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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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TEH PROJEKT HIDRO d.d.

RIJEKA-CROATIA PLANNING.CONSULTING AND ENGINEERING

RESTRICTED

JULY, 1996
ORIGINAL: English

ASSISTANCE IN TREATMENT OF TANNERY

EFFLUENTS - TAMIL NADU, INDIA

US/IND/90/244

FINAL REPORT PHASE 2.

AN OVERVIEW COVERING THE WORK PERFORMED
UNDER THE CONTRACT AND ITS AMENDMENTS

Based on work of UNIDO Sub-Contractor
TEH-PROJEKT HIDRO, Croatia

Backstopping officer: J.Buljan, Agro-based Industries Branch

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

VIENNA

SUBCONTRACTOR I -TEAM

Team Leader:	**Srdjan Selanec**
Effluent Treatment Technologists:	**Mladen Bosnić**
Civil Engineers:	**Petar Brusić**
Translations & Editing:	**Dado Čakalo** **Graham McMaster**

Director:

Zeljko Drnjević

EXPLANATORY NOTES

CD	Country Director
CTA	Chief Technical Advisor
BSO	Back-Stopping Officer
TOR	Terms of Reference
BOD_5	5 days biochemical oxygen demand
COD	chemical oxygen demand
SS	suspended solids
TDS	total dissolved solids
DS	dry solids (matter)
PE	polyelectrolyte (CPE = cationic, APE = anionic)
R/D	research & development
O&M(O/M)	operation & maintenance
ETP	effluent treatment plant
CETP	common effluent treatment plant
E.I.	East India tanned
US$	United States Dollar, in Feb./March 1996 **US$ 1 = Rs 35.20 - 37.00**
Rs	Indian rupees
1 lakh	= 100.000
1 crore	= 10.000.000
TEH TEAM or **TEAM**	TEH-PROJEKT HIDRO team
SC-I	Subcontractor I (TEH- PROJEKT HIDRO)
TNPCB	Tamil Nadu Pollution Control Board
TALCO	Tamil Nadu Leather Development Corporation
CLRI	Central Leather Research Institute
PTIETC	Pallavaram Tanners Industrial Effluent Treatment Co.
RePO	UNIDO Regional Program Office - Madras
DN	Diameter (of pipes, fittings etc.)
ILIFO	Indian Leather Industry Foundation

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FINAL FIELD MISSION REPORT

ANNEXES

1. SUMMARY

The SC-I team has been actively involved in all project activities since 12/08/1992 assisting UNIDO and the local counterparts in designing, selection of equipment, construction, commissioning, start-up, testing and staff training in two common effluent treatment/sewerage systems for tannery clusters of Pallavaram and Ranipet, in the ETP for mechanized wet-blue to finish leather processing in individual PKL tannery and in the ETP for rural E.I. leather processing in Meera Hussain Tannery.
This Final Report covers the overview of the complete work performed under the Contract including Amendments (Chapter 1.), description of the project achievements (Chapter 2) as well as the remaining problems and recommendations for the project follow-up (Chapter 3). Since the final inspection of the sites as well as wrap-up meetings were held during the last SC-I field mission, the report on it is also enclosed to this Final Report. The two UNIDO leading experts have also visited the sites and SC-I comments on their reports can be found in Annex 8 of the Final Field Mission Report.

2. AN OVERVIEW OF THE WORK PERFORMED UNDER THE CONTRACT AND ITS AMENDMENTS

2.1 RESUME OF ALL THE WORK PERFORMED UNDER THE CONTRACT AND ITS AMENDMENTS

In conformity with original TOR (14/04/1992) and its amendments A (25/11/93) and B (04/05/95), SC-I had performed the following work:

2.1.1 The 3-member team undertook the **First Field Mission** to collect relevant data and to elaborate all the parameters relevant to the project (Flash Report, Sept. 92)).

2.1.2 All the existing data and designs as well as recommendations for improvement and activities necessary for implementation of the Project have been evaluated (Progress Report-Phase I, Nov. 92).

2.1.3 SC-I team did its best to clarify all problems with CTA and local counterparts and to make them understand the importance of precise planning and designing during their **Second and Third Field Mission** in Dec. 92 and April 93. The conclusion was that all contractors should send detailed designs and drawings to SC-I for approval. After the mission, detailed recommendations for implementation were made (Draft Final Report-Phase I, May 93).

2.1.4 Since no document was sent to SC-I till Aug. 93, the SC-I was fielded to synchronize the work of contractors and equipment suppliers. **The Fourth Field Mission** to Madras was undertaken in Aug. 93 and the equipment suppliers (Italprogetti) were visited in Sept. 93. After that, the final recommendations for the project implementation were made (FINAL REPORT - PHASE I, October, 1993), as well as detailed instructions for preparation of O/M Manuals. Among others, the problem of inadequate quality of equipment supplied by UEM has been specially emphasized.

2.1.5 The progress of the works was evaluated again in Nov. 93 and UNIDO decided to extend the SC-I services, since local conditions demanded its longer presence in the field.

2.1.6 During his **visit in Jan./Feb. 94**, the SC-I team leader assisted local counterparts to properly present the project at the TPR Meeting and presented to UNIDO and local counterparts the outlines of the staff training program.

2.1.7 The SC-I team leader closely inspected all objects under construction during his **visit between 28/04 and 03/05/1994**. Among many construction and equipment installation problems at CETP Pallavaram reported by the team leader, particular emphasis was given to the problem of negligent handling of equipment supplied by UNIDO. The belt press equipment had already been damaged during unloading and after the inspection by a supplier's technician, it was decided that it could be mended at the customer's cost.

2.1.8 The SC-I team leader inspected the sites once more between 22 and 29/09/94 and gave a detailed report about the work progress and problems in all CETPs and ETPs. The disappointment with even greater negligence by the CETP Pallavaram Project Officer and with UEM performance was clearly expressed during the Steering Committee Meeting. Consequently, the team leader's plan for the rectification and finalization together with time schedules has been accepted by all participants. UEM finally appointed Mr. Emmanuel as a permanent field manager for the plant.

2.1.9 The SC-I team undertook the **Fifth Field Mission** and in three weeks time (starting 18 January) inspected and rectified each and every part of the CETP Pallavaram together with PTIETC, UEM and Italprogetti technicians, eventually making the start-up and the test of the whole system possible. Being aware of many remaining problems before final fine-tuning and regular operation of the plant, the Project Team prepared a detailed list of pre-requisites and requested UNIDO to extend technical and consulting assistance. The extension was also necessary with regards to the other plants that were not ready for commissioning, start-up and fine tuning yet.
Consequently, extensive "Commissioning Report" together with 5 copies of draft O/M Manuals for CETP Palavaram and for ETPs PKL and MHT with SC-I comments have been issued to UNIDO.
UNIDO has accepted the SC-I request and expanded their TOR on 04/05/95.

2.1.10 **The SC-I team leader visited the sites between 01-08/06/95** and found the CETP Pallavaram and ETPs PKL and MHT functional and performing with reasonable success. The CETP Ranipet was still out of operation since conveyance system was not completed. Regrettably, although giving satisfactory results under reduced load, the CETP Pallavaram still was not rectified and upgraded as previously recommended. Moreover, additional problems with the management organization and cost-sharing started to seriously obstruct the works. Detailed plans to overcome the problems were prepared in cooperation with the whole Project team.

2.1.11 The SC-I Team was fielded for the **Sixth Mission in Sept. 95** to find that nothing was realized concerning CETP Pallavaram rectification program. Moreover, equipment was additionally destroyed or damaged due to inadequate quality (which was referred to by SC-I in almost all of the reports). The organizational problems increased due to unsolved contractual obligations between UEM and PTIETC and due to the fact that most of already trained staff had abandoned their posts. Again, the Project Team issued detailed recommendations to overcome the problems.
The CETP Ranipet was found partially operable and the performance of the UNIDO supplied equipment was preliminary tested.
ETP PKL was found to operate regularly and recommendations for instrumentation improvement and plant fine-tuning were made.
ETP MHT did not operate since the tannery did not work.

2.1.12 The SC-I Team was fielded (on UNIDO specific request) for the **Last Seventh Mission** between 23/02-11/03/96 to find that all plants operated with reasonable success as can be seen in the detailed report in Chapter 1. and in Annexes to this report. The SC-I team gave its best (for such a short period of time) while participating in the plant operation and discussed in detail the problems of fine-tuning, optimization, staff training and follow-up program with plant managers, local consultants, UNIDO and TNPCB representatives.

2.1.13 The Draft Final Report as well as final O/M Manuals for CETP-Pallavaram, ETP PKL together with the Comments on Preparation of O/M Manuals were submitted to UNIDO-Vienna in April 1996. Since a delay in UEM's preparation of the data for CETP-Pallavaram was anticipated, SC-I was requested to submit the final O/M Manual subsequently, if at all possible.

2.1.14 The Draft Final Report has been revised by RePO-Madras and SC-I team was requested by BSO, during the briefing on 29/05/96, to submit the Final Report taking into account all the remarks and recommendations. In the same time it was agreed that UNIDO and SC-I would do their best to purchase from UEM the data necessary for final CETP-Palavaram O/M Manual.

2.1.15 Mr. V. Post of RePO-Madras informed the SC-I team in Pakistan by phone on 01/07/96 that the data can be purchased at UEM office in Delhi on 07/07/96, but when the SC-I team leader met the UEM's manager Mr. V. Mehra in Delhi he has been informed that all the copies of final manuals are already submitted to Madras.

2.1.16 Since after more than four years, SC-I cannot anymore prolong the termination of the project the Final Report is going to be submitted without the final CETP-Pallavaram O/M Manual. The SC-I will stay in obligation to finalize it on separate request of UNIDO whenever suitable.

2.2 LIST OF THE REPORTS ELABORATED DURING THE PROJECT

2.2.1 FIRST FIELD MISSION "FLASH REPORT", September, 1992

2.2.2 PROGRESS REPORT - PHASE I, November, 1992
"Evaluation of the Existing Data and Designs with Recommendations for Improvements and Activities Necessary for Final Implementation of the Project"

2.2.3 PROGRESS REPORT - PHASE I, "Executive Summary", November, 1992

2.2.4 EVALUATION OF THE PROPOSALS FOR UNIDO EQUIPMENT, November, 1992

2.2.5 FINAL REPORT - PHASE I, Draft, May, 1993
"Final Recommendations for the Project Implementation"

2.2.6 FINAL REPORT - PHASE I, October, 1993
"Final Recommendations for the Project Implementation"

2.2.7 INSTRUCTION MANUALS FOR OPERATION AND MAINTENANCE OF TANNERY EFFLUENT TREATMENT PLANTS - Draft -,October, 1993

2.2.8 PROGRESS REPORT - PHASE II, November, 1993
"Evaluation of Work Progress at all Four Locations With Recommendations for Improvements and Activities Necessary for Final Implementation of the Project"

2.2.9 - EXECUTIVE SUMMARY - of Common effluent treatment in the tannery clusters of Pallavaram and Ranipet and effluent treatment in the individual tanneries "Meera Hussain" and "Presidency Kid Leather", January, 1994

2.2.10 AN OUTLINE OF THE TRAINING PROGRAM FOR STAFF TO OPERATE, MAINTAIN AND MONITOR THE EFFLUENT TREATMENT PLANTS, January, 1994

2.2.11 PROGRESS REPORT - PHASE II, May, 1994
"Evaluation of the Work Progress at All Four Locations With the Proposal of the Program for the Finalization of the Project"

2.2.12 STATUS REPORT ON THE UNIDO-PROJECT US/IND/90/244
Based on SC-I team leader's field mission between 22/09 and 29/09/1994.

2.2.13 REPORT ON THE FIELD MISSION AND PROPOSAL OF THE PROGRAM FOR THE PROJECT FINALIZATION, October, 1994

2.2.14 REMARKS ON THE DRAFT OPERATION AND MAINTENANCE MANUALS FOR CETP-PALLAVARAM, ETP-MEERA HUSSAIN AND ETP-PRESIDENCY KID LEATHER AS WELL AS ON THE "TENTATIVE PROGRAM ON PREPARATORY ACTIVITIES" PREPARED BY UEM, February, 1995

2.2.15 COMMISSIONING REPORT ON THE INSTALLATION, TESTING AND START-UP OF THE COMMON AND INDIVIDUAL ETPs TOGETHER WITH PROPOSAL OF THE PROGRAM FOR THE PROJECT TERMINATION, February, 1995

2.2.16 FIELD MISSION REPORT ON THE PERFORMANCE OF THE IMPLEMENTED CETPs AND ETPs AND PROPOSAL OF THE PROGRAM FOR THE PROJECT FINALIZATION AND FOLLOW-UP, June, 1995

2.2.17 PROGRESS REPORT - PHASE II, October, 1995
"Field Mission Report on the Performance of the Implemented CETPs and ETPs and Proposal of the Program for the Project Finalization and Follow-Up"

2.2.18 DRAFT FINAL REPORT - PHASE II, April, 1996
"Final Field Mission Report on the Performance of the Implemented CETPs and ETPs and an Overview Covering the Work Performed Under the Contract and its Amendments"

2.2.19 COMMENTS ON OPERATION/MAINTENANCE MANUALS FOR ALL CETPs AND ETPs, April, 1996
SC-I comments on all the four O/M Manuals are submitted together with five copies of each manual.

2.2.20 FINAL REPORT - PHASE II, July, 1996
"An Overview Covering the Work Performed Under the Contract and its Amendments, together with the recommendations for the project follow-up"

3. ACHIEVEMENTS OF THE PROJECT

3.1 CONTAINMENT OF ENVIRONMENTAL DEGRADATION

The construction of the sewerage system and CETP Pallavaram (for 3,000 m^3/day) has been completed while CETP Ranipet (for 4,000 m^3/day), ETPs for PKL (for 120 m^3/day) and MHT (for 100 m^3/day) have been upgraded successfully. The plants are fully operational removing in total more than: 16,000 kg/day of suspended solids, 45,000 kg/day of COD load, 15,000 kg/day of BOD_5 load, 300 kg/day of chromium and 800 kg/day of sulfides.
Although there was no time to monitor the plants for a longer period of time, the roughly calculated treatment operation costs do not exceed US$/$m^3$ 0.20 for the CETPs and US$/$m^3$ 0.40 for the ETPs, which is far below the cost of similar systems in developed countries (*please note that the depreciation costs have not been included*). It is interesting to mention that the effluent treatment cost in PKL (where ETP performance has been monitored more closely) makes only 0.13 % of the product price.

3.2 REINFORCEMENT OF LOCAL CAPABILITIES

Despite the fact and SC-I's higher ambition that the cooperation with local experts and consultants could have been more close, from designing over construction to the actual operation and monitoring of the plants, some results have been achieved. We have established very good cooperation with the ENKEM staff, CLRI representative Mr. Rajamani, CETP Pallavaram Manager Mr. Jayakodi and UEM field manager Mr. Emmanuel. Especially, we believe, the last two have profited and both of them can competently cope with all problems related to tannery effluent treatment.

3.3 DISSEMINATION OF THE PROJECT EXPERIENCES

We believe that the highest achievement of the project is the successful dissemination of experience to other locations in Tamil Nadu. Two more similar common effluent treatment plants have already been constructed in Ranipet and one is planned for Madhavaram Industrial Estate in Madras. Apart from this, the staff of other existing plants, as well as local consultants are already making use of the experience in the design of new and upgrading of existing plants.
Since various technologies and equipment have been applied to the CETPs for aeration/mixing (floating aerators, ejectors and bottom diffusers) and for sludge dewatering (sludge drying beds, belt filter press and centrifuge), the local consultants can compare their performance and determine the optimum for future applications.

4. REMAINING PROBLEMS AND RECOMMENDATIONS FOR THE PROJECT FOLLOW-UP

4.1 CETP PALLAVARAM

All the problems described in the Status Report (Annex 4) and below in the Field Mission Report should be immediately solved with special emphasis on:

- Treated effluent discharge pipeline
- Sludge dewatering (belt press) and disposal
- Additional staff recruitment and training
- Proper organization of the plant management and cost-sharing

4.2 PLANNING AND DESIGN OF THE TANNERY EFFLUENT TREATMENT PLANTS

Each tannery effluent treatment system (or its part) should be properly planned and designed by taking into consideration various options and only then by determining an optimum technical and economical solution. The construction without proper calculations and designs could result in unnecessarily high investment and O/M costs, since the correction of errors after the construction and installation of equipment bears higher cost than the improvement of designs and careful selection of equipment. Regrettably, the problems of this nature and consequently all kinds of problems connected to management and operation were experienced in the case of CETP Pallavaram. It can be also visible that all the problems emerging now at CETP Ranipet were anticipated in the SC-I PROGRESS REPORT-PHASE 2, as early as Nov. 93 and probably could be solved earlier in a more suitable manner.
Tanners and the Government authorities should ensure that this is avoided in future.

4.3 STAFF TRAINING

Although plans for the CETP and ETP staff have been well prepared, delays in construction and frequent fluctuation of the recruited staff caused problems in their complete implementation.
The trained managerial staff still employed should continue to train plant operators in cooperation with local consultants, CLRI and UNIDO.
The plant management should make sure to oblige all the employees not to leave their position for the time necessary for unobstructed plant operation.

4.4 SLUDGE DISPOSAL

The ETPs and especially CETPs cannot operate if the generated sludge is not constantly evacuated and properly disposed of. Since the disposal of special and hazardous waste has not been solved, either on regional or on municipal level (Madras and Ranipet), we believe that the dewatered sludge can be disposed of temporarily at the existing municipal solid waste (garbage) disposal sites. Subsequently (but as soon as possible), the problem should be solved in accordance with the recommendations for temporary and permanent disposal given in the study elaborated by UNIDO Consultant, Mr. P. Rantala, Dec. 1995.

4.5 MANAGEMENT OF THE PLANTS

Apart from PKL ETP that is properly operated and financed by the tannery, all other plants face difficulties with management organization. Apart from operating activities, the common plants face a particular problem concerning the organization of regular fund raising necessary to run the system. Immediate effort should be made by the tanners and the Government authorities to improve organization of the managing companies and to enable regular operation since the systems are threatened by immediate and complete collapse unless properly operated and funded.

4.6 FOLLOW-UP OF THE PROJECT

Apart from the activities necessary to sustain the project, it would be useful to follow it up by the programs recommended by the SC-I report from June 95 as well as by the "Overview " prepared by Mr. Buljan for the Coordination and Planning Meeting held in Madras from 4 to 7 March 1996 (also please note our comments in Annex 7). Specifically in connection with the project, the following studies could be very useful:

- Biological treatment with "biosolar" microorganisms
- Application of the treated effluent and sludge as soil conditioner
- Possibilities of sludge removal and final disposal
- Anaerobic degradation of sludge and tannery solid wastes (fleshings) with utilization of bio-gas
- Effluent treatment by the combination of dissolved air flotation and filtration ("sandfloat")
- Removal of salinity

ENCLOSURE

FINAL FIELD MISSION REPORT

(23/02 - 11/03/ 1996)

FINAL FIELD MISSION REPORT

1. INTRODUCTION

SC-I team, consisting of Mr. M. Bosnic, environmental technologist, and Mr. S. Selanec, the team leader, undertook the last field mission between 23/02 and 11/03/1996 as requested by UNIDO via facsimile dated 12/02/96. The specific objectives of the mission were to:

- technically evaluate current status of the project implementation in the ETPs and CETPs,
- consult the counterparts in further fine tuning and optimization of each operational plants,
- participate in the in-plant training of the staff together with the contractors (UEM and ENKEM) with regards to the technical and managerial aspects of the plants operation.

