad)
Mechanical Composting Plant	(Nagpur)

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	CEDC
Plastic Pipes Sub-Committee	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
Drainage Sub-Committee	BDC 24:2

OTHER ORGANISATIONS

Expert Member, Committee on Community Water Supplies. World Health Organisation, Geneva.

Panel Member, UNESCO, Paris.

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

Member of the Governing Body of the Laxminarayana Institute of Technology, Nagpur.

Sanitary Collection & Disposal of Nightsoil, Ministry of Health (Model Design for Suitable Receptacles, Handcarts and other Mechanical devices for Sanitary Collection and Disposal of Nightsoil).

Member, Environmental Hygiene and Sanitation Expert Committee, Indian Council of Medical Research, New Delhi.

SHRI J. M. DAVE, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Sanitary Installation Sub-Committee	BDC 24:3
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	BDC 24/P3 (Convener)
Soil and 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 the Expert Panel on Air Pollution Control, WHO (1968-1972)

Panel for Post Graduate Studies in Public Health Engineering, Nagpur University, Nagpur.

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

DR. G. J. MOHANRAO, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Industrial Wastes Sub-Committee	CDC 26:1
Panel for Food and Fermentation Industry Wastes.	CDC 26:1:2 (Convener)
Panel for Chemical and Allied Industry Wastes	CDC 26:1:6

OTHER ORGANISATIONS

Technical Committee on the Effluents Treatment of the Synthetic Drugs Project of M/s Indian Drugs and Pharmaceuticals Ltd.

Chaliyar River Pollution Committee set up for Kerala State Government.

Ad-hoc Committee on the Water Pollution Control for Sone River set up by Govt. of Madhya Pradesh.

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

DR. N. U. RAO, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Disinfectants Sub-Committee	CDC 23:1
Panel for River Water & Waste Water	CDC 26:1:11
Plastic Pipes Sub-Committee	BDC 3.8 (Alternate)

DR. G. K. SETH, SCIENTIST

OTHER ORGANISATIONS

Scientific Advisory Board of State Medical Research Council of Andhra Pradesh.

State Compost & Local Manurial Resources Development Committee, Andhra Pradesh.

SHRI K. R. BULUSU, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Water for Industrial Purposes Sub-Committee	CDC 26.2

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

SHRI R. N. CHAKRABARTY, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Panel for Tanning Industry Wastes.	CDC 26:1:4 (Convener)

OTHER ORGANISATIONS

Member of the Technical Sub-Committee on Water Pollution Control Programme, Damodar Valley Corporation, Calcutta.

Member of the Science & Technology Society, Defence Research Laboratory, Kanpur.

DR. A. K. ANWIKAR, SCIENTIST

OTHER ORGANISATIONS

Rural Sanitation Committee, Kasturba Hospital, Sewagram.

Advising Agency to Zilla Parishad, Wardha.

DR. J. S. S. LAKSHMINARAYANA, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Water Sectional Sub-Committee for Cooling system	CDC 26:P1

DR. P. V. R. SUBRAHMANYAM, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Panel for Food and Fermentation Industry Wastes	CDC 26:1:2 (Alternate)

SHRI S. RAJAGOPALAN, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Paper & Allied Industrial Wastes Water Analysis	CDC 26:1:3 (Alternate)

OTHER ORGANISATIONS

Expert Committee to enquire into Alleged Pollution of Water of River Mahi in Baroda.

SHRI S. R. KSHIRSAGAR, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Domestic and Municipal Water Fittings Sub-Committee	BDC 3:2
Water Treatment Equipment Panel	BDC 40/P1 (Alternate)

DR. K. P. KRISHNAMOORTHI, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Panel for Microbiological Methods of Water Analysis	CDC 26:P2 (Alternate)

SHRI R. P. MISHRA, SCIENTIST

ISI COMMITTEE/SUB-COMMITTEE/PANEL

Panel for Microbiological Methods of test for water.	CDC 26:P2

SHRI P. B. RAO, 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 Tubes Sub-Committee	BDC 3:8 (Alternate)
Sanitary Installations Sub-Committee	BDC 24:3
Soil & Waste Pipes above Ground Sub-Committee	BDC 24:4 (Alternate)

DEPUTATIONS, HONOURS & AWARDS

* The Director General, World Health Organization, Geneva (Switzerland), in consultation with the Government of India, has designated CPHERI as WHO Regional Reference Centre on Air Pollution for a period of five years effective January 1969.

