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RESTRICTED JANUARY 1989

17439

POLLUTION CONTROL RESEARCH INSTITUTE

DP/IND/83/008/11-08

Republic of India

Expert Report*

Prepared for the Government of India
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Peter J. Reynolds
Expert in Water Supply Planning
in Hardwar and New Delhi, India

Backstopping Officer: R.O. Willliams, Chemical Industries Branch
United Nations Industrial Development Organization
Vienna

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POLLUTION CONTROL RESEARCH INSTITUTE

DP/IND/83/008/11-08

Water Distribution Planning and Environmental Impact Assessment

Specific action items contained in the mission work plan were dealt with and summarized in the following:

1. Provide information pertaining to different systems of water distribution for an industrial complex.

Action:

Diagrams and outline sketches were distributed to staff members for various industrial plant layouts and discussed in detail with individuals. A regional water use and demand balance model was presented to demonstrate optimum plant site location. A state-of-the-art plant layout for a thermal power generating plant was presented as one of the case examples. Refer to Annex 'C'.

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2. **Work related to designing of water distribution systems, collection, transport and distribution for an industrial complex.**

   Action: Through the use of case examples, and diagrams, the design aspects and operating characteristics of various industries were discussed in detail. Industries discussed, included cane-sugar mill, cement, fertilizers, petro-chemical, paper/textile, and chemical plants including pharmaceuticals. Refer to Annex 'D'.

3. **Work related to designing of sewage collection and transport facilities for an industrial complex.**

   Action: Specific case examples were used to describe the alternative ways of designing sewage collector systems based on operating specifications and characteristics of different industries, and different size plants. Certain advantages and disadvantages of the systems were highlighted. Organizational aspects of pollution monitoring and control systems were also outlined and discussed. Refer to Annex 'E'.

4. **Review of technical papers presented during the International (E.I.A.) Conference taking place in New Delhi.**

   Action: Several papers for presentation at the conference were reviewed and discussed with local PCRI authors.

5. **The expert will return to New Delhi November 23 and assist with the organization of the E.I.A. Conference until December 2.**

   Action: Undertook the charmanship of two technical sessions and acted as rapporteur in two other sessions. Prepared and presented invited key paper at one of the technical sessions.

6. **Assist and guide PCRI staff in designing of rising main, pumping station, reservoir capacity for a typical water distribution system.**

   Action: Provided diagrams, guidelines and discussion of design parameters to meet certain operating requirements, and specifications for various physical conditions. Refer to Annex 'F'.

7. **(Recomend) Training Program for PCRI technical staff.**

   Action: The least cost-effective solution would be to use a Dutch consulting company* located in New Delhi currently providing E.I.A. training to the Indian Department of Natural

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Resources over the next two years. They would provide training on-site at Hardwar. To use other country organizations, such as the University of Aberdeen, Scotland, U.K. would be less effective and far more costly. Refer to Annex 'G'.

* Dr. J.L. Gortworst, Director, Geoplan, Indo-Dutch Training Programme Environmental Impact Assessment, G6, 6th Floor, Hansalaya Building, Barakhamba Road, New Delhi - 110001 Telephone: 3318426, TELEX: 031-4468 Hask IN, FAX: 011-3313631

8. Recommendations for PCRI Financial Budget/Staffing

a) FINANCIAL

Actual vs Estimated budgetary expenditures were to be provided to Dr. Biswas in December. In late October the Government of Indian cost share had reached 60% of the Rs 21.2 million, likewise the UNDP share was rapidly passing 60% of the US $2.851 million. To provide continuity to the PCRI programme, the essential step necessary to protect the past investment, would be to extend the program to December 31, 1989. To realize the full potential of the PCRI effort, and to have sufficient time to recoup a return on the investment it is recommended that the programme be extended a full three years from April 1989 to April 1992. As the majority of the expensive capital items have been purchased, a rough estimate of expenditure forecast would be 50% of current amount rates for 89/90, 90/91, and 30% for 91/92.

b) STAFFING

Based on the initial projection of 120, and the current staffing of 50, comprising approximately 22 professional and technical staff, and the balance made up of 28 clerical and administrative. A cursory examination of existing and more immediate potential work, the following three year estimates are provided, subject to errors and omissions.