Apart from the activities described below (please also see Annex 1), the following report contains:

- technical evaluation of the project achievements,
- recommendations for immediate actions necessary to sustain and further develop the objectives of the project ,
- recommendations for the project follow-up

2. ACTIVITIES, FINDINGS AND RECOMMENDATIONS

2.1 GENERAL

All four treatment plants have been found to operate with reasonable success and it can be freely said that, apart from significant removal of the pollution load, the biggest achievement of the project was the successful dissemination of the experience to other locations. Two more similar common effluent treatment plants have already been constructed in Ranipet and one similar in Pernambut.
Of course, there are many problems (the anticipated ones as well as those emerging from the specific local problems) yet to be gradually solved.
The main problems and recommendations for improvement, (common or specific for particular ETP or CETP) have been elaborated in the LIST OF THE MAIN PROBLEMS AND ACTIONS REQUIRED prepared in RePO-Madras on 03/03/96 (Annex 2). However, we would like to point out the following:

- **Sludge Transport and Final Disposal**

The ETPs and especially CETPs cannot operate if the generated sludge is not constantly evacuated and properly disposed of. Since the disposal of special and hazardous waste has not been solved, either on regional or on municipal level (Madras and Ranipet), we believe that the dewatered sludge can be disposed of (**but only temporarily**) at the existing municipal solid waste (garbage) disposal sites. Subsequently (but as soon as possible), the problem should be solved in accordance with the recommendations for temporary and permanent disposal given in the study elaborated by UNIDO Consultant, Mr. P. Rantala, Dec. 1995.

- **Staff Recruitment and Training**

Permanent staff with appropriate background should be recruited immediately to meet requirements. Since some of the trained staff is no longer available, the plant managements should make sure to recruit the staff on permanent basis as well as to additionally train and introduce them to the duties specified in O/M Manuals.

- **Operation of the plants**

The SC-I team has discussed general operational problems with the plant managers pointing out that apart from regular mechanical operation all parts and equipment should be regularly checked, cleaned and maintained in accordance with the existing instructions and manuals (please see separately prepared COMMENTS ON EXISTING O/M MANUALS by SC-I).
Regular inventory and purchase of necessary materials and spare parts should be better organized as well.
All plant operators and support staff should have day-to-day and periodical duties strictly defined.

- **Monitoring, Data Collection and Experience Dissemination**

The performance of the plants should be monitored regularly, using the standard methods for analyses and log sheets for recording, as defined by the manuals.
Performance data, together with calculated power and chemicals consumption, should be processed periodically and forwarded to RePO-Madras in order to disseminate relevant experience.

- **Fine-Tuning and Optimization of the Treatment Processes**

  The collected data should be utilized for regular fine tuning and optimization of effluent and sludge treatment processes for each and every plant.

NOTE: The existing O/M Manuals should be updated to reflect the comments prepared by SC-I. Besides, the O/M Manuals should be occasionally updated (corrected) in accordance with practical experiences gained during the plant operation.

- **Effluent discharge standards**

  Despite the multi-step effluent treatment (mechanical, chemical, and two-step biological) in all CETPs and ETPs, the treated tannery effluent characteristics would occasionally exceed the standard limits prescribed in the "Pollution Control Legislation - TNPCB, 1989":

Parameters	Inland surface waters	Land for irrigation
Suspended solids	100 mg/l	200 mg/l
BOD_5	30 mg/l	100 mg/l
COD	250 mg/l	-
Chlorides as Cl	1000 mg/l	600 mg/l
Total Chromium as Cr	2 mg/l	2 mg/l
Cr^{+6}	0.1 mg/l	0.1 mg/l
Sulfides as S	2 mg/l	2 mg/l
Ammonical nitrogen	50 mg/l	-
Phenolic compounds	1 mg/l	5 mg/l
Sulfates as SO_4	1000 mg/l	1000 mg/l
Percent sodium	-	60 %
Total dissolved solids	2100 mg/l	2100 mg/l
Oil & grease	10 mg/l	10 mg/l
Ph	5.5-9.0	5.5-9.0

The reason for this can be found in an improper plant operation or in unexpected overloading (CETP Ranipet). Recent requests by TNPCB to improve removal of and color, although it is not specified in the above mentioned legislation, present additional problem. Therefore, we strongly recommend to UNIDO and the tanners' associations to immediately start a permanent dialogue with relevant authorities in order to solve the problem, since, during our last mission, we lacked time and an adequate counterpart in TNPCB to discuss it. Special attention should be paid to a proper presentation of technically and economically feasible methods of pollution control in the present economical situation of the country and of the industrial branch. We believe that it is more important to do what is presently possible, and leave more sophisticated and far more expensive methods for better times. The fact is that more than 90 % of organics, suspended and toxic materials (pH, sulfides and heavy metals) can be removed by already used methods that are technically and economically acceptable, and that the removal of the remaining pollutants requires technically more sophisticated and much more expensive methods.

- The Government, tanners and UNIDO representatives discussed all achievements and the problems connected to the project during the project wrap-up meeting in TNPCB-Madras on 08/03/96 (please refer to Minutes, Annex 3).

2.2 CETP - PALLAVARAM

The plant was inspected on several occasions during the mission and the general conclusion is that it is kept in order and that the effluent treatment results exceed SC-I expectations, taking into the account all the problems described below.
Regrettably, little progress has been made with regards to our recommendations for improvement (please see CETP Status, Annex 4) since our last visit (Sept. 1995). Inasmuch as the recommendations were elaborated in the previous reports (February and September 1995), we will restrict ourselves to the following:

- **Discharge of Treated Effluent**

Although the discharge of treated effluent is one of the crucial problems, it has not been adequately solved. The horizontal centrifugal pump that was additionally installed has not been fully utilized due to necessity of manual priming and flow regulation. It is absolutely necessary to re-design and re-construct the system to work either by gravity or by pressure.

- **Sludge Disposal**

Neither temporary nor permanent disposal has been implemented. This matter has to be solved immediately either in cooperation with TNPCB or with some other competent authority. The study prepared by UNIDO consultant, Mr. Rantala could be used as a guideline.

- **Belt Filter Press**

The belt press has scarcely been utilized due to a difficulty with automatic regulation of the belt adjustment. After a certain operation period, the belt has to be manually re-adjusted despite the fact that the sensors for automatic adjustment seem to be in order. Since there is no visible cause for the defect, the SC-I has strongly recommended that a supplier's expert be requested to:

- fix the press,
- put the press in normal operation,
- optimize the operation (balance between PE consumption and SS content in filtrate),
- simultaneously train permanently employed operator(s)

NOTE: During the last field mission, SC-I representatives drafted a technical request to the supplier (Italprogetti) and handed it to Mr. Post (RePO-Madras).

- **Fine Tuning and Optimization of the Process**

UEM field manager, Mr. Emmanuel, prepared a very useful draft report on CETP operation showing a very good and correct approach to various problems, especially to economic optimization of the process.
Naturally, partial presentation and interpretation of the process data and results cannot be taken as fully representative. It has therefore been decided that the report should be supplemented and finalized in cooperation with the plant manager, Mr. Jayakody and RePO representatives.
Besides, some data and calculations should be corrected (such as: the designed load of 2,000 kg BOD_5/day should be replaced with 4,800 kg BOD_5/day. It is possible that a misprint in the O/M Manual reading BOD_5 concentration of 600 mg/l instead of 1,600 mg/l, was taken into account?!).
The problems of regular operation, fine tuning and optimization were discussed with UEM and CETP managers. SC-I supports their effort to temporarily compensate the sludge disposal problems by avoiding to use chemicals reducing thus the CETP treatment effect and sludge production. Naturally, this requires higher efficiency in the biological step and with it higher

power consumption, which may be an additional incentive to find solutions for sludge disposal immediately.

Besides, it is not possible to return the excess biological sludge into the equalization tank, which has been designed for further improvement of the overall treatment effect, without causing additional increase of sludge volume. The excess biological sludge is presently directly evacuated into the thickener.

To achieve the projected results, it would be necessary to stabilize, thoroughly fine tune and optimize the whole system once all the sludge and hydraulic problems are solved.

In addition, correct monitoring is indispensable for the achievement of the desired results. Analytical results achieved in the CETP laboratory should be verified periodically by other competent laboratories.

- **Contractual Obligations and the Plant Management**

The contractual relationship and problems between UEM and PTIETC are still not solved which may further delay the achievement of the desired results.

2.3 CETP - RANIPET

The plant was inspected on several occasions during the mission and the general conclusion is that it is kept in order and operated properly.
The changes and improvements following our last visit in September 1995 are listed in the CETP Status, Annex 4. In addition, we would like to stress the following problems:

- **CETP load**

Although hydraulic load does not exceed the designed values the plant operation suffers unexpectedly high load of coarse material, suspended solids and organics. The concentrations of SS, BOD_5 and COD are 2-3 times higher than expected (as per design in the tender document).

Parameters	Characteristics	
	As per Tender	In practice
pH	7.5-8.5	6.0-8.0
Total suspended solids (mg/l)	1200-1900	4000-9000
COD (mg/l)	1500-4000	7500-8500
BOD (mg/l)	900-2000	2500-3500
Screenings (t/day)	0.5	3-4
Surface loading of the clariflocculator (kg/m^2 x day)	36	95

The probable reason for that is poor maintenance of the pre-treatment units within tanneries (the CETP has been designed on the basis of the effluent characteristics after removal of coarse materials). *Common sewerage must not be taken as a solution for disposal of tannery solid waste (cuttings, fleshings, shavings, buff dust etc.), since, apart from the CETP obstruction, it will cause clogging and consequently destruction of conveyance system (pipelines and pumping station)!!!*
It is absolutely necessary first to ensure proper maintenance and function of the pre-treatment units and then if the load is still significantly above the designed value, to take adequate measures in process modification and/or CETP upgrading.

- **Manually cleaned coarse screens**

Although ENKEM has already constructed an additional screen for the effluent from the pressure pipeline, both screens remain overloaded with coarse solids. Even a significantly increased number of manual workers does not suffice for a timely and efficient removal of the entire quantity of solids collected at the screens. The extremely difficult working conditions often cause obstruction of the screens and consequently back-flooding of the pipelines and of the platform for collection of the removed screenings.
Unless the prevention of this excessive load is feasible, it will be necessary to modify the system, probably by introduction of adequate automatically cleaned screens. In addition, the present circumstances require an adequate arrangement for collection, temporary storage and regular disposal of coarse materials.

- **Collection tank**

Since the tank had been built before the UNIDO project started, it was not possible to modify it, although SC-I always strongly believed that its volume is too big and consequently its retention time was too long for the designed system. Regrettably, the problem has increased with the high concentration of settling solids, which settle, obstructing the operation of the pumps (discontinuously switching on) and consequently overload the rotary fine screen when the sludge is pumped.

The problem can be temporarily solved by continuous pumping and/or permanently by introducing a mixing with floating aerator or ejector.

- **Rotary fine screen**

Frequent overloading is the reason for the by-passing of the screen which results in the increase of suspended solids concentration in the equalization tank which consequently causes settling and aggravates proper mixing (load equalization).
The permanent solution of the problem could be the installation of two additional rotary screens. This entails proper arrangement for the evacuation of the screenings into containers as well as automatic washing of the screens.

- **Clariflocculator**

The clariflocculator has been properly designed from the hydraulic point of view, but the unexpected SS concentration causes unacceptable overloading of the system. Unless the SS load is significantly reduced, one more clariflocculator should be added.

- **Anaerobic lagoon**

The lagoon was introduced into the CETP system approximately one month before our mission and has not still given the expected results. The BOD_5 removal effect is only 10-20 %. This "poor" performance can be explained with the fact that the required bio-mass content could not develop in such a short time. The performance should be further monitored and, if necessary, additional measures should be taken (e.g. adjustment of nutrient content).

- **Aerobic lagoon**

Although only recently introduced into the system, the lagoon, aerated with five floating aerators (supplied by UNIDO), is already giving the expected results.

- **Activated sludge step**

The concentration of activated sludge (MLSS-mixed liquor suspended solids) is still too low and should be increased by constant sludge return from the secondary settling tank. Occasional excessive foam formation is usual for such systems and does not present a serious problem.

- **Secondary settling tank**

As early as November 1992, SC-I in its PROGRESS REPORT remarked that the tank was inadequately designed. The surface load of the settling tanks treating biologically purified tannery effluent should be half the load of the tanks treating sanitary effluent. It has been confirmed in practice since the results achieved in SS removal are not satisfactory. The concentration of SS in the treated effluent amounts to 300-500 mg/l. In order to improve the treatment and obtain the designed parameters one more settling tank should be added to the system.

- **Sludge dewatering**

The primary sludge has been successfully dewatered on the existing drying beds since the beginning of CETP operation. The dried sludge is manually removed from the beds and simply stock-piled on the nearby field.
The additional sludge drying system consisting of a thickener, sludge pump, CPE dosing and HUMBOLT decanter (centrifuge) that were supplied by UNIDO, was introduced during the SC-I previous field mission in September '95. Since then, certain modifications (replacement of the

under-capacity dosing pumps as well as introduction of the control panel for automatic operation and of the belt conveyer for dried sludge evacuation) have been introduced so that, in this period only approx. 20 m^3 of the dried sludge could be produced.
Since the modified system started only during our last visit, there was no time to check the parameters and to fine-tune/optimize it. However, the visible results seemed satisfactory. In any case, the system should be constantly utilized (especially in view of the present excessive load) and simultaneously fine-tuned. The CPE consumption should be optimized to ensure the required sludge and centrate quality at minimum cost.

- **Sludge disposal**

The problem of permanent disposal has not been solved yet. The solution should be found immediately either in cooperation with TNPCB or with some other competent authority since the disposal site within the CETP presents only temporary solution.

2.4 PRESIDENCY KID LEATHER

The plant was inspected on several occasions during the mission and the general conclusion is that it is kept in order and operated properly. Particularly commendable is the use and maintenance of the laboratory.
The changes and improvements following our last visit in September 1995 are listed in the CETP Status, Annex 4. In addition, we would like to stress the following:

- **Instrumentation and monitoring equipment**

The entire ETP equipment supplied by UNIDO has been installed except for the measuring instruments the installation of which has been delayed due to pending reparation of the control board. The contractor responsible for reparation, MICRO CONTROLS Ltd., has ceased to exist leaving the solution of the problem to its legal successor.

- **Effluent quality and disposal**

Apart from the grayish color the treated effluent, its features are within the range of values to be expected for such ETP. Although the color does not necessarily have more than a psychologically disagreeable effect, it should be given attention during the leather finishing process by reduction of the pigment waste or its replacement with a pigment which can be easily removed.
The treated effluent is being used for watering of fire-wood ("casurina" plants). Although it gives visibly good results, systematic monitoring and experience dissemination is deemed necessary (quantity of effluent which could be applied, changes in the soil quality, plant growth, quality of the gases wasted after burning the wood/plant etc.). In this respect, the SC-I team discussed the problem with the PKL Manager, Mr. N. Ahmad who expressed willingness to participate in potential UNIDO follow-up projects within the Regional S.E. Asia Programme.

- **Sludge quality and disposal**

Additional sludge drying beds are being constructed, which should satisfy the plant's requirements for a longer period of time. Since approximately 2 acres of land is available within PKL, the use of sludge as soil conditioner should be examined in the same way as described above for the effluent.

- **Effluent treatment costs**

LEATHER PROCESSED	PRODUCTION	EFFLUENT GENERATED	EFFLUENT TREATMENT COSTS (LESS ETP DEPRECIATION)		PRODUCT PRICE	PARTICIPATION OF TREATMENT COST IN PRODUCT PRICE
pcs/day of wet-blue goat skins	sqft/day of finished skins	m^3/day	US$/day	US$/$m^3$	US$/sqft	%
10,000	30,000	100	40.00	0.40	1.00	0.13

2.5 MEERA HUSSAIN TANNERY

The plant was inspected on several occasions during the mission. During the first visit, the ETP was found in very poor shape, but was eventually brought to regularly operative state. By the end of our mission, the ETP was kept in order and was properly operated.
The changes and improvements following our last visit in Sept. 1995 are listed in the CETP Status, Annex 4. In addition, we would like to stress the following:

- **ETP operation and results**

Presently the plant operates combining mechanical-chemical treatment, "biosolar" anaerobic lagoon, de-gasification tank and aerobic-polishing lagoon.
The biosolar lagoon seems to give very good results, but the treated effluent is turbid due to the outgoing elementary sulfur. The laboratory tests have shown that sulfur can be easily precipitated with addition of flocculant making the treated effluent very transparent. Since the provision for the removal of sulfur is not yet available, the further upgrading of the system could be useful.
Additional bio-mass (probably sulfuric microorganisms) has developed in the polishing lagoons, which results in heightened SS concentration in the treated effluent. This can be additional reason for further examinations and upgrading of the plant (through Regional Program or otherwise - according to the literature, CLRI has some experience in this respect).
The plant operation is closely monitored by the laboratory (equipped by UNIDO) and parameters are regularly logged in the well laid out sheets.
The overall effect of such simple system is good, resulting in 90 % of COD removal and in approx. 70 % of SS removal (can be improved by the removal of sulfur and secondary developed microorganisms). Equally significant removal of sulfides and sulfates has been reported by ENKEM but exact data should be verified by constant monitoring.

- **Sludge dewatering**

It seems that additional drying beds should be provided since the existing ones are hardly adequate when the tannery works with full capacity.

- **Evaporation of the soak liquor**

It seems that the existing ponds are not being used properly so that the liquors additionally overload ETP.

- **UNIDO assistance**

All the purchased equipment has already been supplied and installed. SC-I recommends that the additional request for "biosolar" technology upgrade be considered in detail (please see previous SC-I Report, Sept. 1995). The experience gathered may prove useful on regional or even broader level (please see status Report, Annex 4).

- **Inconsistent operation**

Before any further assistance, UNIDO has to consider problems in connection with inconsistent leather processing (and consequently ETP operation) due to the often changes in property and management of the plant. The present user, C. THUFAIL AHMED & Co. first dismissed the services of ENKEM and than engaged it again upon request from the authorities?!

3. ADDITIONAL ACTIVITIES

3.1 WORKSHOP ON EFFECTIVE TREATMENT AND DISPOSAL OF TANNERY WASTES AND EFFLUENT

The SC-I team actively participated in the workshop organized by ILIFO to advocate dissemination of operational data and experiences from the existing tannery effluent treatment plants.

3.2 REGIONAL PROGRAM FOR POLLUTION CONTROL IN THE TANNING INDUSTRY OF S.E. ASIA

The SC-I team actively participated in the Coordination and Planning Meeting with the emphasis on monitoring and collection/processing of the data/parameters from the plants implemented in the region as well as on possible future R&D activities.
Mr. Buljan's "Broad Overview of Possible Topics to be Addressed, Studies to be Undertaken and/or Pilot Units to be Set-Up for Development, Demonstration and Training Under Regional SE Asia Program" was widely discussed and SC-I team prepared written comments and recommendations on it (see Annex 7).