* Prof. S. J. Arceivala, Director, CPHERI, attended, on deputation, the 8th International Water Supply Congress of the International Water Supply Association, London, held at Vienna during 1-6 September, 1969 and acted on invitation, as Chairman for one of the Sessions. CPHERI is a Member on the Scientific & Technical Board of the Association.

* Shri J. M. Dave, Scientist, attended the meeting of Directors of the International Reference Centres and Collaborating Laboratories of World Health Organization on Air Pollution, held at Geneva during 6-13 October, 1969. Shri Dave represented CPHERI which is a WHO Regional Reference Centre on Air Pollution.

* Shri J. M. Dave, Scientist was awarded WHO Fellowship for a period of six months from September, 1968.

* Dr. A. K. Basu, Scientist has been awarded D.Sc. Degree in Applied Sciences by the University of Liege, Belgium. While on deputation at the University of Liege, Belgium, Dr. Basu also attended XXII International Water Congress, held at Liege, Belgium in May, 1969 and presented a paper at the Congress.

* Shri J. S. Gadgil, Scientist has been deputed to Japan for training in the field of Bio-Chemistry & Microbiology as applied to Industrial Waste Treatment for a period of one year from October 1969, under the Colombo Plan.

* Shri M. Parabrahmam, Scientist, has been deputed to Czechoslovakia for training in the field of recent techniques and development of waste water treatment etc. for a period of one year from November 1969 under the Exchange Programme of Scientific Cooperation between CSIR and the Czechoslovakia Academy of Sciences.

* Shri R. S. Dhaneshwar, Scientist has been deputed to Czechoslovakia for training in the field of Bio-Chemistry and Sanitary Microbiology for one year with effect from October 1969 under the Exchange Programme of Scientific Cooperation between the CSIR and the Czechoslovakia Academy of Sciences.

* Dr. C. A. Sastry, Scientist shared the Nawab Zain Yar Jung Bahadur Memorial Gold Medal with Shri M. N. Rao, Assistant Professor of Civil Engineering, Regional Engineering College, Durgapur. The medal was awarded for their joint paper "Effect of Polyphosphates on Coagulation of Turbid Waters by Alum" published in the Institution of Engineers Journal, Vol. 48, No. 6 Pt. PH2, p. 115 February, 1968.

* Shri S. G. Bhat, Scientist was awarded Associateship of the Institute of Information Scientists, London.

STAFF

DIRECTOR

PROF. S. J. ARCEIVALA

HEADQUARTERS

WATER TREATMENT

Shri K. R. Bulusu, Scientist-in-Charge

Shri B. N. Pathak, Scientist

Shri V. P. Thergaonkar, Scientist

Shri P. N. Dadina, S.S.A. (resigned)

Shri D. N. Kulkarni, J.S.A.

Shri R. C Dixit, J.S.A.

SEWAGE TREATMENT

Dr. J. S. S. Lakshminarayana, Scientist-in-Charge

Shri R. P. Mishra, Scientist

Dr. K. P. Krishnamoorthi, Scientist

Shri M. Parabrahmam, Scientist (On deputation to Czechoslovakia)

Dr. G. B. Shende, Scientist

Miss Rekha Mitra, S.S.A.

Shri A. N. Khan, S.S.A.

Shri C K. Kale, J.S.A.

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

Miss K. W. Choudhari, J.S.A.

Shri M. K. Abdulappa J.S.A.

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

Shri B. N. Phadnavis, J.S.A.