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E.I.A.'s/year	1	5	10	25+
Budget Year	88-89	89-90	90-91	91-92
Type of Staff				
Specialists eg. Chemists/ Engineers	6	24	30	25
Technicians/ Other	16	40	35	35
Sub-Total	22	64	65	60
Clerical/ Admin.	28	56	60	50
TOTAL	50	120	125	110

The above table assumes the ability of the organization to handle an increasing number of E.I.A.'s and complimentary or additional research tasks as experience and efficiency increases.

CONCLUDING REMARKS

1. Some problems have existed since the inception of PCRI which has resulted in idle expensive test equipment.

   Recommendation: The equipment should be calibrated as quickly as possible as it delays many possible applications and experiments for determining possible effects and impacts of various pollutants. This also means fully documented test procedures for laboratory experiments should be readily available.

2. There is some obvious potential for substantial work to be carried out now that much of the equipment is in place or virtually set-up for use.

3. A cursory look at water and air monthly lab reports can determine a steady increase in productivity, but with a large potential for greater productivity as test samples are received in larger numbers. In terms of organizational improvements, necessary increase in supervision, and as key scientific positions are filled it is evident that the institute is heading in the right direction. It has identified key areas of research with some research results emerging. However, there is some gaps between the institutional concept, the pilot stage phase and the actual

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implementation of full scale results, and, finally, marketing of the potential results. The institute has some bright young people who have the right background of training, and a sufficient level of enthusiasm to carry through with a successful research program, and range of services to interest clients in PCRI.

Recommendation: Provide the necessary funding to continue the PCRI programme until 1991-92, and advertize research findings in the form of brochures to potential clients. The recently published PCRI overview brochure is a good start in giving PCRI some visibility and advertizing its services. Productivity and results should be measured and reported to management by December 1989 to analyze PCRI progress. This report could be in the form of a brochure.

4. The organization of the International E.I.A. Conference, under the Chairmanship of Mr. S.B.C. Agarwala, was excellent. It was amply demonstrated in the quality of presentations and the full range of topics covered resulting in very interesting discussions. It provided a good opportunity for BHEL and PCRI staff to publicize their activities. The more than 250 participants, from over 25 countries, were also exthusiastic with the conference results.

Recommendation: Consider symposium or workshops for 1990 update and review of future PCRI plans and ongoing programme.

5. With the existing nucleus of about 22 professional, including Laboratory Technicians, there is some potential for increased expansion of work activity. There are many possibilities, for example, both air and water labs could increase their work in air and water quality monitoring, waste samples, and evaluative reporting.

It should be worth checking out to what extent the institute can get involved with projects from the Ganges river major program of water clean-up.

Recommendation: Have PCRI discuss with the Ganga River Authority on how PCRI can become involved in the Ganga Project.

6. In response to the author's request for written problem questions, more than 70 (seventy) questions were received. Some of these questions were dealt with, in some degree, during the course of the lectures. However, a number of reports, manuals and papers dealing with the subject matter will be shipped to Mr. Agarwala for distribution to the staff of PCRI. Refer to Annex 'H'.

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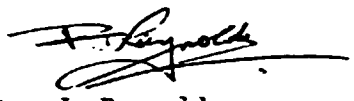
I would like to thank Mr. Agarvala and his staff for their cooperation and individual courtesies, as well as, Mr. Sat Pal at UNDP-New Delhi for his very kind assistance.

Yours sincerely,



Peter J. Reynolds

Annex 'A'

Work Plan for Expert on Water Distribution
(Amended)

Dr. P.J. Reynolds

Nov-Dec'88 (4 weeks)

1. Provide information pertaining to different systems of water distribution for an industrial complex.

2. Work related to designing of water distribution Systems - collection, transport and distribution for an industrial complex.

3. Work related to designing of sewage collection, and transport facilities for an industrial complex.

4. Review of technical papers presented during the International Conference.

5. Assist and guide PCRI staff in designing of rising main, pumping station, and reservoir capacity for a typical water distribution system.

Persons to be attached from water group

1. Mr. P.K. Behera, Engineer Trainee
2. Mr. Rajiv Maheshwari, Engineer
3. Dr. N.C. Trehan, Dy. Manager
4. Dr. (Mrs.) Ramani, Jr. Executive

Annex 'B'

Following is the schedule of lectures/tables, discussions with UNIDO expert P.J. Reynolds.