3.3 SIDCO - RANIPET CETP.

SC-I separately visited the new effluent treatment plant on which ENKEM successfully used experiences and recommendations of this project.

3.4 MADHAVARAM INDUSTRIAL ESTATE IN MADRAS

SC-I visited the site and discussed the possibilities for CETP construction with Mr. N. T. Rajan and local tanners. It has been recommended that experiences of this project be used in the plant design paying special attention to the possibility of the treated effluent discharge into the existing Madras municipal sewerage and treatment system.

3.5 THE PROJECT WRAP-UP MEETING

The final meeting was held in TNPCB with BSO Mr. Buljan, Government representatives, tanners, and RePO on 08/03/96 and all the items and recommendations have been recorded in the minutes enclosed in Annex 3.
It was additionally agreed with Mr. Buljan that SC-I would prepare the Draft Final Report as soon as possible enclosing the copies of the O/M Manuals for all the CETPs and ETPs together with the SC-I comments and recommendations. Since a delay in UEM's preparation of the O/M Manual for the CETP Pallavaram was anticipated, SC-I was requested to submit the documents for other plants immediately while the documents for the CETP Pallavaram would be submitted subsequently if possible.

ANNEX 1

FIELD MISSION ACTIVITIES

DATE	DAILY ACTIVITIES
23/02/96	Late night arrival
24/02/96	Meeting Mr. Hannak. General planning of the mission.
25/02/96	Sunday
26/02/96	Detailed inspection of CETP Pallavaram.
27/02/96	Detailed inspection of CETP Ranipet and ETP MHT
28/02/96	Detailed inspection of ETP PKL
29/02/96	- Participation in WORKSHOP ON EFFECTIVE TREATMENT AND DISPOSAL OF TANNERY WASTES AND EFFLUENT organized by ILIFO - Meeting BSO, Mr. Buljan and RePO representatives to plan the activities connected to the project and to the Coordination and Planning Meeting (4-7/3/96) of the REGIONAL PROGRAMME FOR POLLUTION CONTROL IN THE TANNING INDUSTRY IN SE ASIA
01/03/96	- Meeting CETP Pallavaram Manager, Mr. Jayakodi and UEM technologist, Mr. Emmanuel to discus fine tuning and optimization of the plant operation. - Discussing the possibility to test application of the PKL treated effluent and sludge on the surrounding farm land with the PKL Manager Mr. N. Ahmad
02/03/96	Meeting BSO, Mr. Buljan and RePO representatives to discus Mr. Buljan's BROAD OVERVIEW OF POSSIBLE TOPICS TO BE ADDRESSED, STUDIES TO BE UNDERTAKEN AND/OR PILOT UNITS TO BE SET-UP FOR DEVELOPMENT, DEMONSTRATION AND TRAINING UNDER REGIONAL SE ASIA PROGRAM and preparation of the SC-I written comments and recommendations on it.
03/03/96	- Preparation of the LIST OF THE MAIN PROBLEMS AND ACTIONS REQUIRED under US/IND/92/244, to serve as the base for the wrap-up meeting in TNPCB. - Coordination of the DP/SYR/92/004 project with UNIDO Consultant, Mr. M. van Vliet.
04/03/96	Inspection of CETP Ranipet and ETP MHT and preparation of additional information on possible follow-up activities of the project.
05/03/96	- Participation in the Coordination and Planning Meeting with emphasis on monitoring and collection/processing of the data/parameters from the plants implemented in the region as well as on possible future R&D activities. - Mr. Selanec debriefing NPD, Mr. B. Koirala, Mr. Buljan and RePO representatives on the field mission on US/NEP/92/120.
06/03/96	- Visit to CETP Ranipet and ETP MHT within the program of the Coordination and Planning Meeting. - Separate visit to the new SIDCO-Ranipet CETP.
07/03/96	- Visit to the Cr-recovery plant and CETP Pallavaram with the Meeting participants - Preparation of the project wrap-up meeting with BSO, Mr. Buljan and RePO representatives
08/03/96	- The project wrap-up meeting with BSO, Mr. Buljan, TNPCB, PTIETC, MHT, PKL, TALCO, UEM and RePO representatives. - Preparation of the request for the belt press adjustment, fine tuning and staff training which RePO should mail to Italprogetti. - Final meeting on the project with BSO, Mr. Buljan
09/03/96	Visit to the Madhavaram Industrial Estate in Madras and discussion with Mr. N. T. Rajan and local tanners about the possibilities for CETP construction.
10/03/96	Mr.Bosnic departure
11/03/96	Mr. Selanec departure

ANNEX 2

LIST OF THE MAIN PROBLEMS AND ACTIONS REQUIRED

US/IND/90/244

LIST OF THE MAIN PROBLEMS AND ACTIONS REQUIRED

0. GENERAL (TO BE APPLIED AT ALL THE CETPS AND ETPS)

0.0 Organize permanent checking, cleaning and maintenance of all the plant parts and equipment Regular inventory and purchase of all the materials and spare parts should be organized as well. All the plant operators and support staff should have strictly defined day to day and periodical duties.

0.1 Check all the methods for determination of analytical parameters including the calculations.

0.2 Prepare and adopt log-sheets for operational and analytical parameters.

Notes: 1. Operational parameters: flow, working hours of equipment, chemical consumption, power consumption, volumes of evacuated solid wastes (screenings, sludge), interruptions of the operation including reasons for them, data recorded by instruments, etc.

2. Analytical parameters: raw effluent characteristics, treated effluent characteristics throughout the treatment process (after mechanical treatment, after chemical treatment, after biological treatment, etc.), sludge characteristics, solid waste characteristics.

0.3 Regular filling of the log-sheets (originals to be retained at the plant and copies regularly to be send to the UNIDO Office in Madras).

0.4 Calculate operation/maintenance costs, expressing them absolutely (material consumption, power consumption, labor, sludge transport etc.) and relatively per m3 of effluent treated and per leather produced. Send the results to the UNIDO Office - Madras once per a month.

0.5 Organize temporary control and correction of particular operations with the objective of technical and economical optimization.

1. CETP PALLAVARAM

1.1 Treated effluent discharge pipeline

Urgently solve the problem since now it is not possible to run the plant correctly. The solution alternatives (gravity or forced pipeline) should be properly designed, compared from technical and economical points of view and only than executed.

1.2 Sludge disposal

Disposal (temporary and/or permanent) should be urgently solved since now it is not possible to run the plant correctly.

1.3 Belt filter press

The press should be put in proper function urgently since now it is not possible to run the plant correctly. Experienced fitting/operating expert should be send from producer side to find reasons for belt slipping and to train the press operator. PTIETC should urgently appoint new press operator (previous, already trained has left).

1.4 Staff

Employ and appoint all the staff necessary in accordance with the prepared scheme.

1.5 Others

Check and solve other problems specified in the previous SC-I reports.

2. CETP RANIPET

2.1 Try to solve the problem of settling in the collection tank (by constant evacuation or/and additional mixing)

2.2 Increase the capacity of the fine screening since the inflow contains unexpectedly high concentration of solids (by adding required number of rotary screens).

2.3 Insure proper execution and performance of the mechanical sludge dewatering system so that it is used as planned (within the CETP system as well as for demonstration required by the UNIDO project).

2.4 Sludge disposal (temporary and/or permanent) should be urgently solved.

3. ETP for PKL Tannery

3.1 Instrumentation supplied by UNIDO should be made operative.

3.2 Provide PC to ETP laboratory to facilitate data recording, processing and presentation.

3.3 Compete the upgrading of the sludge drying beds (already started).

4. ETP for MH tannery

4.1 Upgrade the system in the way recommended in SC-I "Progress report for the phase II, October 1995" to enable correct operation of the "bio-solar" system and to achieve better treatment results.

4.2 Investigate the problem of soaking liquor evacuation and evaporation since it was not planned for it

to be included into ETP.

4.3 Upgrade the sludge drying ponds if possible.

Madras, 3 March, 1996 Sub-contractor I

ANNEX 3

MINUTES OF THE PROJECT WRAP-UP MEETING HELD IN TNPCB-MADRAS ON 08/03/96

A-3

Minutes of the meeting held at 1000 hrs on 8 March 1996 in Tamilnadu Pollution Control Board meeting hall at the conclusion of TEH projekt team's subcontract under US/IND/90/244

A list of participants in the meeting is enclosed at Annexure 1.

The meeting was held as a wrap up session with the subcontractor M/s TEH projekt, Croatia, who were responsible for implementation of Subcontract 1 under US/IND/90/244 in the CETP at Pallavaram, CETP at Ranipet, ETP at Presidency Kid Leather, Kannivakkam and ETP at Meera Hussain Tannery, Ranipet. The list of important recommendations made by the sub contractor's team is enclosed at Annexure 2.

Mr. A. Sahasranaman, Programme Coordinator, Regional Programme Office (RePO), UNIDO, presented the general findings of the sub contractor's team as applicable to all the units. The participants noted all the findings and agreed to implement these. They also agreed to provide the UNIDO RePO at Madras with the log sheets as well as operation and maintenance costs, on a monthly basis.

The other important general point discussed, relevant to all the units, was the disposal of sludge. It was pointed out that with a large number of effluent treatment plants coming up, thanks to the efforts of the TNPCB, the quantity of sludge generated was considerable. The siting of disposal sites as close to these clusters as possible has assumed much greater urgency now. Besides, some of the operating plants need temporary sites till permanent sites are finalised. Mr. Rengasamy agreed to give clearance to the temporary sites before end of May 1996, if the applications were made immediately. This time is required because the temporary sites must also conform to prescribed standards of TNPCB. On the subject of management of permanent sites to be created in due course, the matter will be discussed by TNPCB with the concerned parties in due course.

CETP, Pallavaram

The findings of the experts' team were noted.

Mr. J. Buljan pointed out to the Chairman and Managing Director of PTIETC that subsequent to the last meeting in January 1996, there has not been much progress in the CETP vis a vis the improvements recommended. He stated that though UNIDO was very keenly interested in presenting CETP Pallavaram as a model and in that regard would like to continue its support and association with the plant, this would be possible only if the plant management rectified the main defects already pointed out and achieve greater operational efficiency.

With regard to the discharge pipeline for carriage of treated effluent, the Member Secretary, TNPCB, Mr. Rengasamy stated that he would induct the services of experienced engineers from the Madras Metropolitan Water Supply Deptt and do a re-survey of the entire pipeline. Thereafter, redesigning of this pipeline and required modifications would be carried out by the PTIETC management. It was agreed that this would be completed as soon as possible. PTIETC estimated that the entire task could be completed in 2 months.

For the belt press, it was agreed that UNIDO would invite a technical expert from the machinery supplier to set this right. It was however pointed out that PTIETC must have an operator appointed beforehand so that when the expert visited India, he could train the PTIETC operator as well.

The management of PTIETC agreed to engage required number of staff with appropriate technical background.

The pending issues between PTIETC and UEM, it was hoped, would be sorted out, with the help of the good offices of TNPCB, soon. The rectification of the various defects pointed out by the subcontractors in their previous reports would be carried out. It was repeatedly emphasised that the plant's efficiency and life would be seriously jeopardised if these defects were not rectified very urgently.

The request of PTIETC for providing a centrifuge sludge filter was not acceded to.

CETP, Ranipet.

The findings of the expert team were noted.

Mr. MM Hashim, Chairman of the Ranipet CETP stated that they had set up a vigilance committee to keep a watch on the member tanners. He also stated that they had decided to buy flow meters to measure the flow of effluent from each tannery. The experts however recommended that the purchase of flow meters should be postponed for the present as the flow meters tended to become disfunctional if these were used to measure effluents. Instead, the practices adopted in the primary treatment in the tanneries must be evaluated immediately by an expert. ENKEM Engineers, it was felt, were competent to do this task but the CETP management will have to specifically entrust this task to them. Only after necessary improvements are made in the primary treatment systems should the management evaluate the additional requirements of the plant in the shape of, say, one more receiving sump/ one more clarifocculator, etc. Looking at the present characteristics of the effluent received by the CETP, the experts felt that the CETP could immediately go in for two more konica screens to sieve the finer particles of 3mm size as well as a floating aerator or an injector in the receiving sump to keep the effluent received in a state of constant agitation. The request of CETP Ranipet that UNIDO should provide the additional screens was recorded.

Mr. Hashim's request that an expert should be fielded to study the situation on the ground and suggest a fool proof method for measuring the effluents discharged by member tanners was accepted and an appropriate expert would be fielded soon.

Mr. Hashim's request that tertiary treatment of effluents must be taken up was discussed but it was considered too premature in the current context of India. However, his request that UNIDO should advise the Government of Tamilnadu and the TNPCB that tertiary treatment of effluents at this stage would be premature in Indian context was accepted. An appropriate communication in this regard will be issued.

Effluent Treatment Plant of Presidency Kid Leathers, Kannivakkam.

The findings of the experts team were noted.

With regard to the process control system supplied by Micro Control Systems, Pune, Mr. Niaz Ahmad stated that despite their best efforts they could not get the supplier rectify the defects. It was requested that PKL should persist with the supplier. RePO UNIDO will also take up the matter with the supplier.

Mr. Niaz Ahmad agreed to provide a PC to the laboratory for proper storage of data, its analysis and presentation. He also stated that the upgradation of the sludge drying bed would be completed in about a month.

Now that the TNPCB has given permission to PKL to use the treated effluent for irrigating trees and the sludge as fertiliser, it was hoped that PKL would be able to carry out this experiment subject to the conditions specified. However, TNPCB agreed to send a team of experts from the departments of Agriculture, Forest and Social Forestry to advise PKL on the type of species that may be promoted in their land.

Effluent Treatment Plant at Meera Hussain Tannery, Ranipet

Member Secretary, TNPCB agreed to depute his Divisional Engineer at Vellore to MHT to see how the bio solar system could be upgraded. The report of the sub contractor for Phase II-October 1995 will also be considered. Mr. Buljan wanted further discussion on this with the sub contractor.

It was agreed that this was a good model plant for a small rural based tannery doing vegetable tanning.

The meeting ended with a vote of thanks to the chair.

Annexure 1

List of Participants

TNPCB

Mr. G. Rengasamy, Member Secretary.
Mr. K. Renganathan, Jt. Chief Environmental Engineer

UNIDO

Mr. Jakov Buljan, Senior Industrial Development Officer, UNIDO, Vienna.
Mr. A. Sahasranaman, Programme Coordinator, RePO, UNIDO, Madras.
Mr. Valentin Post, Associate Expert, RePO, UNIDO, Madras.

PTIETC, Pallavaram

Mr. Sethu Lakshmanan, Chairman.
Mr. Arun Mehra, Managing Director.
Mr. P. Jeyakodi, Plant Engineer.
Mr. KV Emmanuel, Project Manager, UEM Ltd.

CETP, Ranipet.

Mr. MM Hashim, Chairman.
Mr. TM Abdul Rahim
Mr. CM Zafarullah, Secretary
Mr. G. Mohd. Kaleemullah, VISHTEC, Melvisharam
Mr. KS Rasheed, Talco.

Presidency Kid Leather, Kannivakkam

Mr. Niaz Ahmad
Mr. Rajamurthy

TEHprojekt, Croatia

Mr. S. Selanec
Mr. M. Bosnic

ANNEX 4

STATUS REPORT ON CETPs PALLAVARAM & RANIPET AND ETPs PKL & MHT

Follow-up on CETP/ETP Status

S.No.	Activities/Pre-requisites PALLAVARAM	Deadline	Agency responsible	Progress as of 19/09/95	Progress as of 07/03/1996
	Conveyance System				
1.1.	Pre-treatment units				not checked
	Clean Pre-treatment units	30/03/95	PTIETC	98 out of 138 installed, damages of collection pipeline in course of road construction, should be immediately repaired, still 50 tanneries not connected to the system	"
	Re-commission pre-treatment units	15/04/95	TNPCB	to be checked by PTIETC	"
1.2.	Individual Pumping stations	15/02/95	PTIETC	6 installed, 1 to be installed	"
1.3.	Complete already constructed Common Pumping Stations covers, surrounding, connection and proper communication with control CETP room	30/03/95	PTIETC UEM	all flowmeters to be changed or repaired (size!)	"
1.4.	Clean complete network, remove air-locks and test free flow	30/03/95	PTIETC TNPCB		" "
	CETP				
1.	Collection Well & Main Pumping Station				
1.1.	Provide rake for coarse screen	10/03/95	UEM	completed	
1.2.	Replace oil seal at one pump	30/03/95	UEM	completed but pump not installed	completed,
1.3.	Provide automatic operation of the pumps. Adjust the level switches to protect drying beds from flooding and to protect the pumps from dry run.	20/03/95	UEM	UEM to complete as per contractual obligation fix level switches properly	completed
1.4.	Modify, provide adequate system to lift pumps	20/04/95	UEM	should be done as recommended by Kishor	not completed
1.5.	Upgrade electric equipment and installations		UEM	installed equipment is substandard, should be replaced or repaired. Cables should be properly connected.	not completed
2.	Rotary Fine Screen				
2.1.	Provide automatic operation simultaneous with main pumps	20/03/95	UEM	UEM to complete as per contract, use already available provision at control board	completed
2.2.	Connect waste waters from the fine screen (spilling, drainage, screening) back to the pumping station.	20/03/95	UEM	completed, arrangement of walls not suitable	no change
2.3.	Install manual screens made of good quality stainless steel. NOTE: Damage of the connection between the compactor and its drive successfully rectified	25/06/95	PTIETC	UEM has removed screens, should replace immediately (preferably by stainless steel screens)	mild steel screens installed

3.	Grit Chamber				
3.1.	Modify and adjust civil works and equipment required for proper operation	20/03/95	UEM	partly completed, but still grit rake not adjusted, organic return device not appropriate, grit chute not appropriate	partly completed, but bad quality of the equipment causes problems (one of the scrapper axes loose)
3.2.	Prevent approach to the open gear mechanism	30/03/95	UEM	completely inappropriate solution, to be replaced	no change
4.	Equalization Tanks				
4.0.	Provide equalization pump suction at adequate level to ensure proper effluent equalization	15/03/95	UEM	completed	completed
4.1.	Modify emergency outlet (sluice) in ET-1	20/03/95	UEM	UEM to complete as per contract, inlet channel of insufficient capacity.	nothing has been done
4.2.	Block temporary opening to ET-2	20/03/95	UEM		nothing has been done
4.3.	Remove present inlet distribution pipe and provide adequate distribution overflows to be regulated by sluices	30/03/95	UEM		nothing has been done
4.4.	In cooperation with supplier rectify the problems with aerators (high Amps draw)	30/04/95	UEM	Kishor successfully replaced by open type impeller	completed
4.5.	Provide easier lifting of aerators (modification)	30/04/95	UEM	started to be rectified	arrangement implemented but not tested
4.6.	It would be useful to provide bottom connection with valves between the tanks	trial peribd	UEM		*not done*
4.7.	Provide adequate protection of electrical switch board covers (minimum IP55 protection)	immediately	UEM	ongoing solution inadequate	ongoing solution inadequate
5.	Equalization Pumping Station				
5.1.	Provide adequate priming	trial peribd	UEM	completed	completed
5.2.	It would be more practical if the suction pipes are directly horizontally (above the ground) connected with pumps for easier maintenance.	trial peribd	UEM	presently not a problem	no change
5.3.	Flow regulation valve to be provided (return to ET)	25/06/95	UEM	provide proper flow equalization	nothing has been done, change immediately
6.	Flash Mixer Tank				
6.1.	Provide necessary detention in the tank (increase outlet level)	30/04/95	UEM	UEM to complete as per contract	complete immediately
7.	Distribution Chamber and Splitter Boxes				
7.1.	Modify existing chambers providing required levels of the inlets and outlets (according to the detailed surveys, design and calculation) to enable distribution and/or use of only one clariflocculator if necessary.	30/03/95	UEM	UEM to fulfill hydraulic and technological requirements.	to be completed immediately
7.2.	Install proper pH measuring and recording	30/03/95	UEM	completed	never seen in function, present arrangement of probe and housing seems to be inadequate
8.	Clariflocculators				
8.1.	Adjust inlet pipes	05/03/95	UEM		to be done immediately