INDUSTRIAL WASTES TREATMENT

Dr. G. J. Mohanrao, Scientist-in-Charge
Dr. P. V. R. Subrahmanyam, Scientist
Shri M. V. Srinivasan, Scientist
Shri J. S. Gadgil, Scientist (On deputation to Japan)
Shri S. S. Mudri, Scientist
Shri S. B. Deshmukh, S.S.A.
Shri K. Rajagopala Kini, J.S.A. (resigned)
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Mrs. S. Satyanarayana, J.S.A.

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Shri C. V. Sabnis, Scientist
Shri P. K. Yennawar, Scientist
Shri H. B. Singh, Scientist
Shri V. L. Pampattiwar, S.S.A.
Miss J. M. Deshpande, S.S.A.
Shri V. I. Pandit, J.S.A.

MICROBIOLOGY (including VIROLOGY)

Dr. N. U. Rao, Scientist-in-Charge
Dr. V. Chalapati Rao, Scientist
Shri N. M. Parhad, Scientist
Dr. S. H. Godbole, Scientist (resigned)
Shri M. D. Patil, Scientist
Shri P. V. R. C. Panicker, Scientist
Shri K. Subba Rao, J.S.A.
Shri S. R. Joshi, J.S.A. (On study leave)
Miss U. B. Karmalkar, J.S.A.
Shri S. B. Lakhe, J.S.A.
Shri S. I. Elyas, J.S.A.

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Miss N. S. Joshi, J.S.A.

ENGINEERING (DISTRIBUTION & DRAINAGE)

Shri P. B. Rao, Scientist-in-Charge

Shri A. W. Deshpande, Scientist

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

Shri S. B. Dabadghao, Scientist

Shri V. R. Bhave, Scientist

Shri V. R. Apte, Scientist

TRAINING, INFORMATION, LIBRARY & EXTENSION SERVICES

Dr. J. S. S. Lakshminarayana, Scientist-in-Charge

Shri R. K. Saraf, Scientist

Shri I. P. Bahri, Scientist, (resigned)

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.

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Shri S. R. Alagarsamy, Scientist
Shri R. S. Nagabhushana, J.S.A.

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Shri D. Raguraman, Scientist-in-Charge

WORKSHOP

Shri S. B. Dabadghao, Scientist-in-Charge
Shri C. Vedantiah, Scientist
Shri H. J. Patil, Scientist
Shri P. Y. Khanapurkar, S.M.A.
Shri G. T. Kale, S.M.A.
Shri A P. Netke, J.M.A. (resigned)

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. Jayangouder, Scientist
Shri V. Kothandaraman, S.S.A.
Shri S. G. Shaikh, J.S.A.
Shri Harish Chandra, J.S.A.

BHOPAL

Shri P. M. Phirke, Scientist-in-Charge
Shri K. M. Aboo, J.S.A.

BOMBAY

Shri S. R. Kshirsagar, Scientist-in-Charge
Shri Y. S. Murty, Scientist
Shri R. K. Pandit, Scientist
Shri S. K. Gadkari, Scientist
Shri N. S. Phadke, Scientist
Shri A. L. Kulkarni, J.S.A.
Shri S. V. Deshpande, J.S.A.

CALCUTTA

Shri R. C. Trivedi, Scientist-in-Charge
Shri R. N. Chakrabarty, Scientist (resigned)
Dr. A. K. Basu, Scientist (On special leave to Belgium)
Shri R. S. Dhaneshwar, Scientist (On deputation to Czechoslovakia)
Shri C. S. G. Rao, Scientist
Shri A. Q. Khan, S.S.A.
Mrs. D. Roy, J.S.A.

DELHI

Shri J. M. Tuli, Scientist-in-Charge
Shri J. S. Jain, Scientist (On study leave)
Shri N. Dutta, Scientist
Shri A. K. Seth, Scientist
Shri S. K. Srivastava, Scientist
Shri L. N. Sharma, S.S.A.
Shri N. K. Kaushik, S.S.A. (resigned)

HYDERABAD

Dr. G. K. Seth, Scientist-in-Charge
Shri D. Seethapati Rao, Scientist (On deputation to I.D.P.L. Hyderabad)
Shri I. P. S. Prasada Rao, Scientist
Shri K. Srinivasan, J.S.A.
Shri L. Shantikumar, J.S.A.