S.N.	Date	Subject/Title
1	14-11-88	Introduction, Visit to laboratories and discussion on bentonite project. Preparation of Abstract and discussion.
2	15-11-88 (FN)	Overview of E.I.A. and case studies.
	(AN)	Discussion.
3	16-11-88 (FN)	Modelling of River Systems with case studies and planning of River Pollution Studies.
	(AN)	Discussion.
4	17-11-88 (FN)	Water Quality Management with case examples.
	(AN)	Discussion.
5	18-11-88 (FN)	Management Framework for E.I.A. - Legislation and Institutional.
	(AN)	Discussion.
6	19-11-88 (FN)	Methodologies of E.I.A. (Part I).
	(AN)	Discussion.
7	20-11-88	Sunday
8	21-11-88 (FN)	E.I.A. methodologies (Part II).
	(AN)	Discussion.
9	22-11-88 (FN)	Tertiary Treatment systems, and Air Pollution Management.
		Discussion.

SASKMONT ENGINEERING

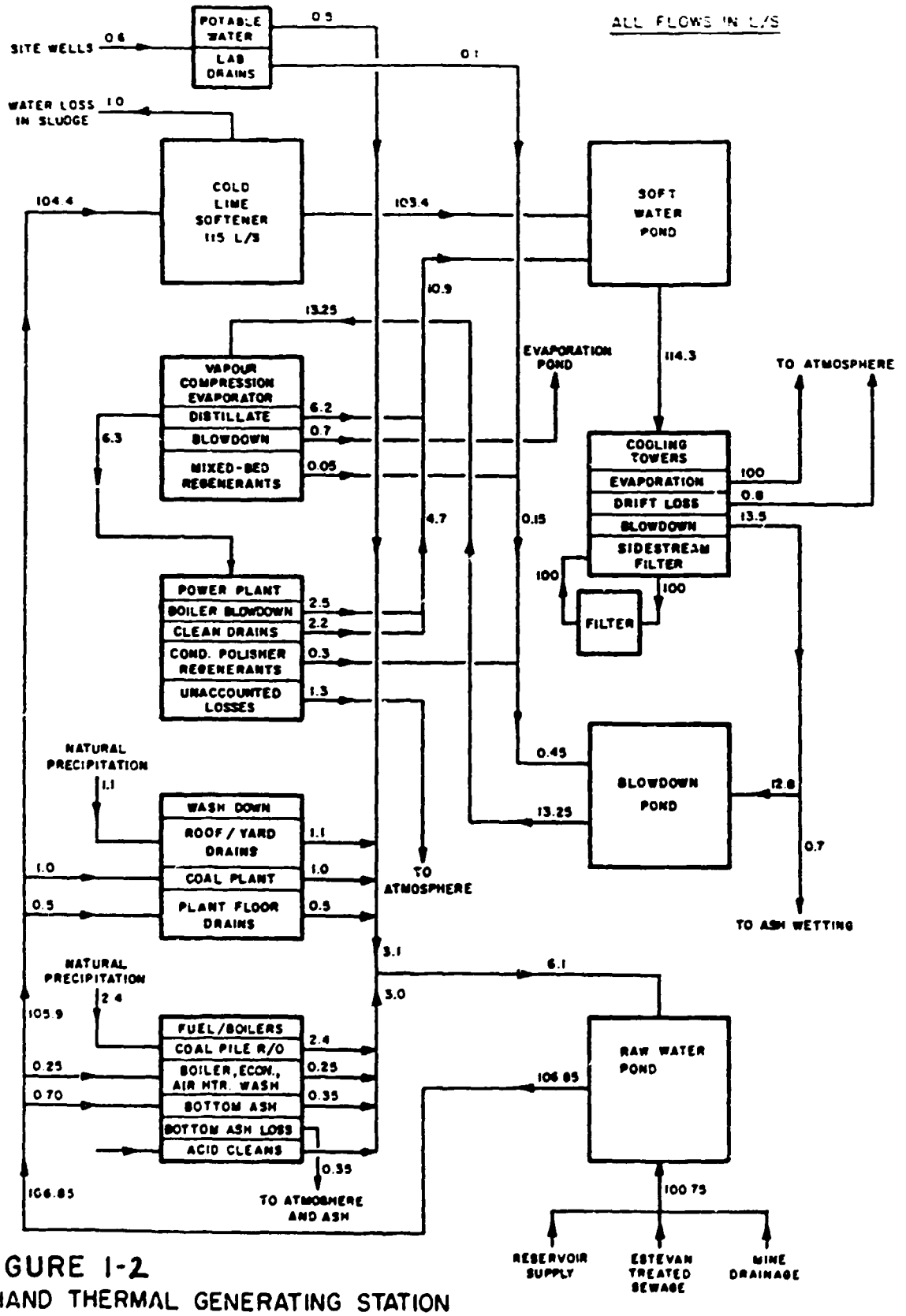


FIGURE 1-2
SHAND THERMAL GENERATING STATION
WASTE MANAGEMENT AND COOLING WATER SYSTEM
FLOW DIAGRAM

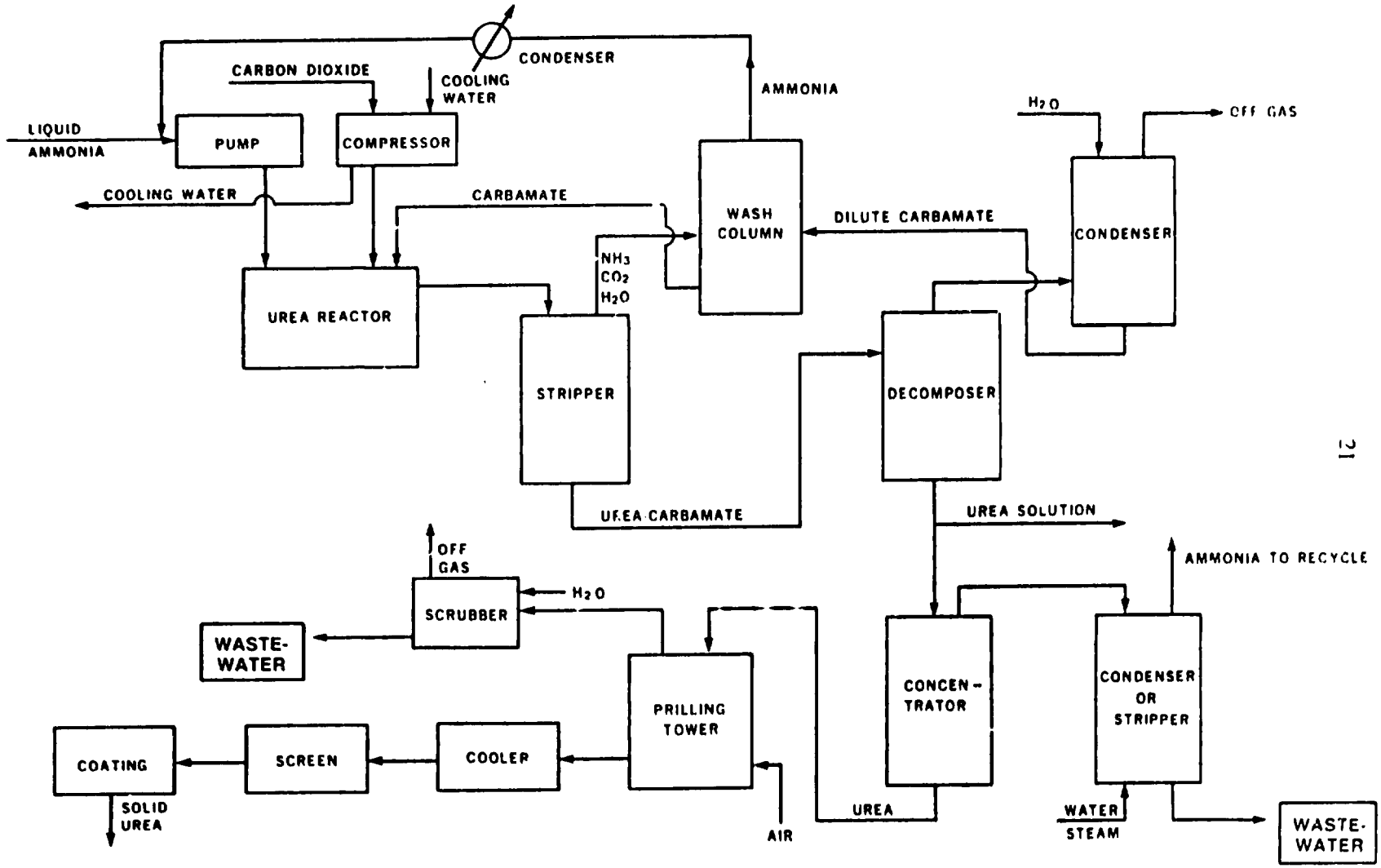
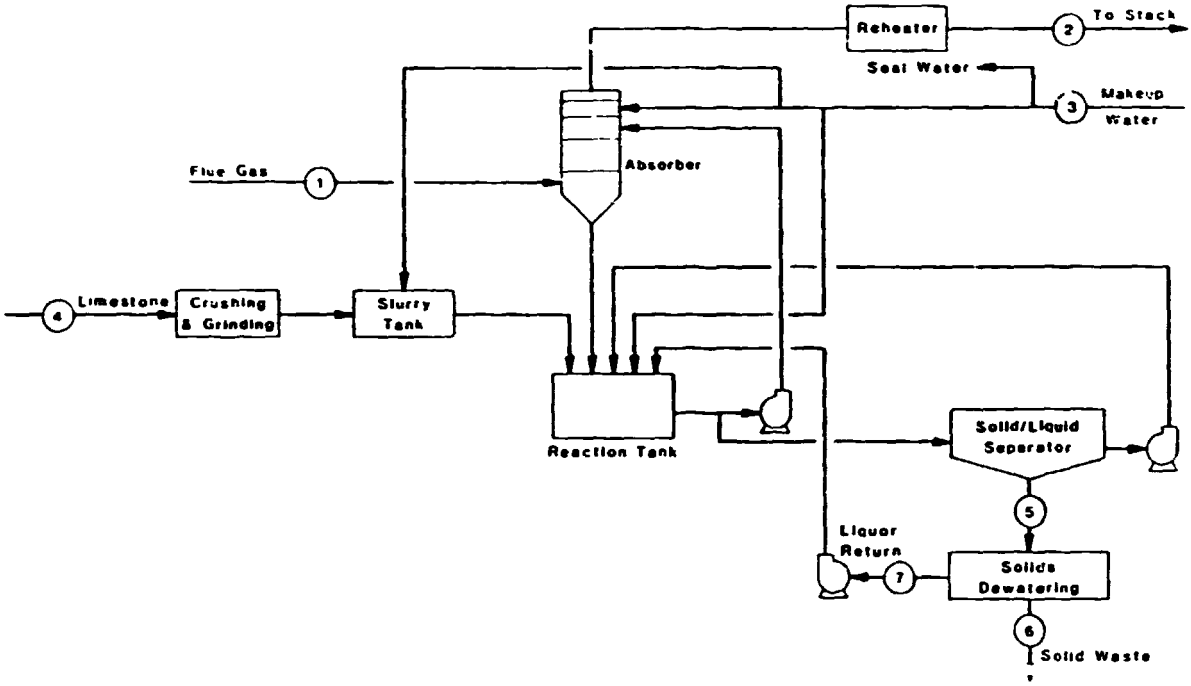


FIGURE 5 PROCESS FLOW SHEET - UREA PRODUCTION



Coal Type	STREAM											
	1			2		3	4	5		6		7
	Gas Flow (Nm^3/min)	Sulphur (kg/min)	Water (kg/min)	Sulphur (kg/min)	Water (kg/min)	Water (kg/min)	Limestone (85% $CaCO_3$) (kg/min)	Solids (kg/min as inerts, $CaCO_3$ & hydrated $CaSO_3$)	Water (kg/min including H_2O of hydration)	Solids (kg/min as inerts, $CaCO_3$ & hydrated $CaSO_4$)	Water (kg/min including H_2O of hydration)	Water (kg/min)
#1												
W/O F.O.	27 630	208 8	1801	20.9	3657	2553	710	931	2248	931	697	1551
W/ F.O	27 630	208 8	1801	20.9	3657	2320	710	1107	2770	1107	464	2306
#2												
W/O F.O	22 767	99 3	1555	8.9	3073	1848	336	441	1064	[illegible]	330	734
W/ F.O.	22 767	99 3	1555	8.9	3073	1738	336	524	1312	52[illegible]	220	1092
#3												
W/O F.O.	30 968	24.8	3069	9.9	5037	2026	60	78	188	78	58	130
W/ F.O.	30 968	24.8	3069	9.9	5037	2007	60	93	232	93	39	193
#4												
W/O F.O.	25 250	52	1739	10	3282	1698	158	207	501	207	155	346
W/ F.O	25 250	52	1739	10	3282	1646	158	247	617	247	103	514