8.2.	Adjust RPMs of the flocculators and scrapers	10/03/95	UEM	scrapers and mechanisms dismantled, scraper bridges sagged, rectification to be completed immediately	completed
8.3.	Install properly adjusted neoprene scrapers (overlapping scraper parts)	10/03/95	UEM	as above	completed, but not possible to control since in operation
8.4.	Properly construct skimmers, scum boxes and scum evacuation	30/04/95	UEM	as above; scum removal system should be properly implemented	no change
8.5.	Adjust weirs	trial period	UEM	to be done immediately	no change
8.6.	All pipelines should fulfill hydraulic requirements		UEM	nothing has been done	no change
8.7.	Gear and transmission mechanisms to be improved	15/09/95	UEM		Although new mechanisms are of a better quality than previous, they do not comply with the standards for 10-20 years of operation.
8.8.	All scraper bridges to be fortified	15/09/95	UEM		partly completed but beyond standards of developed countries
9.	Aeration Tanks				
9.1.	Enable proper operation in series (prolong HDPE pipe to the end of AT-1)	30/04/95	UEM	UEM to complete as per contract, to be completed immediately	no change
9.2.	Install adequate pressure gauges (0-1 bars) for the blowers to enable proper use of otherwise successfully commissioned and tested aeration system (blowers, air-distribution pipelines, fittings, valves and diffusers).	20/02/95	UEM	completed, but installed pressure gauge 0-4 bars, maintain properly! (presently valves and pipes loose)	no change
9.3.	Provide adequate DO measurement to enable optimum aeration	30/03/95	UEM	still not calibrated, to be completed immediately	no change
9.4.	One blower to be replaced or repaired	25/06/95	UEM	repaired	completed
9.5.	Properly maintain aeration system	ongoing	UEM	some of the flexible connections between blowers and air collectors broken, blower drive belts missing (presently only two blowers can be used), should be repaired immediately	completed but weights on security valve of one blower are missing
10.	Distribution Chambers				
10.1.	Modify existing chambers providing adequate levels of the inlets and outlets (according to the detailed surveys, design and calculations).	30/03/95	UEM	see 7.	no change
11.	Secondary Settling Tanks				
11.1.	Install properly adjusted neoprene scrapers (overlapping scraper parts)	30/03/95	UEM	repair not completed, only one scraper put in operation	completed, since in operation no control possible
11.2.	Properly construct skimmers, scum boxes and scum airlift pumps	30/03/95	UEM	presently no scum, recommendation SC-1 to be completed as per contract (skimmers and scum removal system)	no change
11.3.	Adjust weirs	trial period	UEM		no change
12.	Treated Effluent Outlet				

12.1.	Adjust discharge pipeline based on proper hydraulic calculation prior to rectification	01/10/95	UEM PTIETC	one pump installed, SC-I considers this as inadequate solutions. It has been found that the pipeline is damaged at three-four places, to be repaired immediately	temporary solution with only one pump (see the Field Mission Report)
12.2.	Install proper pH & conductivity end-control	30/03/95	UEM	never seen in function, present arrangement of probe and housing seems to be inadequate	not solved
13.	Flow-meter Channel				
13.1.	Design and adjust outlet pipe at proper level (ref.12.1.)	30/04/95	PTIETC	operational only in dry season	not solved
13.2.	Provide required flow measurement and recording	30/04/95	UEM	nothing been done, cannot be verified till proper completion of outlet pipeline	not solved
14.	Treated Effluent Reuse				
14.1.	Provide constant treatment and required quantity of process water		PTIETC	solution not adequate for full utilization, required quantity and constant pressure of water should ensured	system does not seem functional (valves, pressure gauges corroded). No time to check!
14.2.	Test and provide (PTIETC) dosage of anti foaming agent if necessary	trial period	UEM PTIETC	presently no foam formation	presently no foam formation
15.	Primary and Secondary Sludge Valve Chambers and PS				
15.1.	Provide dry valve chambers with automatic valves (protected with manual long spindle valves) or manual valves as required.	30/05/95	UEM	nothing has been done, to be completed immediately	No change at primary sludge. Prolonged spindles installed at secondary sludge. Should be solved in dry period when valve chambers dry.
15.2.	Provide automatic operation and protection of the pumps	30/04/95	UEM	level switches not properly fixed, rectify immediately	no change
15.3.	Protect overflowing of the sludge collection tanks - top should be at the same level as the outlet of the clariflocculators	30/04/95	UEM	to be completed immediately	no change
15.4.	Modify, provide adequate system to lift the pumps	30/04/95	UEM	UEM to complete immediately	no change
19.	Thickener				
19.1.	Install properly adjusted neoprene scrapers	30/04/95	UEM	scraper and bridge dismantled, to be repaired	cannot be checked since in operation
19.2.	Provide dry valve chamber with manual long spindle valves, also verify drainage pipe diameter	30/05/95	UEM	current solution not acceptable	no change
19.3.	Adjust overflow weir (concrete and MS) and central cylinder level, same as clarifier	30/04/95	UEM	UEM to complete as per contract immediately	nothing has been done, to be completed immediately
20.	Thickened Sludge Pipeline				
20.1.	Adjust drying bed inlet levels	30/03/95	UEM	to be checked in operation	nothing has been done
20.2.	Provide easy closing of the valves (no leaking).	30/03/95	UEM	to be checked in operation	nothing has been done

20.3.	It would be useful to install a valve and dismountable joint with flange at the intake of belt press feeding pumps to enable easy maintenance		UEM	permanently clogged, UEM to find solution immediately	no solution provided
20.4.	Provide adequate means for pipe flushing (water, pressure, joints).	30/04/95	PTIETC	see above	no change
21.	Sludge Drying Beds				
21.1.	Complete beds	20/02/95	UEM	completed, however beds are not properly used and are currently flooded	
21.2.	Design and replace, if necessary, main drainage pipe (currently diameter 100 mm from the drying beds, belt filter press, chemical house and thickener with bigger diameter. Manholes at all underground joints are necessary for proper maintenance.	30/03/95	UEM	no further action required, backflooding is regulated by floating switches in the main pumping station. But SC-I considers present solution (100 mm pipes not properly installed, without manholes at the pipe joints) inadequate	no change
21.3.	Provide concrete slabs to prevent erosion of the beds under the sludge inlets.	10/04/95	PTIETC	completed	completed
22.	Chemical House				
22.1.	Lime, Al-sulphate and DAP preparation/dosage facilities				no maintenance
	- Provide protection against overflowing from the tanks	30/03/95	UEM	since presently the whole system is not being used, it could not be checked, but it seems nothing has been done	no maintenance
	- Provide protection of the equipment against corrosion	30/04/95	UEM	dosing pumps are rusty, and chemical residuals not removed from equipment	
	- Prevent leakings of the pipes, valves and fittings	20/03/95	PTIETC	see above	
	- Provide adequate (easy movable, corrosion protected) baskets	30/04/95	UEM	not available, to be provided and fixed immediately	
	- Design and provide operation of the alum and lime dosing pumps simultaneous with operation of the equalization pumps	30/04/95	UEM	S C-I is of the opinion that this is useful and necessary	
22.2.	Mn-salt Preparation and Dosage Facilities will be designed and provided by UEM in accordance with trial experience	trial period	UEM	so far not necessary	so far not necessary
22.3.	Anionic Polyelectrolyte Preparation/Dosage Units				
	- Provide trays under the units to prevent spillage of the highly viscous and slippery solution.	30/03/95	PTIETC	solution acceptable	solution acceptable
	- Design and provide operation of the dosing pumps and solenoid valves for dilution of PE solution simultaneous with operation of the equalization pumps. Note: Solenoid valves operate at 24 V AC.	30/03/95	UEM	UEM to complete as per contract and instruction manuals provided by Italprogetti	no maintenance. Dosing pumps and electro-magnetic valves not connected to the operation of equalization pumps
22.4.	Belt Filter Press, Cationic Polyelectrolyte Preparation/Dosage Unit and Sludge Belt Conveyor.			PTIETC to recruit and properly train operator immediately	

	- Ensure proper operation of belt press under full load			Since belt press has not been fully used due to non-operation of the CETP, SC-I recommends to field experienced operator of Italprogetti to verify the function of the belt press under full capacity (CETP in normal operation) and train new operator.	See the Field Mission Report
	- Provide trays under the PE unit to prevent spillage of the highly viscous and slippery solution.	30/04/95	PTIETC	solution acceptable, chemicals and sludge residuals have not been removed from system due to lack of proper operation and maintenance	
22.5.	Floor and Equipment Washing: provide washing facility (hose, connections)	30/03/95	PTIETC	completed	completed
22.6.	Floor Drainage: Enable drainage of all washings/leaking	30/03/95	PTIETC	completed	completed
22.7.	Provide flushing of all chemical pipelines	25/06/95	UEM	to be provided immediately	no change
23.	Main Building				
23.1.	Laboratory Equipment and Chemicals: Ensure purchases equipment and chemicals be of adequate quality.	20/03/95	PTIETC	to be followed up by UNIDO/UNDP in Delhi	no results received
23.2.	Electrical Works and Instrumentation.				
	- Provide all the required automatic monitoring and control of the whole common sewerage and treatment system.	30/04/95	UEM	UEM should provide as per contract and generally acknowledged standard. It seems that majority of provided equipment is substandard (also refer PTIETC findings No.119/CETP/76, July 1995)	no change
	- Provide graphic display of process operation with signaling lamps indicating operation and alarm.	trial period	UEM	additional information for finalizing purchase order have not been provided by UEM	
25.	Piping				
25.1.	Prevent all leaking - especially acute at the HDPE/concrete connections	20/04/95	UEM	further trials required	nothing has been done
25.2.	It would be useful to design and implement emergency by-passes of particular CETP units/treatment steps (for example biological step to enable easier maintenance).	trial period	PTIETC	to be designed and proposed to PTIETC by UEM	nothing has been done
26.	Water Supply System Ensure steady quantity, quality and pressure of the required process and sanitary water (present temporary arrangement will not satisfy the full-scale operation).		PTIETC		still to be provided
27.	Compound Roads Complete roads and areas to be paved together with the required drainage system	30/06/95	PTIETC	no change, to be completed later due to current lack of funds	no change
29.	Walkways				no change

29.1.	Provide easy over ground communication between the units, necessary for the CETP operation and maintenance.	31/05/95	UEM	to be designed and proposed to PTIETC by UEM	no design available
29.2.	Provide fences at all walkways	31/05/95	UEM	to be completed	to be completed
29.3.	Protect against corrosion		UEM PTIETC	all handrails and walkways are rusty, constant protection has to be done	
30.	Final Sludge Disposal				See Field Mission Report
30.1.	Sludge Transport				
	- Procure one tractor	31/01/95	PTIETC	SC-I is of the opinion that only one tractor and one trailer (being purchased by UNIDO) will not suffice with demand. PTIETC should make arrangement for hiring additional transport capacity	
	- Procure 2 trailers (of 8t capacity) together with tank (fro chrome liquor) mounted on one trailer	30/03/95	PTIETC	UNIDO waiting for quotations for one trailer, one under procurement by PTIETC	
30.2.	Provide permanent site (temporary site for 4000m3 has been purchased).	trial period		pending with TNPCB, issue should be solved immediately prior to start-up of CETP	
30.3.	Prepare temporary disposal site	30/04/95	PTIETC	to be completed immediately under supervision of TNPCB	same
31.	Other Pre-requisites				
31.1.	Provide easy closing of all valves (no leaking)	30/04/95	UEM	to be tested by PTIETC	still,to be tested by PTIETC
31.2.	Prevent approach to the open rotating mechanisms	30/04/95	UEM	UEM to complete per contract	to be done immediately
31.3.	Procure chemicals for trial period.	30/04/95	UEM	UNIDO placed order for PE	procured
	Order chemicals for the continuation of CETP operation	trial period	PTIETC	rest to be procured locally	to be procured locally
31.4.	Prepare detailed process description with calculations, as-built drawings and operation/maintenance manuals in adequate binding (parts which will be used constantly by operators should be bound separately in plastic).	trial period	UEM	to be done immediately by UEM	to be done immediately
31.5.	Prepare detailed PTIETC organigram with staff list and staff deputed to UEM for practical training during trial period.	30/03/95	PTIETC	staff for training not available, PTIETC to immediately proceed with recruitment of operators	Unacceptable situation. Practically no (trained) staff.
31.6.	Respect detailed plan and program of start-up and staff training prepared by UEM		PTIETC	see 31.5.	see 31.5.
31.7.	Provide adequate storage and handling of spare parts and consumables and study necessity of possible purchase and replacement of parts which are not presently available. Also study possibilities to replace foreign parts with adequate Indian parts.	trial period	PTIETC	Organize spare parts and inventory management. UEM to provide full set of spare parts for equipment as specified in original purchase orders and contract. These spareparts are not to be used by UEM during the trial run period!	No change
	- Provide necessary workshop tools		PTIETC	under procurement	
31.8.	Arrange protection of all electrical outdoor equipment (should be like IP 55)	15/09/95	UEM PTIETC	to be completed immediately	not according the standards

31.9	Ensure gobd maintenance of all equipment and installations as per standards and manuals	ongoing	UEM PTIETC	emergency DG set to be repaired immediately, maintenance has to be done although plant is not working	
31.10	Install proper lighting and ventilation in motor control room	15/09/95	UEM		
32	Operation Control				
32.1.	Connect PLC and computer	01/10/95	UEM		not being attended at all

S.No.	Activities/Pre-requisites RANIPET	Deadline	Agencies involved	Progress as of 19/09/95	Progress as of 07/03/96
	Conveyance System				
1.1.		15/04/95	TALCO		
1.2.	Complete and commission PS I+ II	20/03/95	ENKEM	PS-I completed, PS-II work pending	
1.3.	Complete missing parts of pressure line	20/03/95	ENKEM		
1.4.	Connect all 70 tanneries to the conveyance system	31/03/95	TALCO		it does not seem that pretreatment units within the tanneries are properly maintained
	CETP				
2.1.	Connect CETP to electric grid	31/03/95	TALCO	completed	
2.2.	Install rotary screen	15/09/95	ENKEM	installed and tested on 18/09/95, in/outlet capacity to be appropriately modified. Automatic operation issue has been discussed with SC-I, Italprogetti and ENKEM and all problems solved. After completion of modifications, screen can be commissioned.	Overloaded by unexpectedly high concentration of fine particles. It is recommended that automatic washing of the screen is introduced and that at least two more rotary screens are installed if possible. See the Field Mission Report!
3.1.	Finalize bottom sealing in anaerobic/aerobic lagoons	15/03/95	ENKEM	new deadline 25/06/95	completed
3.2.	Install aeration system in aerobic lagoon (five surface floating aerators)	15/09/95	ENKEM	installed, but still to be tested in operation	completed
3.3.	Complete lagoon walls	20/03/95	ENKEM	completed	completed
4.1.	Install and connect sludge centrifuge	10/05/95	ENKEM	completed, but to be tested	completed See the Field Mission Report!
4.2.	Trial run sludge centrifuge	15/05/95	ENKEM	first test run on 18/09/95 for function, sludge was dewatered, continue test trials and fine tuning. After successful verification of guaranteed values (capacity, cake dryness, SS in centrate, PE consumption) the centrifuge can be commissioned.	completed and dried sludge conveyer introduced. See the Field Mission Report!
4.3.	Complete PE purchase	30/03/95	TALCO	under procurement	some PE borough from UNIDO stock
5.1.	Commission temporary sludge disposal site	31/05/95	TNPCB	TALCO to prepare site in RANITEC	still pending See the Field Mission Report!
5.2.	Prepare temporary sludge disposal site	15/06/95	TALCO	solution not available	See the Field Mission Report!
5.3.	Identify and commission permanent sludge disposal site	31/10/95	TNPCB/ TALCO	pending	no change
6.1.	Prepare process description with calculations	15/02/95	ENKEM	not available	description within the O/M Manual but no calculations
6.2.	Prepare as-built drawings	15/02/95	ENKEM	deadline 20/06/95	not available
6.3.	Prepare operation and maintenance manuals and forward to SC-I	15/02/95	ENKEM	to be completed immediately	submitted to SC-I on 17/12/95

6.4.	Prepare organigram with staff list (for ENKEM staff - 6 months operation). TALCO representatives recommend to include their CETP Vanianbady chemist into the training. He will later train the CETP Ranipet staff to be appointed by March 1995.	30/03/95	ENKEM	Management and maintenance will be contracted to outside company.	the plant is operated by ENKEM for the time being
6.5.	Purchase required chemicals	30/03/95	ENKEM	to be completed immediately	unknown quantity at the site
7.1.	Laboratory facilities	25/06/95	ENKEM	completed	working surfaces tiled with ordinary ceramic. It would be better to use special tiling (anti-acid) for laboratories
7.2.	Delivery and installation of laboratory equipment	30/06/95	ENKEM	to be delivered from CETP Pallavaram	completed
8.	Start-up of plant	30/06/95	ENKEM TALCO	CETP has been started, estimated effluent inflow more than 50% of designed capacity, however with by-passing anaerobic and aerobic lagoon. First treatment results acceptable. All equipment seems to be of acceptable standard and functional	The plant is operated with full designed hydraulic load but the concentrations of SS and organics significantly exceed the designed parameters. See the Field Mission Report!

S.No.	Activities/Pre-requisites ETP PKL	Deadline	Agencies Involved	Progress as of 19/09/95	Progress as of 07/03/96
1	Repair and/or replace flow meter and both pH meters	30/03/95	TNPCB	both pH meter, flowmeter and recorder are out of order, sent for repair	supposedly repaired but still not installed
2	Repair control panel (with 3-point strip chart recorder and common display unit)	15/04/95	TNPCB PKL	recorder sent for repair (under warranty) to manufacturer	not solved
3	Complete laboratory building	31/05/95		completed	
4	Install laboratory equipment (as per list)	15/06/95	TNPCB	completed, laboratory equipment under procurement	completed. SC-I does not believe that additional request for flame spectrophotometer could be justified for ETP laboratory **but an PC could be very useful for data logging, processing and dissemination**
5	Provide laboratory chemicals		UNIDO	under procurement	completed
6	Commission temporary sludge disposal site		TNPCB	decision pending with TNPCB	still no permanent solution. The sludge is disposed within the PKL property.

S.No.	Activities/Pre-requisites ETP MHT	Deadline	Agencies involved	Progress as of 19/09/95	Progress as of 07/03/96
1	Finalize laboratory facilities		ENKEM	not completed, laboratory equipment in bad condition	completed
2	Install laboratory equipment (as per list CTA)		TNPCB	production stopped for one month, restart operation by mid July 1995	completed
3	Appoint ETP operators		MHT		**still operated by ENKEM**
4	Analyze sludge composition to decide on further utilization		ENKEM		no change
	ADDITIONAL: SC-I recommends UNIDO to assist this upgrading by procurement of some/all equipment listed.			ETP was proved functional during the operation, but inconsistent operation of the tannery creates problems. After successful test with photo-sensitive bacteria recommendation has been made to upgrade the plant according to new scheme prepared by ENKEM.	ENKEM has implemented the "biosolar" step but it has to be still upgraded. **See Field Mission Report**
	Additional Equipment required for upgrading MHT Tannery : 1 Two Transfer Pumps 2 One Flocculator Channel 3 One FRP Settling Tank of size 2.5x1.5m SWD 4 One PE Agitator 5 One Lime Agitator 6 Two Lime Dosing Pumps 7 Two PE Dosing Pumps 8 Electricals				
	Estimated Total Cost: US$ 30,000				

ANNEX 5

DRAFT REPORT ON CETP PALLAVARAM OPERATION

prepared by

Mr. Emmanuel, UEM field manager

A-5

CETP : SALIENT FEATURES

Type of Industries catered for: Tanneries (Mainly wet blue to finish processing)
Designed Treatment Capacity : 3,000 M3/day.
Incoming Effluent B.O.D : 2,000 Mg/l
Treated Effluent B.O.D : < 30 Mg/l

Treatment Units

1. Receiving Sump : Collection capacity : 60 M3.provided with manually cleaned coarse bar screen. 3 Submersible Type pumps (KISHOR make) of 30 HP capacity and pumping rate of 300 M3/Hr has been installed.

Function : To collect effluent being pumped from outside collection wells. Coarse screen will remove coarse particles.

2. Mechanical Screen : 'Konica' Model, rotating self cleaning mechanical screen, supplied by UNIDO, provided with screen drum, doctor blades and solids conveyor.

Function : To remove fine leather particles, hair etc.

3. Detritor : Provided with Grit chamber, Grit removar mechanism and organic return pump.

Function : To remove grit (sand like particles') from effluent.

4. Equalisation Tanks : 2 Nos of 1200 M3 capacity each have been provided. 4 Nos. of submerged Ejector type Aerators - KISHOR make (2 in each Tank) of 25 HP capcity has been provided.

Function : To equalise effluent to get raw effluent of uniform quality. Ejector Aerator will keep solids in suspension and aeration also oxidises the Sulphides present in the raw effluent. Provisions for addition of MnSO4 catalyst for Sulphide oxidation also has been provided.

5. Equalised Effluent Transfer Pumps : 3 Nos self priming pumps : STORK make. 10 HP, 125 M3/Hr capacity. has been provided.

Function : To pump equalised raw effluent from Equalisation Tank to Flash Mixer.

6. Flash Mixer : Provided with paddle mixer revolving at slow speed.

Function : To mix effluent with coagulant chemicals added.

12/

7. Distribution chamber 1 : Function : To distribute well mixed effluent slurry into Clariflocculatros. An on-line pH meter has been provided to control the chemical addition.

8. Clariflocculators : 2 Nos Clariflocculators of 12 M dia have been provided.

Function : To seperate chemical sludge and precipitated materials from the effluent. Flocculator paddles provided shall impart gentle mixing to effect flocculation and clarifier scrapper shall transfer the sludge settled into centre sludge pit.

9. Distribution chamber 2 . Function : To combine Clarifier overflows into one stream.

10. Splitter Box : To distribute flow into two Aeration Tanks.

Function : To facilitate parallel and Series operation of Aeration Tanks.

11. Aeration Tanks : provided with a total detention time of 38 Hrs. 1200 Nos. of Fine Bubble Diffusers manufactured by UEM Inc. USA has been erected in these tanks. 5 Blowers of 50 HP capacity each has been provided for the supply of oxygen in the form of air into the system. Diffusers has been mounted in removable sub headers to facilitate easy lifting for servicing etc. FBDs are capable of achieving very high efficieny of BOD removal with power consumption only half of conventional aeration systems. The Aeration system has been supplied through UNIDO.

Function : Biological stabilisation of effluent using aerobic micro organisms converting organic matter into basic components like water and carbon dioxide.

12. Distribution Chamber 3 . Function : To distribute Aeration Tank overflow into two Clarifiers.

13. Secondary Clarifiers : 12 M dia with sludge scrapper arrangement.

Function : To seperate biological sludge from treated effluent.

14. Return Sludge Pumps : 3 Nos. submersible pumps of KISHOR make.

Function : To return/waste organic sludge settled in Clarifiers.

/3/

15. Sludge Thickener : 12 M dia Thickener with scrapper mechanism.

Function : To increase the solids concentration of primary and wasted secondary sludge through gravity thickening.

16. Belt press Filter : manufactured by ITALPROGETTI and supplied by UNIDO. capacity 400 Kg/Hr of dry solids.

Function : To dewater the thickened sludge to a solids concentration of 20% or above.

17. Sludge Drying Beds: 6 Nos, Total area 800 M2.

Function : To dewater sludge, in case belt press filter is not in operation.

The CETP is also provided with Diesel Generator of capacity 325 KVA, A full fledged Environmental Laboratory and a central control room to control the CETP operation through programmable logger controller and computer.

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CETP OPERATION-SALIENT POINTS

1.Ø INTRODUCTION

The CETP started commisioning process on 1.2.1995. By regulating the feeding into biological treatment system, by maintaining the ncessary environmental conditions for the micro organisms in Aeration Tanks and by resorting to seeding by way of charging activated sludge from a sewage treatment plant, we have tried to stabilise the biological metabolism of micro organisms involved in the treatment process. Now we are achieving steady, satisfactory results for treated effluent flowing out from the CETP. We are presenting the General observations as well as the results of our experiments done in the operation of CETP.

2.Ø QUANTITY OF EFFLUENT TREATED IN CETP

The flow rate recieved into the CETP was on lower side as against the designed capacity. There were a lot of fluctuations observed in daily flow rates, which was the main hurdle in stabilising the biological treatment system. Details of flow rates recieved is given in Annexure-1.

3.Ø EFFLUENT CHARACTERISTSICS

While the raw effluent characteristics, though varying met the anticipated values, the treated effluent characteristics surpassed anticipations. We have recieved B.O.D values around 15.Ø mg/l as against the tolerence limit of 3Ø mg/l. Though it was difficult to keep the B.O.D loading into the aeration system in a steady level due to fluctuations in raw effluent flow rates, the treated effluent characteristics generally maintained a steady level. The characteristics of raw and treated effluent as observed in Pallavaram CETP is presented in Annexure-2.

4.Ø SLUDGE GENERATION

The raw effluent we receieved into the CETP was observed to be having only 1Ø-2Ø% suspended solids of the anticipated value. We have also tried to minimise the sludge volume by regulating the Treatment Chemical quantities. The effect of the above, resulted in reduction of sludge volume to almost one - tenth of the anticipated figures.

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5.Ø ORGANISATIONAL SET UP FOR OPERATION OF CETP

The Operation Team of CETP consists of CETP Manager, Stores in charge, Electrical and Mechanical Operators, Two Jr. Operators, Casual labours etc.

6.Ø HOUSE KEEPING

Being a Demonstration Plant as well as a model for entire south-east Asia region, it is very important to keep the CETP and sorroundings neat and tidy. So far we were able to maintain this cleanliness inside the Plant. Four casual labours are exclusively engaged in cleaning operations and till date there was no complaints about any foul smell due to solids deposits etc.

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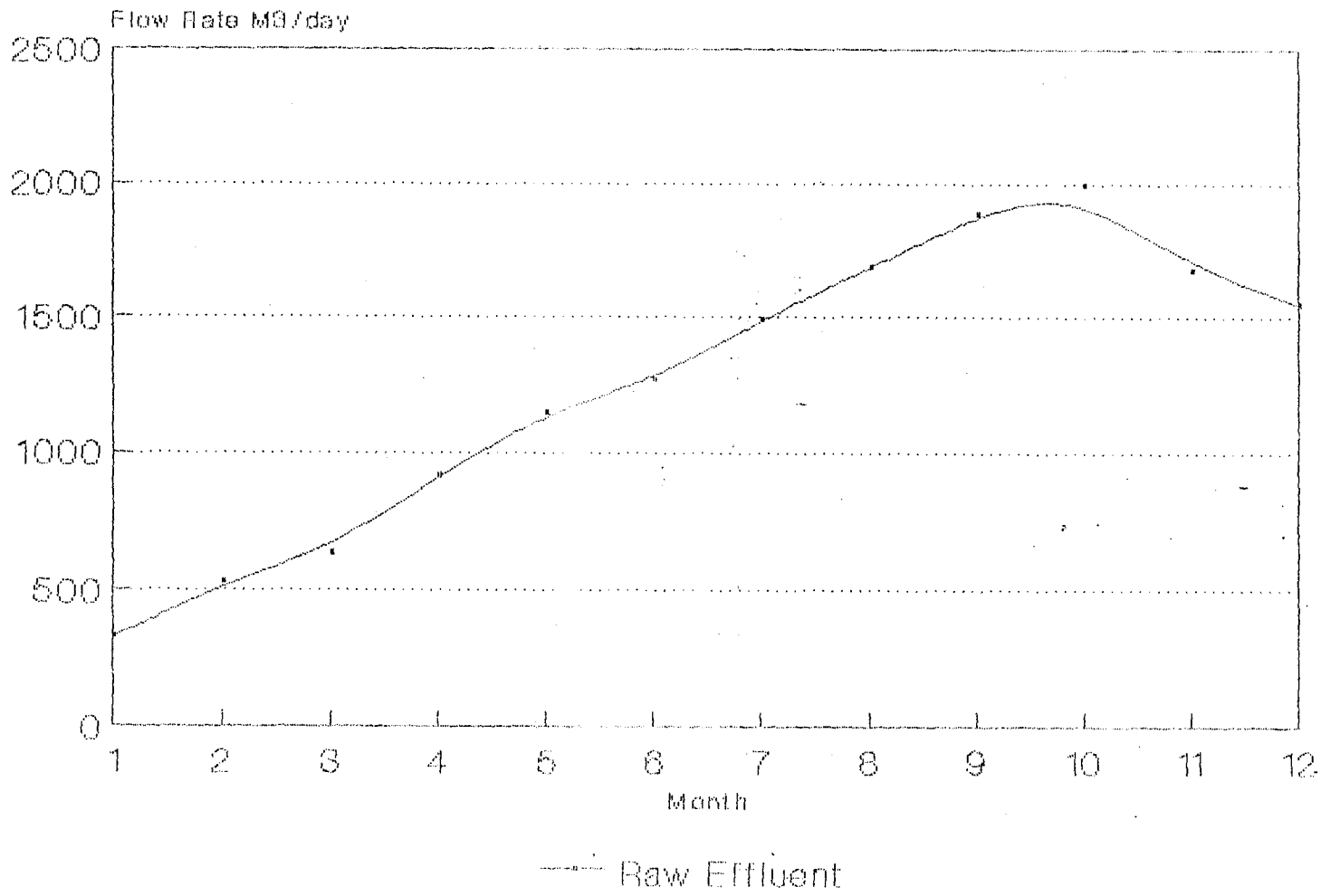
UEM

Average flow rate of effluent into CETP



Period : 1.2.1996 - 1.2.1998

Operation cost of CETP at Present

1.0. INTRODUCTION

The Present Operation cost of CETP is much lower than the designed / anticipated figures of operation cost. The main reason behind this phenomenon is the careful control of operation and by way of extracting the maximum benefit from biological treatment. One of the reasons why we are able to keep the high efficiency and the low cost of treatment is the lesser quantity of effluent to the designed quantity. Any planning related to operation of CETP is to be done, while obviously, the running cost of the plant at its full design level.

2.0. OPERATIONAL COST

2.1. Power

Power cost is the one single highest expenditure in the operation of CETP, Pallavaram. Whereas for an effluent feed volume of 2000 M^3/day, the anticipated figure of power cost remains around Rs. 16,000 per day, the actual figure came around Rs. 7,700 per day only. The reasons for the lesser cost were as follows:

1. Optimum utilization of biological treatment units.
2. Switching off done for Ejector Aerators.
3. Intermittant Operation of Pumps, especially secondary sludge pumps, which are supposed to be operated continuously.

2.2. Chemical

Since the effluent volume received into CETP, Pallavaram is lower than the designed level, we have explored the possibility of reducing operational cost by employing the biological treatment system to the maximum possible extent and by decreasing the coagulant chemical dosages. The results of initial trials were encouraging and thereafter the chemical dosages maintained were minimum and the cost involvement in this respect were less than Rs. 500.- per day.

2.3. Labour

At present, we are using the minimum labour force only for the operation of CETP, Pallavaram. The salary component of the present staff engaged here comes around Rs. 650 per day. Occassionally we are employing the services of more no. of casual labours and the expense component of that comes around Rs. 200 per day. Thus the total labour charges comes around Rs. 850.00 per day.

2.4 Expenditure for Preventive maintenance

For undertaking preventive maintinance like applying oil and grease etc to machinery in CETP, Pallavaram a good amount is being spent. For a Plant of this magnitude, where a lot of motors, gearboxes and other mechanisms are employed, frequent attention and care is indispensable. At present, around Rs. 200 per day is being used exclusively for such applications.

2.5. Routine maintenance & Repairs

Being a Plant consisting of hundreds of machinery, some maintinance works as well as repairs of minor complaints will be always there in CETP. This expenditure includes the replacement of fuses, attending any leaking joints, replacement of any broken component etc.

The present expenditures as regards to this sector comes around Rs. 250 per day.

2.6. Miscellaneous Expenses

This item includes the expenses related to office maintinance, Conveyance expenses for purchases etc. Expenses for communication with various offices concerned as well as suppliers of consumbles, stationary and printing etc.

At present, the expenses in this category comes around Rs. 200 per day.

3.0. EVALUATION OF PRESENT EXPENDITURE

From the foregoing, it is very clear that expenses related to various components had been somewhat optimised and the trend is encouraging.

The total expenses comes around Rs. 9,050 per day only, where as the anticipated figures were indicating an expenditure of around Rs. 23,000.00 per day.

3.1. COST SAVINGS

The above figures indicates a cost saving of around Rs. 14,000 per day in Operation & Maintenance of CETP, Pallavaram. This works out to Rs. 4.2 Lakhs per month and half a crore rupees (.5 million) per annum.

4.0. CONCLUSION

It can be seen that by regulating the treatment parameters and optimising performance of treatment systems, a lot of money can be saved from day to day operational cost of CETP. Perhaps, this saving can determine the survival of the CETP. itself, which generally has been considered as a thing of extravagance, being non productive from the planner's view point

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EXPERIMENTS IN CETP OPERATION

PART-1

EXPERIMENTS IN PRIMARY TREATMENT

As per the original suggestion, the Chemical treatment is to be done with Alum, Hydrated Lime and Anionic Polyelectrolytes, the dosages of which was decided to be fixed by trial and error in Operation.

1.Ø Chemical Dosages

We have started the treatment with 35Ø mg/l of Alum and 4ØØ mg/l Lime and with no polyelectrolyte. It was shown that the treatment results in in around 45% reduction in B.O.D and 5Ø-55% reduction in C.O.D.

Then we have tried the addition of 1 ppm of Anionic polyelectrolyte alongwith coagulant dosages as mentioned above. The addition of Polyelectrolyte was not found to be giving encouraging results as the improvement in reduction was only around 3% and 6% respectively. However, it was noted that the polyelectrolyte addition helps in faster settling rates and the settling time required could be reduced by around 3Ø%.

As a next step, we have increased the dosages of Alum and Lime to 4ØØ and 5ØØ mg/l respectively. We have obtained around 48-5Ø % reduction in B.O.D and 6Ø% reduction in C.O.D. However, it was noticed that the sludge volume is almost 2Ø% higher than the previous case. In this case also, we have tried the addition of Polyelectrolyte (1.Ø ppm) and the same is observed to be giving 3% and 5% reduction in B.O.D and C.O.D and the sludge volume was found to be reduced by 15%.

In next step, we have reduced the Chemical dosages to 2ØØ mg/l Alum and 3ØØ mg/l Lime with no polyelectrolyte. We have got 38% reduction in B.O.D and 42% reduction in C.O.D.

The effect of varying dosage of chemicals has been presented in Annexure-3.

Since we are not receiving the full quantity of effluent, we were not utilizing the efficiency of Aeration System to the maximum level. Hence we have decided to make use of the biological system

as much as possible, by reducing the chemical dosages in primary treatment. Hence we have fixed the dosages of Alum and Lime to be 175-200 mg/l and 200 - 250% respectively and decided to continue like this, till we get more effluent quantity.

2.0 Sludge Volume

The reduction in Coagulant chemical dosages resulted in a notable reduction in Sludge volume also. As pointed out earlier, the combined effect of low Suspended Solids and low Chemical dosages resulted in reduction of sludge volume to be almost one-tenth of its anticipated value.

3.0 Usage of MnSo4

The Sulphide concentration in the raw effluent is observed to be on the lower side, ie, around 15-30 ppm only. We have observed that the entire sulphide quantity is getting oxidised in Equalisation Tanks without adding any catalyst. Besides low conc. of Sulphides, another factor resulting in full oxidataion was the higher detention time in Equalisation Time, owing to the low quantity of effluent being pumped into the CETP. Hence the addition of MnSO4 is not being done now.

PART-2

EXPERIMENTS IN BIOLOGICAL TREATMENT

Initially we were operating only One Aeration Tank with only one Blower running, since the effluent volume was only around 400 M3/day. Later, when we started getting effluent around 1000 M3 per day, we have switched on to Series operation of Aeration Tanks. But this arrangement we didn't continue for long as we have noted a drastic reduction of MLSS concentration, persumably due to the fluctuations in raw effluent quantity being pumped into the CETP. Now we are operating both Aeration Tanks in parallel.

1.0 Seeding the Biological System

Initially we have started efforts to stabilise the biological system without adding any cow dung etc. We were successful in getting MLSS concentration upto 800 mg/l in this way. Thereafter, the growth rate was found to be in a standstill. Further, it has been noticed that the no. of varieties of Organisms in the Aeration System is comparatively less. Hence to increase the no. of reactive species, we have resorted to seeding of the Aeration system by way of charging return sludge of Activated sludge process from a Sewage Treatment Plant. The addition produced notable effect in the reaction rate and the MLSS concentration was gone up to 2000 mg/l.