NOTE

W/O F.O.- Without Forced Oxidation

W/ F.O - With Forced Oxidation

Coal Type	%S	AHV (MJ/kg)
1. High S Bituminous	7.0	25
2. Med. S Bituminous	4.0	28
3 Western Lignite	0.5	16
4. Ontario	2.0	29.8

FIGURE 18 MATERIAL BALANCE FOR LIMESTONE SCRUBBING PROCESS

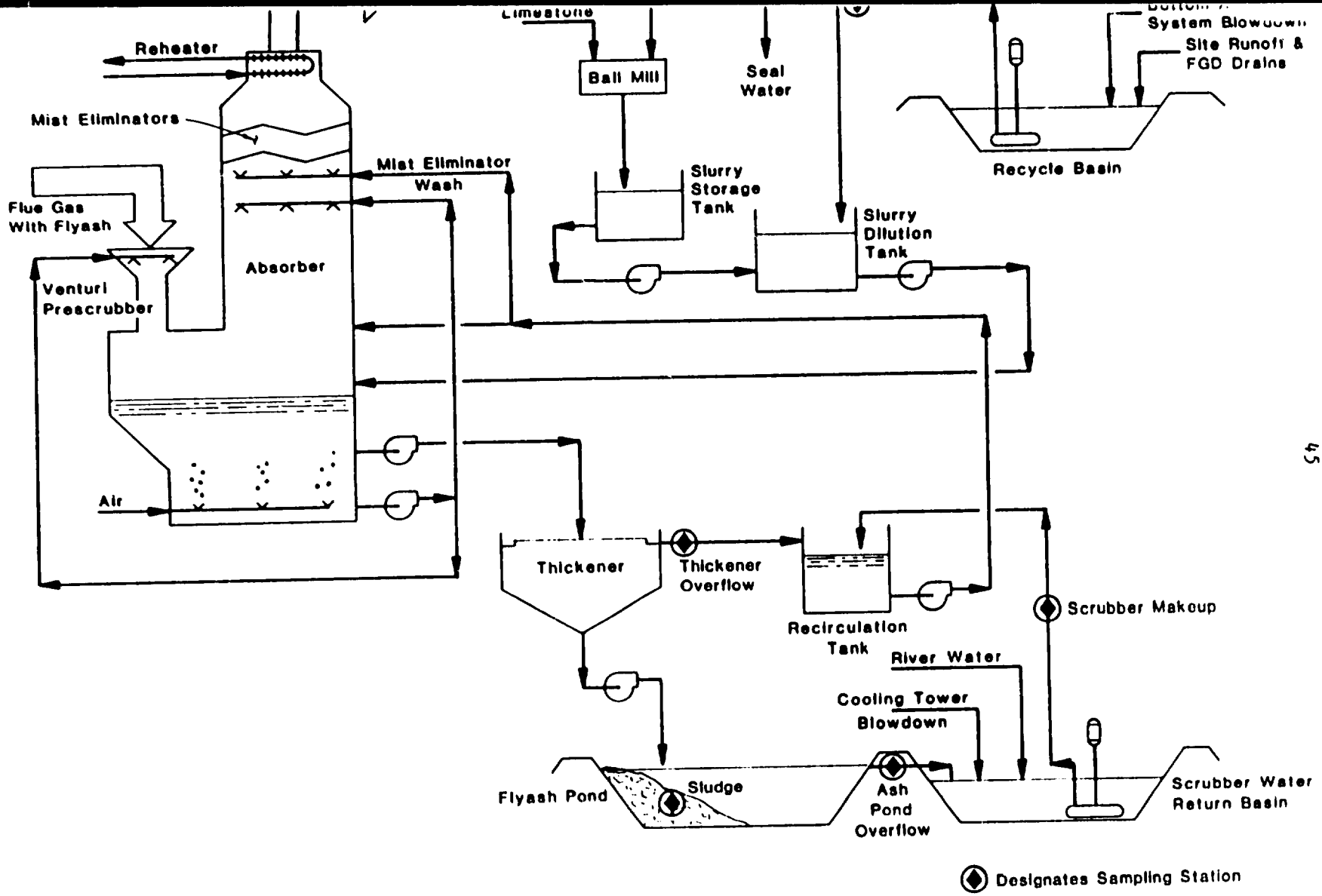


FIGURE 10 NORTHERN STATES POWER CO., SHERBURNE COUNTY GENERATING STATION SAMPLING LOCATIONS

Annex 'G'

For the attention of Mr. Peter J. Reynolds
Pres. Inst. Water Resources Association
Box 6243
Postal Station 'J'
Ottawa Ontario
K2A 1T3 CANADA

Our ref.: EdC/8836

January 4th, 1989

Dear Mr. Reynolds,

On the last day of the E.I.A congres in Delhi we discussed the Geoplan training programme in India and the possibility to repeat that in other countries.
You mentioned your interest for the programme and asked whether Geoplan would be able to do these workshops in other countries.

I would like to confirm our ability and willingness to do that.
In two months we hope to finish the preparation of our material on E.I.A. We prepare workshops on 3 subjects e.a. water resources (inclusive dam building, waterlogging/irrigation) ports and harbours and industrial siting. As I explained to you our organization is a co-operation of all the Dutch universities, Ministry of Environment and private consultants.
In our training we always stimulate both a theoretical and a practical approach and that is why the trainers have always different backgrounds (university, government and consultancy).

I hope that you are still interested in our activities and we can inform you in more detail if you want so. Holland has a lot to do with water, we handle with that for centuries, our E.I.A. knowledge is more recent but belongs to the top of the world.

Yours faithfully,

Dr. J.L. Gortworst
Director Geoplan

GEOPLAN

Indo-Dutch Training Programme
Environmental Impact Assessment

Dr. J. L. Gortworst
Director

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Annex 'H'

List of Questions to Dr. P.J. Reynolds

1. Oxygen balance of a valley.

2. River modelling.

3. Development of SO_2 resistent varieties for forestation in the vicinity of thermal power plants.

4. Water hyacinth (aquatic weed) as a tool for waste water treatment and gas generation.