2.0 Mode of Operation of Aeration Tanks

When we started to get effluent quantity around 1000 M3/day, we have changed the mode of operation into series operation of Aeration Tanks. This change, while giving improved results in terms of effluent B.O.D, resulted in a drastic decrease in MLSS concentration. The reason behind this phenomenon is believed to be the fact that high detention time created in the Aeration Tanks may have caused Endogenous Respiration conditions, thus reducing the Mixed Liquor concentrations.

Then, we have changed the Operation of Aeration Tanks in parallel, so that we can keep constant feeding into Aeration Tanks at a steady rate ie, around 2000 M3/day.

As regards to the effluent B.O.D, we have noticed that, whenever Aeration Tank-2 gets upset due to high fluctuations, the treated effluent B.O.D goes up a little ie, upto 40 mg/l, even though the B.O.D of settled sample from Aeration Tank-1 shows very low B.O.D value ie, 12-15 mg/l. Since such variations cannot be permitted in a Treatment Plant which is supposed to be a model plant and the one gets constant attention from Statutory Organisations, we have decided to operate the Aeration Tank in parallel in such way that any shock loadings will be equally distributed to both the Aeration Tanks and arranged the feeding accordingly.

As result of this operation, the MLSS level (in both Aeration Tanks) started maintaining a definite range and the fluctuations in B.O.D value of the treated effluent was observed within the specified limit most of the time.

Now we are continuing the same pattern of Operation and are planning to change again into Series operation, once we get effluent quantity more than 2000 M3/day.

3.0 Reduction in Substrate concentration

As already mentioned, we have achieved 2000 mg/l MLSS concentration, when we were feeding the effluent into One Aeration Tank. Later when we changed into Series operation, the MLSS concentration came down to 600 - 700 mg/l . When we started feeding constant quantity into A.T-1, we were successful in raising the MLSS concentration to 3000 mg/l in A.T-1 and MLSS conc. in A.T-2 was around 500 mg/l. Now the MLSS conc. in both the Aeration Tanks are same and are in the range 3000 - 3500 mg/l. It is expected that once we start getting more effluent quantity, we can easily get MLSS conc. around 4500 mg/l.

The MLSS:MLVSS ratio was observed to be around 0.6 to 0.7 most of the time and whenever the ratio comes down, we are increasing the quantity of activated sludge being wasted every day.

We are maintaining the feeding into the system in such a way that the B.O.D of substrate never goes above 100 mg/l.

Though we are getting only aorund 60% effluent flow, at present around 3.25 M.T. of B.O.D is getting removed in Aeration system, as we are making use of the Biological system to remove maximum B.O.D by reducing the quanitity of B.O.D removed in primary treatment.

4.Ø Blower Operation

Initially we have started the treatment with only one blower in Operation. Later we have increased the No. of blowers in Operation to two and the same condition is continuing. The operation of the Blowers is regulated in such a way that, a blower shall not be in oepration for more than 8 hours continuously.

5.Ø Nutrient Requirement

We have observed that the Nitrogen , Phosphorous and Iron content in the equalised raw effluent is in the level of around 3ØØ mg/l, 8Ø mg/l and 5 mg/l respectively. We have also observed that the biological metaboilsm reacts satisfactorily to this concentration levels and further addition of nutrients in the form of DAP didn't produce any significant change in performance. Hence no nutrients are currently being added.

6.Ø Sludge Bulking

No sludge bulking was observed till date in Secondary Clarifiers. However, we have observed that the conc. of Suspended Solids in the treated effluent goes up, if only one Clarifier is in operation.

7.Ø Admitting Return sludge into Eq.Tank

Normally, wherever primary chemical treatment is there, Return sludge will not be admitted into the Equalisation Tanks, even if the Tanks are provided with Aeration. The main reason is that the uncontrolled biological reaction will result in production of partially digested biological floes which will affect the settling process when chemicals are added into the effluent.

For experimental sake, we have tried admitting a portion of return sludge into the Equalisation Tanks and observed for any reduction in B.O.D. The addition resulted in production of biological sludge upto 4ØØØ mg/l within two days and B.O.D. reduction was observed to be around 4Ø%. It was also noted that no scum formation or sludge floation occurs, if the chemical dosages are below 15Ø mg/l Alum and 25Ø mg/l Lime.

However, we have noticed that the D.O. of the effluent in the Eq.Tank is becoming minimum (Ø.5 -1.Ø) when the biological reaction is allowed to happen. Hence it was inferred that, we cannot do this practise when full quantity of effluent comes into the CETP as the Aeration capacity of the Aspirators is not designed to accomodate any biological reaction.

8.Ø Return Sludge Requirements

We have tried various levels of sludge return percentage so as to arrive at optimum level of biological sludge returned to Aeration Tank. We have noticed that at an MLSS concentration of 3ØØØ mg/l, the clarifier underflow concentrations reach upto 12,ØØØ to 15,ØØØ mg/l. The Optimum return rate was identified to be around 9Ø% of the influent to Aeration Tank.

9.Ø Sludge wasting

The mineralisation of biological sludge was observed to be in the usual level and a sludge wasting rate of 2Ø% is being maintained to keep MLVSS:MLSS ratio in the range of 65-7Ø%. The excess sludge is drawn from the return sludge line and admitted into the Thickener.

1Ø.Ø Dissolved Oxygen Level

Various D.O. levels have been tried in Aeration Tank and reaction rates were closely monitored. It has been observed that the Optimum D.O. level in Aeration Tank is 2.Ø - 2.5 mg/l. It has been also observed that settleability of bio sludge is coming down drastically at D.O. levels less than 2.Ø mg/l.

11.Ø Organic Loading

Though the desired level of organic loading into the Aeration Tank is 2.1 Tonnes/day (at an F/M ratio Ø.1), currently the organic loading to Aeration Tanks is as high as 4 Tonnes/day. It is noteworthy that we are able to achieve this level without sacrificing the treated effluent quality. The prime reason for the high removal rate is the good performance of Fine Bubble Diffusers installed.

12.Ø Type of Micro Organisms

The type of Aerobic Organisms existing in Aeration Tanks of CETP, Pallavaram was observed to be mostly Mesophilic with some quantity of Thermophilic:

13.Ø Clogging of Diffusers

The most common problem associated with diffused aeration systems is reported to be frequent occurence of clogging. But in CETP, Pallavaram not a single time so far we have observed any clogging in any of the 12ØØ diffusers. The utilisation of non-clog diffusers thus makes it easy to operate the system.

It is also noteworthy that installation of diffusers in CETP, Pallavaram have been done in such a manner that any individual air subheaders can be easily lifted up for any cleaning, repairs etc without affecting the operation of the system. We have tried lifting up individual air subheaders and it is found to be very easy.

14.Ø. Efficiency of Biological Treatment System

Normally, the maximum B.O.D reduction possible in a Single stage Aeration system will be 96-98% as beyond this value, the reaction kinetics of biological treatment will be affected because the reaction rate is always proportional to the substrate concentration, provided population of micro organisms, Dissolved Oxygen etc. are O.K.

However, In Pallavaram CETP, we have observed that we are getting even 99.3% reduction in single stage Aeration treatment inspite of fluctuations in organic loadings.

It is obvious that the principal factor behind this achievement is the employment of FINE BUBBLE DIFFUSERS in Aeration system. The system is easy to operate and control and so far we have not faced any difficulty in Operating the system or to maintain this high level of efficiency.

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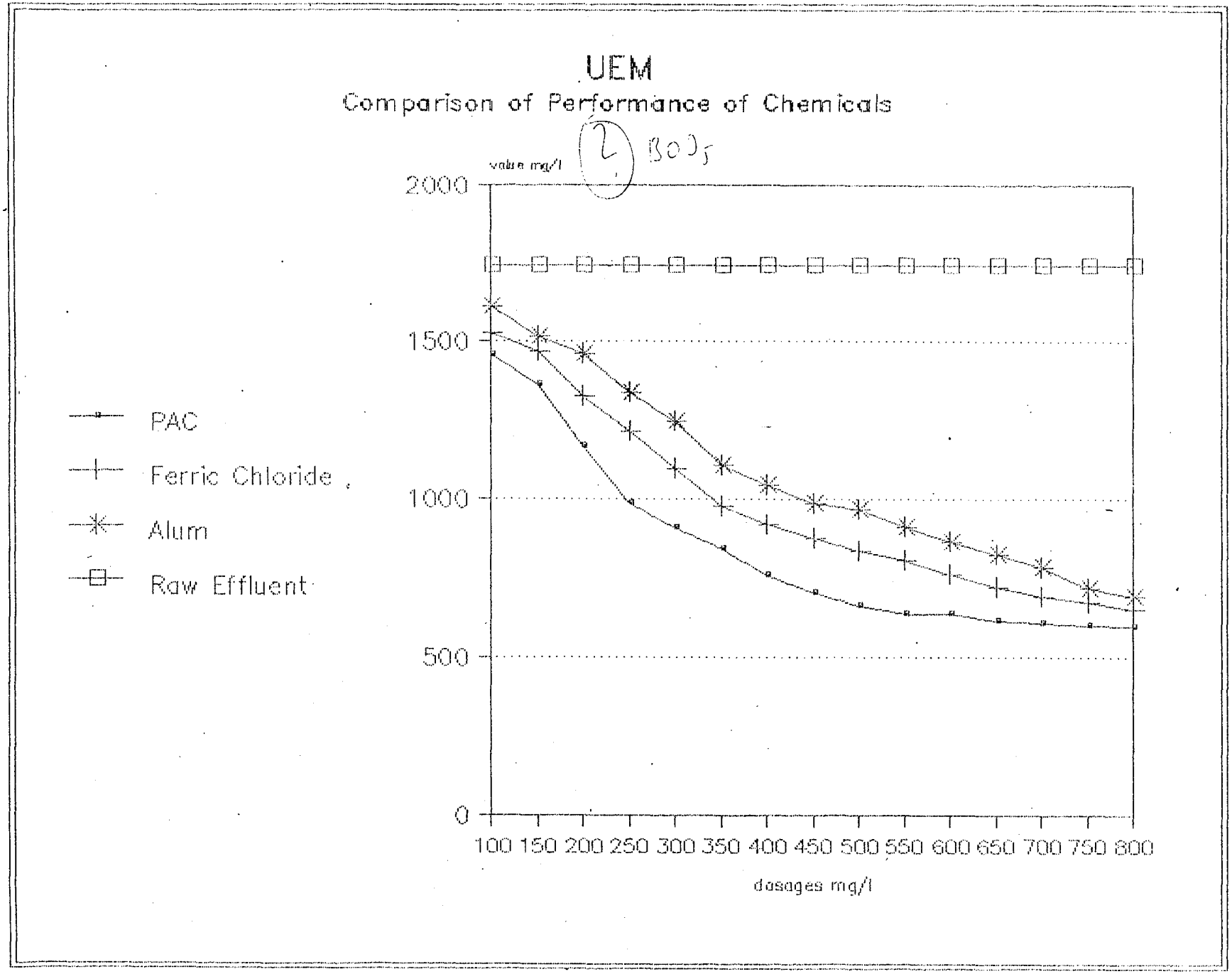
UEM
Comparison of Performance of Chemicals
2) BOD5
value mg/l
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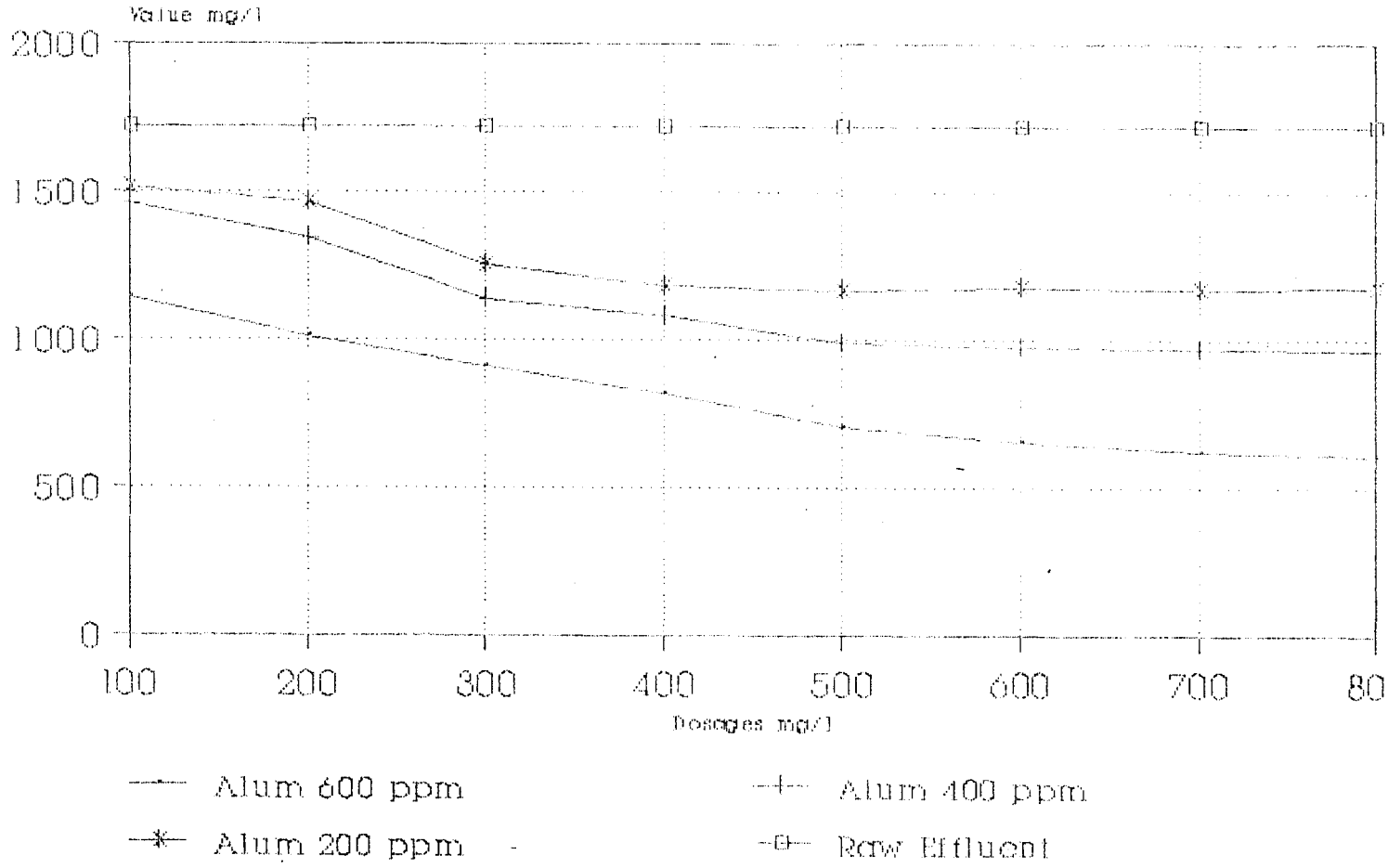
1500
1000
500
0
PAC
Ferric Chloride
Alum
Raw Effluent
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800
dosages mg/l

UEM

Effect of various dosages of Lime
alongwith alum on BOD values



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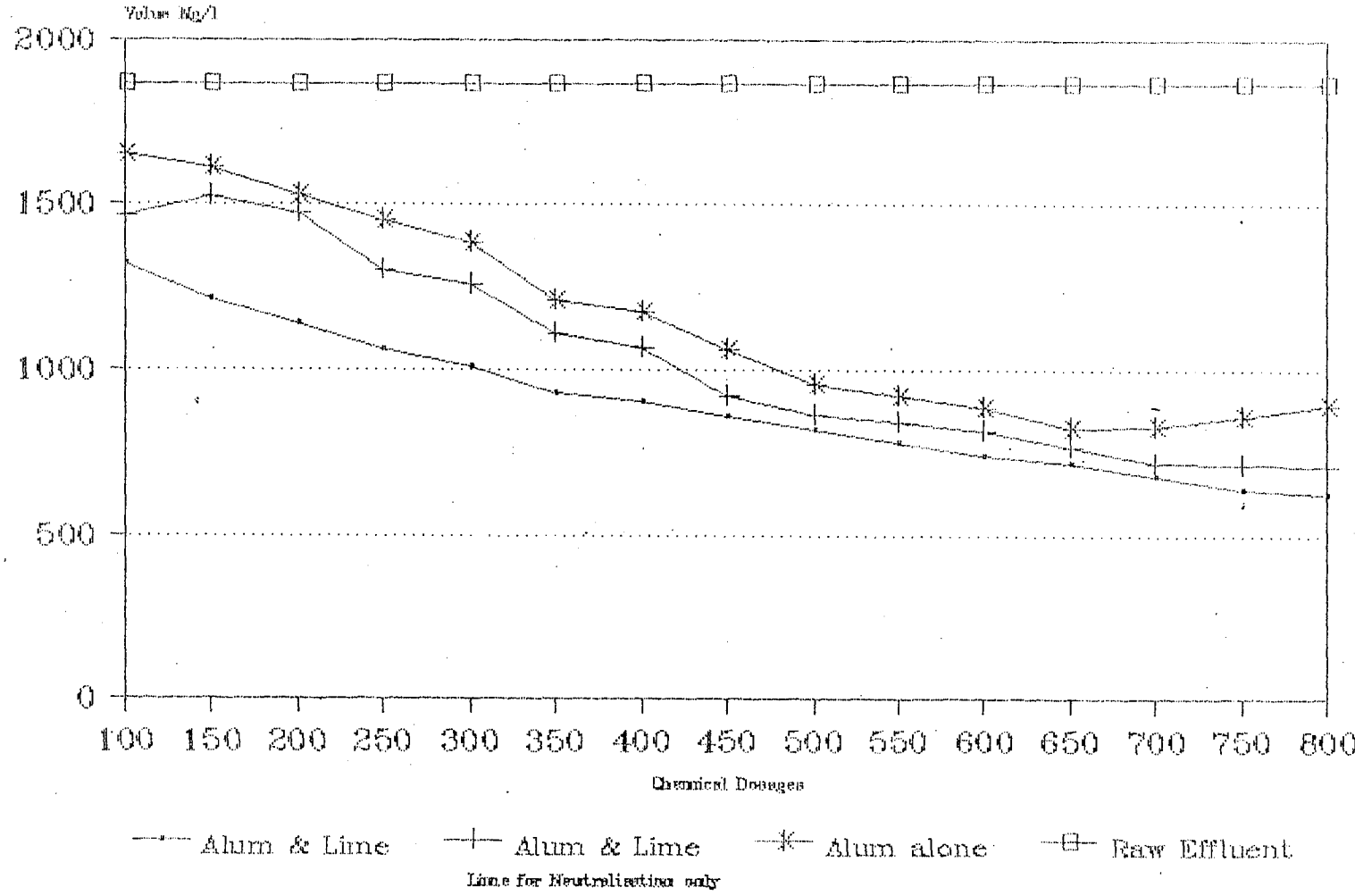
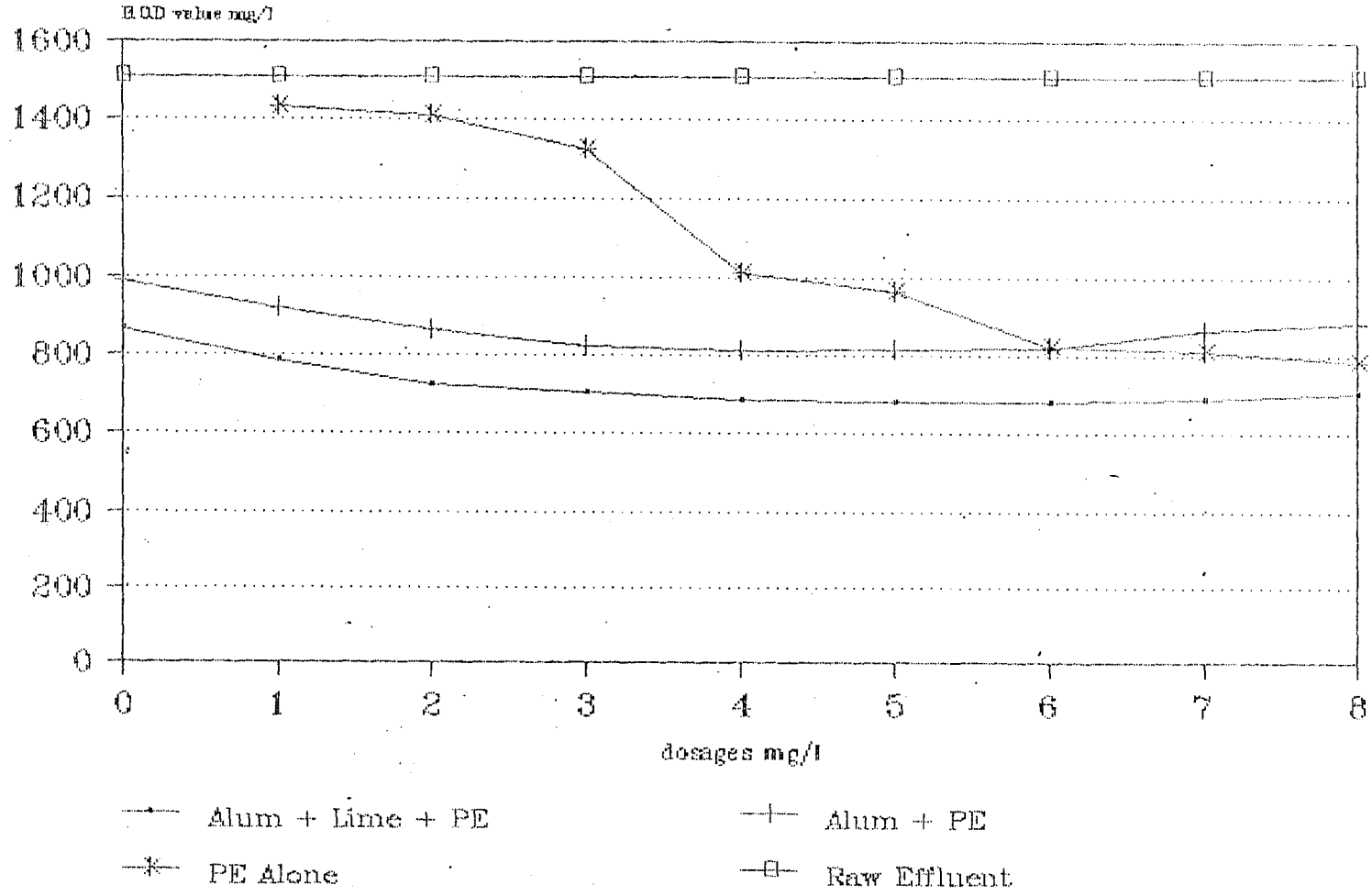
B.O.D AGAINST CHEMICAL DOSAGES



UEM

Effect of Anionic Polyelectrolyte



Note: Alum Dosage : 300 Mg/l Lime dosage : 350 Mg/l

Based on Lab studies

CETP OPERATION COST & ~~ITS ECONOMISATION~~

Forword

The CETP operation cost can be broadly devided into Four main catagories: (1) Power , (2) Chemicals , (3) Man power and (4) Others including routine maintenance cost. Although the last one is quite unpredictable and cannot be optimised, the other three categories can be regulated and optimised to work out the most economical option for the operation of the CETP. An attempt based on theoretical and plant scale observations has been made to optimise the cost. Findings and observations are presented below:

The process of cost optimisation is very complex and is often subjective with regards to variable situations like cost of electricity, chemical cost impact including handling charges and resultant after effects like sludge dewatering & disposal costs and possibilities of extra utilisation of facilities etc.

Options Available

Two modes of operations are available. To choose the cheapest method, various factors are to be considered. The options are the following:

(a) Using the biological treatment as the principal mode of treatment and reducing the pollutional load by biological means alone even by increasing the no. of blowers in operation (thereby increasing the electricity cost) to reduce the chemical consumption and costs associated with chemical treatment.

(b) Using chemical systems more to reduce load on biological systems, taking chemical cost and related expenses.

Pros & Cons of various operation modes

The option No.1 indicates more dependency on biological treatment. Even though biological treatment systems are considered to be least expensive mode of treatment, cost of electricity in Tamil Nadu is observed to be very high. However, the operation mode is having advantages viz, better control of treatment, less sludge generation etc.

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The option No.2 also bears advantages as well as disadvantages. While it can produce effluent with better clarity, it requires careful control, generate more sludge and dependency on chemicals and its associated problems such as Chemical storage , handling of toxic and hazardous materials etc., will be more

Hence, an operational method can be selected only on careful consideration of various factors having impacts on total cost of treatment. Depending on laboratory studies and plant operational experience, the following figures have been arrived at as possible cost of operation on various operational modes. Calculations related to the estimation of costs is being given in Annexure-1

(a) For 3,000 M3/day

Item		Expenses (Rs) Option 1	Option 2
Power Cost	:	18,050.00	16,840.00
Chemical Cost	:	11,040.00	12,690.00
Labour Cost	:	1,100.00	1,100.00
Sludge treatment cost	:	3,290.00	3,675.00
Maintenance cost	:	3,000.00	3,000.00
Total	:	36,480.00	37,305.00

Thus it could be seen that, it is more economical to utilize biological treatment system as much as possible to degrade organic materials, when the flow into the CETP reaches 3,000 M3/day.

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(b) For 2,500 M3/day

Item		Expenses (Rs) per day Option-1	Option-2
Power Cost	:	17,783.00	14,102.00
Chemical Cost	:	7,825.00	10,575.00
Labour Cost	:	1,100.00	1,100.00
Sludge Treatment Cost	:	2,625.00	3,080.00
Maintenance Cost	:	3,000.00	3,000.00
Total	:	32,333.00	31,857.00

Thus it could be seen that, when the flow is at the rate of 2,500 M3/day to CETP, it is better to utilize chemical treatment system more rather than utilizing biological treatment system to its maximum level.

(c) For 2,000 M3/day

Item		Expenses (Rs) Option -1	Option-2
Power Cost	:	16,395.00	12,471.00
Chemical Cost	:	3,266.00	8,270.00
Labour Cost	:	1,100.00	1,100.00
Sludge Treatment Cost	:	924.00	2,310.00
Maintenance Cost	:	3,000.00	3,000.00
Total	:	24,685.00	27,151.00

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Thus it could be seen that it is better to utilize biological treatment system as much as possible to reduce the pollutional load when the flow to the CETP is 2,000 M3/day.

Calculations Related to Assessment of Operation cost in CETP,Pallavaram.

Case 1

Getting the maximum benefit from biological treatment units:
The maximum B.O.D reduction that can normally be achieved from the biological treatment system of CETP, Pallavaram is 2160 Kg BOD/day (Assuming an MLSS concentration at 4500 mg/l with MLVSS content 65-70% and assuming maximum F/M ratio to be 0.1).

(1) For 3000 M3/day

(a) Power cost

For 3000 M3/day, To operate the biological treatment system fully, we have to operate 4 Blowers. Hence 4 blowers will be in operation for 24 Hrs. Raw Effluent pumps will be in operation for 10 Hrs (assuming a pumping rate of 5 M3/min). Ejector Aerators will be in operation for 24 Hrs. Return Sludge pumps will be in operation for 24 Hrs. Primary sludge pumps will be in operation for 12 Hours (assuming withdrawal rate of 480 M3/d). Secondary Sludge Pumps will be in operation for 24 Hrs. Treated effluent pump also will be operated 24 Hrs. Belt press Filter will be operated for 12 Hours (assming total sludge vol to be 4800 Kg/d dry solids). Clarifiers, Clariflocculators, Thickener, Detritor,Fine screen (if automatisation is not done), etc will be in operation for 24 Hrs. Agitators & Chemical dosing pumps in Chemical house will be in operation for 24 Hours(if chemical dosages requirement increases, 2 Nos each of dosing pumps may be required) and yard lighting will be in operation for 11 Hours.

Total cost for the above operations shall be as follows:

Blowers : 4 x 50 HP = 200 HP/Hr = 4800 HP/day = 3580.8 KW
Ej.Aerators:4 x 25 HP = 100 HP/Hr=2400 HP/day = 1709.4 KW
RE Pump : 1 x 30 HP = 30 HP/Hr = 300 HP/day = 223.8 KW
RS Pump : 1 x 15 HP = 15 HP/Hr = 360 HP/day = 268.6 KW
Tr.Pump : 1 x 12.5 HP = 12.5 HP/Hr=300 HP/day = 223.8 KW
Others : Total 910 HP/day = 678.9 KW.

Total power requirement = 6685 KW/day
Total power cost @ Rs.2.7/KW = Rs.18,050/day.

(b) Chemicals

As stated earlier, the maximum B.O.D removal from biological treatment units will be 2160 Kg B.O.D per day. This means, for and effluent volume of 3000 M3/day, the maximum admissible value for B.O.D concentration of influent to Aeration Tanks will be 720 mg/l only.

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Taking the normal influent conc. of B.O.D for effluent received into CETP, Pallavaram as 2000 mg/l, it is very clear that 64% of the total B.O.D load (for a volume of 3000 M3/d) should be removed by other means before the same can be admitted into the Aeration Tanks. From laboratory experiments, it has been observed that in order to achieve this efficiency, the optimum dosages of chemicals may be as follows: Alum 450 mg/l, Lime 550 mg/l and APE 2 mg/l. (The resuts of all lab/plant scale experiments with chemicals is being compiled and prepared seperately).

Hence, the chemical cost/day shall be as follows:

Alum :	450 ppm =	1,350 Kg/d =	Rs.3,780.00
Lime :	550 ppm =	1,650 Kg/d =	Rs.2,970.00
APE :	2 ppm =	6 Kg/d =	Rs.1,920.00
MnSO4:	20 ppm =	60 Kg/d =	Rs.1,110.00
DAP* :	40 ppm =	120 Kg/d =	Rs.1,260.00

		Total Chemical cost :	Rs.11,040.00

*
Assuming balance Nutrients shall be available from sewage streams proposed to be mixed with Tannery effluent.

(c) Labour

To run the CETP efficiently, the following staff are required: Manager, Chemist, Instrumentation Engineer, Head Operator, Plant Operators (4 Nos), Belt press filter operator, 2 Technicians, 4 Casual Labours.

The total cost of salary may come around Rs. 1,100 per day.

(d) Sludge Treatment

To operate the belt press filter, Cationic polyelectrolyte is to be dosed into the thickened sludge. The optimum dosage required to increase DSC from 3% to 5% as observed from lab studies is 5% of DSC. Sludge volume expected from the CETP is as follows:

Contribution from Suspended Solids present in effluent: 500 ppm x 3000 M3 = 1.5 Tonnes/day.
Contribution from chemicals added for treatment : 1.85 Tonnes/day.

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Wasted Sludge from Biological treatment : 1.35 Tonnes/day.

Hence, Total Sludge qty (as Dry solids) : 4.7 Tonnes/day

To dewater this much sludge in the Belt press Filter, a PE dosage of 9.4 Kg/d is required. The total cost of PE then comes around Rs.3,290 per day.

(d) Maintenance Cost

This cost factor is often difficult to calculate as the quantum of works required is quite unpredictable. Other expenditures like Diesel requirements for D.G. operation etc also comes under this category. Generally the maintenance cost comes into two sections : (1) Routine maintenance charges including preventive maintenance like Oiling, Greasing, Painting etc. and (2) Repair and replacement charges which includes spares, labour and purchase of consumable. It is very clear that no definite amount can be earmarked for this purpose.

On an average, around Rs.3,000 can be earmarked as maintenace charges.

(2) For 2500 M3/day

(a) Power cost

For 2,500 M3/day of effluent volume also power cost will not change significantly except that working times of Raw effluent pump and Eq.effluent transfer pump shall come down by 1.8 and 5 Hrs respectively. The total power cost in this case will be : Rs. 17,783.00

(b) Chemical Cost

As the B.O.D load to be removed prior to biological treatment is less in this case, an effluent of B.O.D upto 864 mg/l can be fed into Aeration Tanks, which means around 57% of BOD load should be removed in chemical treatment. A chemical dosage of 350 mg/l of Alum and 400 mg/l Lime with 2 ppm of APE is found to be optimum for producing this result.

Then the daily chemical cost will be as follows:

Alum :	350 ppm =	875 Kg/day =	Rs. 2,450.00/d
Lime :	400 ppm =	1000 Kg/d =	Rs. 1,800.00/d
APE :	2 ppm =	5 Kg/day =	Rs. 1,600.00/d
MnSO4:	20 ppm =	50 Kg/day =	Rs. 925.00/d
DAP :	40 ppm =	100 Kg/day =	Rs. 1,050.00/d

Thus the total chemical cost will be : Rs. 7,825.00/day.

(c) Labour

There won't be any change in labour cost in this case from the previous case, hence labour cost will be Rs.1,100. per day.

(d) Sludge Treatment

The quantity of sludge generated in this case will be as follows:

Contribution from SS in raw effluent = 1.25 Tonne.
Contribution from Treatment chemicals= 1.35 Tonnes
Contribution from wasted biological sludge= 1.15 Tonnes

Total quantity of sludge generated : 3.75 Tonnes/day. (dry wt)

For dewatering this much sludge, CPE consumption/day shall be 7.5 Kg/day. Hence the CPE cost/day shall be Rs. 2625.00 per day.

(e) Maintenance Charges

Like labour costs, maintenance charges also will not change in this case. Hence the arbitrary figure of Rs.3,000 per day has been considered as the likely expenditure.

/5/

(3) For 2000 M3/day

(a) Power cost

As the biological treatment system is to be used as much as possible, power cost in this case also will not change much except that the No.of blowers in operation could be reduced to 3 some times and pumping times will be reduced. The Total cost of power day will be Rs. 16,395.00

(b) Chemical Cost

In this case a total B.O.D load of 1840 Kg B.O.D per day is to be removed from raw effluent by chemical treatment prior to admitting the same to Aeration Tanks, which means a removal efficiency of 46% is sufficient to achieve the results.(The permissible B.O.D load to Aeration Tanks will be 1,080 mg/l. in this case). A chemical dosage of 200 mg/l Alum, 300 mg/l lime and 1 mg/l of APE is found to be optimum for this result.

The total chemical cost will be as follows:

Alum : 200 ppm = 400 Kg = Rs. 1,120.00
Lime : 300 ppm = 600 Kg = Rs. 1,080.00
APE : 1 ppm = 2 Kg = Rs. 640.00
MnSO4: --- *
DAP : 20 ppm = 40 Kg = Rs. 420.00

* MnSO4 is not required, as due to the higher detention time in Equalisation Tanks, the sulphide will get oxidised without any catalyst.

Then the total chemical cost will be: Rs.3,260/day.

(c) Labour

Labour cost will remain as Rs.1,100 per day in this case also.

(d) Sludge Treatment

The sludge generation will be as follows:

Contribution from SS in raw effluent : 1000 Kg
Contribution from chemicals added : 720 Kg
Contribution from wasted bio sludge : 920 Kg

/6/

Total sludge quantity thus comes to 2.64 Tonnes and the CPE requirement per day is Rs. 924.ØØ per day.

Case-2

In this case, more pollutional load is proposed to be removed by chemical methods so that load on biological system will get reduced, which in turn may result some savings in power.

For 3ØØØ M3/day

(a) Power cost

The maximum B.O.D removal efficiency in chemical treatment has been noted as 68-7Ø%. Even assuming this maximum removal, the B.O.D load to Aeration Tanks will be 18ØØ Kg/day. This means, for getting this much reduction, 83% of optimum efficiency in Aeration system is required. For 3,ØØØ M3/day of effluent flow, 3-4 Blowers will be in operation. Other working times of machinery will be the same as in Case-1, section (1). Hence the total power cost will be:

Blowers: 3.5 x 5Ø HP = 175 HP/Hr = 42ØØ HP/d = 3133.2 KW.
Ej.Aerators:4 x 25 HP= 1ØØ HP/Hr = 24ØØ HP/d = 17Ø9.4 KW.
RE pump: 1 x 3Ø HP = 3Ø HP/Hr = 3ØØ HP/d = 223.8 KW.
Tr.Pump: 1 x 12.5 HP = 12.5 HP/Hr= 3ØØ HP/d = 223.8 KW.
RS.Pump: 1 x 15 HP = 15 HP/Hr = 36Ø HP/d = 268.6 KW.
Others : Total 91Ø HP/day = 768.9 KW.

Total Power requirement : 6237.4 KW/day
Total power cost Rs : 16,84Ø/day.

(b) Chemicals

To achieve the maximum reduction in B.O.D in chemical treatment, the optimum dosage of Alum, Lime and APE shall be 55Ø mg/l, 7ØØ mg/l and 2 ppm respcetively. DAP, MnSO4 etc. will be the same as in Case-1 section (1).

Hence the total chemical cost will be as follows:

Alum : 55Ø ppm = 165Ø Kg/d = Rs.4,62Ø.ØØ per day.

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Lime : 700 ppm = 2100 Kg/d = Rs.3,780.00 per day.
APE : 2 ppm = 6 Kg/d = Rs.1,920.00 per day
MnSO4: 20 ppm = 60 Kg/d = Rs.1,110.00 per day.
DAP : 40 ppm = 120 Kg/d = Rs.1,260.00 per day.

The total chemical cost : Rs.12,690.00 per day.

(c) Labour

There wont be any change in this and the cost factor remains as Rs.1,100.00 per day.

(d) Sludge Treatment

The total sludge volume shall be as follows:

Contribution from SS in raw effluent : 1.5 Tonnes/day.
Contribution from Treatment Chemicals: 2.4 Tonnes/day.
Wasted Sludge from biological treatment: 1.35 Tonnes/day.

Total quantity of Sludge: 5.25 Tonnes/day.

To dewater this much sludge, 10.5 Kg CPE is required.Hence the cost involvement will be Rs.3,675.00 per day.

(e) Maintenance

Here also, there won't be any change in calculations and the figure remains as Rs.3,000.00 per day.

(2) For 2,500 M3/day

(a) Power cost

Considering 70% reduction in chemical treatment, the B.O.D load to biological treatment system will be only 1,500 Kg/day. Hence only 64% of optimum efficiency of biological treatment is required in Aeration Tanks. Hence the No. of blowers in operation can be reduced to 2-3. Other operations will be similar to case-1 section (2).