5. Neutrilization of emitted gases (cyanides and cromium) in electroplating shop of BHEL, Hardwar.

6. Information on energetic plantations.

7. Designing of W/W treatment plant for :

   7.1 Ansorbic digestor : (a) Fluridised bed
   (b) Upflow sludge Blanket roaster

   Details about lab-scale and Pilot-scale along with what type of modifications are required for different waste like distillary waste, sugar vaste diary waste etc.

   7.2 Economical w/w treatemtn for petroleum industry with special reference to (a) Wastes from drilling operations with possible recovery/recycling.
   (b) Wastes from processing plant of petroleum products and possible recycling/recovery.

   7.3 Fertilizer Indsutry: w/w treatement and recovery of products from waste. Use of SO_2 scrubbers for the manufacture of ammonium sulphate.

   7.4 W/W treatement and solid waste treatment/handling/disposal in thermal pwer plant with possible recycling of water.

   7.5 Water problems in Gas Turbine one power plants.

   7.6 Economical recovery of metals from the waste of metal coating shop.

   7.7 W/W treatment for textile industry with special reference to removal of colour and fibres.

8. Modelling:

   8.1 EIA models for TPS which can be extended for any TPS.

   8.2 EIA models for a typical river in India.

8.3 Model for deposition of particulates after they asre omitted from the source with special reference to pathways of heavy metals.

9. Hazardous waste - management with special refernece to radioactive waste.

9.1 What type of problems and what are the modes of disposal for a Nuclear Power Plant.

9.2 What type of treatement is required for the waste water.

9.3 The handling and mode of disposal of ash from Thermal Power plant.

10. Risk assessment for heavy Industries.

11. Instrumentation required for on-line monitoring of water.

12. Format for writing technical and EIA format.

13. Design features of pipelines used for transmission of waste products.

14. Field of Training: Environmental Pollution Control & Impact Assessment

15. Detailed Description:

(a) Training is requested in biological analysis of the ecosystem like Impact of Pollutants, Toxicant etc., and preparation of Ecological Model.

15.1 Biomonitoring methods for the biological control of environmental pollution.

15.2 Preparation of Ecotoxicological model for the Interpretation of data on Toxicological studies.

15.3 New & Economical biotechnology for the biological control of Environmental pollution.

(b) The Impact of various Environmental factors on vegetation and Electron Microscopy.

15.4 Effects of pollutants like SO_2, Trace metals and other toxicants for designing of Experiment.

15.5 Application of electron microscopy in Histopathological studies.

(c) Ecological Protection.

15.6 Formulation of Decision support system for the environmental management plan.

15.7 Formulation of Eutrophication model for the Lake Eutrophication.

15.8 Equipments, books/journals for the Ecological studies.

15.9 Methods of Environmental Conservation.

16. Design, erection and project management for wastewater treatment plant followed by discussions on case studies or working in a ongoing project.

16.1 Design of effluent treatement plant for thermal power statement effluent e.g., ash slurry, oil effluent, water treatment plant effluents etc.

16.2 Design and practical consideration of a conventional secondary biological treatement system for cane sugar industry effluent.

16.3 Sludge characterization studies followed by design of treatment facilities.

16.4 Design of dissolved air floatation system, tube settlers, tertiary treatement systems, toxicants (chemicals plant - H_2SO_4, $N_{a_0}H$. Pharmaceutical, Carbide pesticide, phenols, lignin, etc.).

16.5 Design of tannery effluent treatment plant.

16.6 Treatment of paint, emulsion and organic polymer industry effluent using bentonite and other techniques.

17. River Pollution Studies and Modelling:

17.1 Planning of river pollution studies.

17.2 Modelling of river systems.

18. Anaerobic Digestion - upflow Anaerobic sludge blanket process and fluidized bed (design) to be used for treatment of distillary effluent (molasses based).

18.1 Design of laboratory scale set up.

18.2 Upgradation and design of pilot scale set up.

18.3 Upgradation and design of full scale treatment plant.

18.4 Design of Diphasic system.

18.5 How to solve sulphur toxicity and corrosion problem.

19. Environmental Impact Analysis Methodologies followed by case studies on thermal power projects and other industrial and water resources project.

19.1 EIA methodologies.

19.2 EIA for thermal power stations.

19.3 EIS for other large industrial and developmental projects.

20. Biological Modelling for:

20.1 Industrial effluents from phenolic wastewater and electroplating shop.

20.2 Municipal sewage.

20.1 A typical river.

21. Plant tissu culture technique:

21.1 Identification of certain species of plants suitable for tissue culture.

21.2 Effective utilization of the technique in various industries.

21.3 Development of sulphur dioxide resistent varieties of certain plants/trees fit to be grown in the vicinity of thermal power stations.

21.4 Techniques using enzyme as a tool for wastewater treatment with special reference to (1) removal of nitrates for fertilizer industry effluents.

21.5 Efficiency of treatment system by applying enzymes.

21.6 Techniques of isolation of plant metabolites in plants contaminated with heavy metals.

21.7 Identification of metabolites with special reference to organic pollutants.

22. To develop a model and design for a common wastewater treatment plant for various industries in an industrial complex.

24. Complex technologies

24.1 Process designing of wastewater of distillery/pesticide industry with special reference to biological treatment.

24.2 Design of wastewater treatment plant of electroplating shop and producer gas plant wastewater using water hyacinth.

24.3 Treatment of fertilizer industry wastewater with special reference to application of membrance processes for the removal of toxicants.

24.4 Technique to neutrilize gaseous emissions emitted by electroplating shop.

25. Utilization of Waste

25.1 Utilization recycling of organic/inorganic waste of pesticide and chemical industries.

25.2 Utilization of industrial waste for the production of single cell protein e.g., wastes of petroleum and fermentation industry.

25.3 Utilization of agricultural waste such as strav, cellulose for single cell protein.

25.4 Recovery of metals from wastewater with special reference to chemical industry using bacteria as a tool.