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Total power cost shall be as follows:

Blower : 2.5 x 50 HP = 125 HP/Hr = 3000 HP/day = 2238 KW.
RE.Pump: 1 x 30 HP = 30 HP/Hr = 249 HP/day = 186 KW.
Ej.Aerator: 4 x 25 HP = 100 HP/Hr= 2400 HP/day = 1709 KW.
Tr.Pump: 1 x 12.5 HP = 12.5 HP/Hr= 250 HP/day = 187 KW.
RS.pump: 1 x 15 HP = 15 HP/Hr = 300 HP/day = 224 KW.
Others : Total 910 HP/day = 678.9 KW.

Total power consumption : 5223 KW.
Total power cost Rs: 14,102 per day.

(b) Chemical

Chemical dosage required shall remain the same:

Total Chemical consumption shall be as follows:

Alum : 550 ppm = 1375 Kg/d = Rs.3,850.00 per day.
Lime : 700 ppm = 1750 Kg/d = Rs.3,150.00 per day.
APE : 2 ppm = 5 Kg/d = Rs.1,600.00 per day.
MnSO4: 20 ppm = 50 Kg/d = Rs. 925.00 per day.
DAP : 40 ppm = 100 Kg/d = Rs.1.050.00 per day.

Total chemical cost : Rs. 10,575.00 per day.

(c) Labour

Labour cost remains the same Rs.1,100.00

(d) Sludge Treatment

Quantity of sludge generation shall be as follows:

Contribution from SS in raw effluent : 1.25 Tonnes.
Contribution from chemicals added : 2.1 Tonnes.
Contribution from Wasted biosludge : 1.05 Tonnes

Total sludge qty : 4.4 Tonnes/day.

To dewater this much sludge, 8.8 Kg CPE is required. Hence daily APE cost will be Rs. 3,080.00.

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(3) For 2,000 M3/day

(a) Power cost

The B.O.D load, after removal by chemical treatment to the maximum possible will be only 1,200 Kg/d. To degrade this much organics, only 2 Blowers need to be in operation. Hence power consumption shall be as follows:

Blowers : 2 x 50 HP = 100 HP/Hr = 2,400 HP/d = 1709 KW.
Ej.Aerators 4 x25 HP= 100 HP/H = 2,400 HP/d = 1709 KW.
RE Pump: 1 x 30 HP = 30 HP/Hr = 199 HP/d = 149 KW.
RS pump: 1 x 15 HP = 15 HP/Hr = 300 HP/d = 224 KW.
Tr.Pump: 1 x 12.5 HP = 12.5 HP/Hr = 200 HP/d = 149 KW.
Others : Total 910 HP/day = 678.9 KW.

Total power consumption : 4619 KW/day
Total power cost Rs : 12471/day.

(c) Chemical

Chemical consumption and cost shall be as follows:

Alum = 550 ppm = 1,100 Kg/day = Rs. 3,080.00
Lime = 700 ppm = 1,400 kg/day = Rs. 3,920.00
APE = 2 ppm = 4 kg/day = Rs. 640.00
MnSO4 = Not required
DAP = 30 ppm* = 60 Kg/day = Rs. 630.00

Total Chemical cost shall be : Rs.8,270.00 per day.

(d) Labour

Labour cost remains Rs.1,100.00 per day.

(e) Sludge Treatment

Sludge generation will be as follows:

Contribution from SS in raw effluent : 1.0 Tonne
Contribution from Chemicals : 1.5 Tonnes
Contribution from wasted biosludge : 0.8 Tonnes

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Total sludge quantity : 3.3 Tonnes.

For dewatering this much sludge, a CPE dosage of 6.6 Kg/day is required and the cost shall be Rs. 2310.00 per day.

(f) Maintenance Charges

Maintenance charges will be the same Rs.3,000 per day.

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Addition of this alum also may result in increase of colour as the Iron prsent in this product is of +2 oxidation state and ferrous form being amphoteric in nature, a good portion of Iron will go to biological treatment step and due to oxidation of ferrous Iron into ferric Iron in Aeration Tanks, a brown colour will be imparted to the final treated effluent.

The environmental impacts of such contaminations is to be studied before selecting alternative chemicals for the treatment.

2. Controlling the chemical treatment : As the nature of effluent being recieved into the CETP will be highly fluctuating, the dosages of the chemicals being added to the effluent every day should be adjusted according to the nature of the equalised raw effluent (raw effluent should be homogenised by utilising the Equalisation Tanks). Such control and re-arrangement will prevent wastages of chemical to a greater extent and allow us to get the maximum benefit out of treatment. For example, since the CETP recieves effluent from some raw to finish tanneries the effluent from which will be highly alkaline and with high suspended solids, the addition of lime can be minimised whenever such effluent comes to the CETP.

3. Arriving at the optimum dosages of coagulant chemicals: The sinergesic effect of various chemicals on raw effluent of different characteristics is to be studied and chemical dosages are to be adjusted accordingly. UEM have conducted lab scale studies with Alum, Lime, Iron salts and APE on raw effluent with different characteristics observed so far. The results of the studies are presented seperately. This type of simulation studies and optimisation process should be a contineous operation to ensure that the maximum benefit is being recieved from the treatment being given.

4. Careful control of biological treatment system : Operating biological treatment at its optimum efficiency will prevent the wastage of power in the treatment operation. This involves maintenance of optimum F/M ratio, maintenance of sufficient D.O.,control of sludge recirculation and sludge wasting, maintenance of sufficient nutrients etc.

5. Extra utilisation of facilities:

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(a) In treatment: It may sometimes be possible to get extra utilisation of treatment facilities provided in the CETP. A typical example is the utilisation of Equalisation Tanks as primary Biological treatment units. Biological reaction can be initiated by admitting a part of return sludge into the tanks. However three things are to be considered in this case. (1) As the design of Eq. Tanks is not meant for the above purpose, the oxygen offtake should not lead to conditions of zero level D.O. - a regular monitoring of D.O. is required. (2) The operation may result in uncontrolled bilogical reaction and the bio-sludge generated being reverse in ionic charge may counteract with coagulation process of colloidal particles, resulting in floatation of chemical sludge when coagulant chemicals are added into the mixture. However, it is also noted that at low dosages of coagulant chemicals and with a dosage of CPE instead of APE, this situation can produce even better results in Chemical treatment. (3) Since the bio-sludge generated is not getting fully digested and mineralised, keeping the same for long time in Thickener may result in putrification of sludge. However, intermittent high dosages of coagulant chemical (Giving normal high dosages of coagulant chemicals at intervals in which the Ejector Aerators in Equalisation Tanks are switched off) will result in primary sludge of usual high mineral content which will prevent the bio-degradation of primary sludge.

Another example is the utilisation of Sludge Drying Beds for dewatering the sludge. The SDBs in CETP is meant for operation only in case of a failure of Belt press Filter. However, operating Belt Press Filter is a costly affair which requires a good quantity of CPE, labour and power. Hence, it is desireable to use the SDBs as much as possible, especially when the sludge quantities are low.

(b) In Administration

The CETP is equipped with facilities for regular monitoring & analysis of trade effluent samples. Since the no. of tests to be conducted in the lab every day is limited one, it is possible to conduct analysis for samples from other ETPs as well as raw

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effluent from industries on a chargeable basis. The basic equipment back up required for converting the laboratory in the CETP to a public utility service laboratory is practically nil. Only quantity of chemicals and manpower (if the no. of sample receiced becomes high) will be required extra. This type of service will result in : on one hand, customers getting a reliable laboratory for testing their water and effluent samples, on other hand will provide additional revenue to the CETP, which at the least will be enough to meet the expenses related to the laboratory in CETP.

Another option is lend the services and experience of Engineers in CETP to other projects for installation of similar plants, which, considering the present trend & the scenario emerging, seems to be a promising field.

EVALUATION OF PERFORMANCE OF CETP, PALLAVARAM DURING FEB, 95 - FEB, 96

1.0. INTRODUCTION

The Performance of CETP, Pallavaram has been evaluated in terms of constructional quality, functional efficiency and operational cost. The result, by and large seems to be very much encouraging. It is noteworthy that visitors coming to the Plant are unanimously stating that CETP, Pallavaram is by far the best Plant they have visited so far. However, the desire for excellence by the Officials concerned with the Operation & Maintenance of the CETP is not satisfied with this and we are constantly exploring the ways and means to improve still further. TNPCB and UNIDO are giving whole hearted support to all the efforts in this line now.

2.0. Constructional Quality

While the civil works quality excelled all anticipations, there were some complaints as regards to quality of mechanical equipments. The problems were identified as due to bad vendors and later all the equipments have been replaced by new sub contractor and the mechanical equipments this time have been fabricated strictly as per American Standards and thereafter these machinery are observed to be functioning satisfactorily. All other components of construction also noticed to be maintaining high quality and the performance had been appreciated by all parties concerned.

3.0. Functional Efficiency

3.1. General

The functional efficiency of CETP, Pallavaram had been much more than all anticipations / designed level. The super performance of Aeration System has earned many a praise from experts in this field.

3.2. Physical Treatment Units

3.2.1. Screens

There are 3 screening installed in CETP, Pallavaram before the raw effluent enters the Equalisation Tank. The Coarse Screen installed prior to Receiving Sump is observed to be functioning well and the size of screenings varies from 2 mm to upwards. The average quantity of screenings removed from this area is around 70 kg/day and the area is being cleaned twice/day. The performance of mechanical screen also had been highly good and size of screenings varied from 0.2 mm to 5 mm. Approximately 110 kg/day of solids has been observed to be removed by this unit. The third screening is being done by the manually cleaned screen placed in RE channel prior to Grit Chamber. This two no. of screen is placed as a safe guard to remove any solids coming bypassing KONICA Screen. This also gets cleaned daily.

All the screenings are collected together and deposited in Sludge Drying Beds for onward removal.

3.2.2. Grit Chamber / Detritor

It has been noticed that the presence of grit and sand like materials are not there much in the raw effluent and following are considered to be the reasons for this behaviour (1) The pre-treatment units installed in Individual tanneries remove most of the grit present, if any, in the raw effluent. (2) The processing of Leather in Tanneries in Pammal - Pallavaram area is mainly wet blue to finish (3) Most of the effluents coming to CETP gets pumped from Collection wells and only very few units have been connected directly.

Approximately 0.5 kg/day of solids are being removed by the Grit Chamber in CETP

3.2.3. Ejector Aerators

The Ejector Aerators installed in Equalisation Tanks of CETP, Pallavaram also has been noticed to be functioning satisfactorily. Initially it has been observed that these Aerators are taking higher amperages. The problem had been studied in details and found to be due to the nature of impeller blades being closed type. Thereafter these impellers have been cut into size to make it Open impeller type and thereafter they have been observed to be taking lower amperage only.

3.3. Chemical Treatment Units

3.3.1 Flash Mixer

The unit is working satisfactorily. Sometimes it has been noticed that the foam emerging from Flash mixer comes out and consequently an M.S. Cover has been provided over the top to prevent foam coming out.

3.3.2. Chemical Preperation and dosage Units

The chemical preparation Units and dosing pumps are working satisfactorily. We have noticed that at times blocking of the chemical dosing lines occurs due to deposits of Alum and Lime. We have provided flushing lines to remove the blocks. whenever such an incident occurs.

3.3.3. Clarifloccalators.

These units also are working OK. Previously we have noticed that gearboxes are getting more load and frequent lubrication was necessary. Now to avoid any chances of wearing off in worm gears, we have changed the type into oil immersed type which is self lubricating. The units are observed to be functioning at high loads of sludge effortlessly

The weir loading rates maintained with the Clariflocculators were generally in the range of 1.9 $M^3/M^2/hr$ and Surface loading rates were 0.5 $M^3/M^2/hr$.

3.4. Biological Treatment Units

As mentioned earlier, the performance of Aeration System installed in Pallavaram CETP was observed to be superb. The oxygen transfer efficiency of the system was noticed to be 1.2 kg HP/hr. Average conc. of MLSS being maintained in Aeration Tank is 3000 mg/l and average concentration of MLVSS being maintained is 2000 mg/L.

The System has produced 99.3% BOD reduction and at the same time, the Organic loading maintained to the inlet of Aeration Tanks are 3.5 Tonne BOD/day as against a design loading rate of 2. Tonne/day. The suggested F/M ratio for Aeration Tanks in CETP, Pallavaram was 0.1 kg BOD/kg MLSS/d whereas the present ratio being maintained is 0.22 kg/kg MLSS/d. The D.O level in Aeration Tank is also maintained more than 2 mg/L at all times.

Altogether, Currently the efficiency of Aeration System in CETP, Pallavaram is valid to be 225% of its designed level

3.5. Sludge Treatment Units.

A more detailed information about the performance of Sludge handling and treatment units has been presented elsewhere. Generally the functioning of the units are found to be O.K.

3.6. Ancillary Systems in CETP.

Other supporting Units in CETP, Pallavaram like pressure sand filter, Diesel Generator, Control Units etc are also observed to be functioning satisfactorily

3.7. Quality Control & Monitoring

Effluent samples are collected from following points daily ; (1) Raw Effluent (2) Clariflocculator Inlet (3) Clariflocculator outlet and (4) Final treated effluent. The results are also recorded and accordingly the treatment method is adjusted. Specific parameters such as MLSS conc ; SVI, Solids consistancy in Sludge etc are also checked frequently.

4.0. Conclusion. Operational Cost.

From General, the fact

A more detailed study over operational cost presently being incurred to the Operation of CETP, Pallavaram is presented elsewhere.

5.0. Conclusion.

In general, the performance of CETP, Pallavaram during the operational period Feb. 95 to Feb. 96 is found to be more than Satisfactory.

1.Ø Forward

As reported earlier, the quantity of sludge generation in CETP, Pallavaram at present is only one-tenth of the anticipated level and at the moment the Sludge Drying Beds are utilized for the dewatering of the Sludge.

2.Ø Quantity of Sludge

2.1 At present

At present, approximately 1.2 Tonnes (Dry wt) of sludge is being generated in CETP, Pallavaram. The contribution of sludge is as follows: Suspended Solids in raw effluent and treatment chemicals : Ø.8 Tonnes/day. Wasted bio-sludge from Aeration system: Ø.4 Tonnes/day. Considering a solids consistancy of 3Ø% in the dewatered sludge from Belt press Filter/Sludge Drying Beds, the total quantity of sludge for disposal from CETP, Pallavaram is around 4.Ø Tonnes/day.

2.2 At Designed Load

The total quantity of sludge to be generated at 3ØØØ M3/day

Contribution from Suspended Solids present in effluent: 5ØØ ppm x 3ØØØ M3 = 1.5 Tonnes/day.

Contribution from chemicals added for treatment : 1.85 Tonnes/day.

Wasted Sludge from Biological treatment : 1.35 Tonnes/day.

Hence, Total Sludge qty (as Dry solids) : 4.7 Tonnes/day

Considering 3Ø% solids consistancy in dewatered sludge, the total quantity of sludge to be disposed from Pallavaram CETP will be 15.67 Tonnes/day

3.Ø Sludge Dewatering

3.1 In Sludge Drying Beds

It has been observed that the Sludge Drying Beds can take care of around 25ØØ Kg/Day/Bed of sludge load at 5% solids consistancy. This works out to be almost 75Ø Kg of sludge as dry wt/day for all six beds.

Since sludge dewatering in SDBs are cheaper, it has been decided to utilize the same to the maximum extent possible. However, it

is very much evident that this practise cannot be done when full load of effluent is received into the CETP, when sludge quantity generated every day will be several times higher.

3.2 In Belt press Filter

We have conducted experiments with various concentration of wet sludge input to the Belt press Filter without changing the Belt drive speed from the deafault condition. It has been observed that a satisfactory cake is obtained when the solids consistancy in sludge nearing 5%. The dry solids content in the dewatered sludge has been noticed in the range of 25-30%.

We have also tried various concentration of CPE to attain the solids concentration of wet sludge in the desired range of 5%. The result is reproduced in Annexure-1.

To find out the viability of using indignenious CPE for sludge conditioning, we have compared the efficiency of various CPEs and the result obtained is present in Annexure-2. It can be observed that the Polyelectrolyte supplied by Italprogetti is producing the best results. However, a final choice of CPE can be taken only after comparing the total economy of sludge dewatering.

4.Ø Performance of Gravity Thickener

The Thickener is observed to be functioning good and the optimum surface loading rate based on solids level is observed to be 1.2 Kg/M2/Hr. Based on hydraulic loading rate, the optimum loading rate is observed to be 115 Litres/M2/Hr and the optimum weir loading rate of thickener is observed to be Ø.318 M3/M2/Hr.

We have observed the performance of thickener in terms of its dewatering capacity at various concentrations of primary sludge and the observations are reproduced in Annexure-1

5.Ø Sludge Conditioning by metal salts

In laboratory level we have tried the effect of ferric chloride in improving the solids consistancy of sludge and in improving the performance of Thickener. We have observed that while the addition of metal salt is producing good results, it also results in blackening of the sludge persumably due to the presence of sulphides in the primary sludge that could have been produced by the action of SRB. Hence further experiments in this line has been discontinued.

6.Ø Sludge Characteristics

6.1 At present

It is evident that since at present very small quantity of coagulant chemicals are being utilised, the characteristics of dried up sludge produced at present will be much different from what will be generated from CETP in future. It is also to be noted that any idea regarding the effective disposal/utilisation of this sludge is to be based on the charcteristics of sludge to be generated at full load conditions.

The present sludge has been found to be having the following characteristics:

Moisture Content	:	68-72%
Chromium Hydroxide	:	2%
Other metal Hydroxides	:	2-3%
Calcium Sulphate	:	3-4%
Fine Leather particles	:	15%
Nitrogen & Phosphorous	:	5-6%
Sand & Others	:	Balance

The colour of the sludge is observed to be brownish grey. The colour changes to pale ash when further dried up.

6.2 At full load conditions

We have produced some quantity of sludge by keeping the conditions in the plant in such a way that the quality of sludge will be identical to the sludge characteristics to be generated in future so as to ascertain the actual characteristcs of mixed sludge (primary & wasted secondary) and the values obtained is presented below:

Moisture Content	:	68-72%
Chromium Hydroxide	:	Ø.4%
Other metal Hydroxides	:	7-8%
Calcium Sulphate	:	8-9%
Fine Leather particles	:	6-7%
Nitrogen & Phosphorous	:	2-3%
Sand & Others	:	Balance

The colour of the dewatered sludge is observed to be dark brown and grey when dried further.

7.Ø Sludge Utilisation

7.1 As soil conditioner/manure

The high nutrient content in the dewatered sludge is indicative of possible utilisation of the sludge generated from CETP, Pallavaram as a soil conditioner/manure. We have conducted some study in this respect.

Some quantity of dewatered sludge has been utilised in cultivation of trees like Coconut as a fertiliser. The initial observations are encouraging. However, a concrete suggestion can be given only after longer periods of observation as there is a possibility that the higher mineral content in the sludge may affect the osmotic action in roots of the species and consequently the water abosrption properties which may result in retardation of growth rate/yield. The experiment is continuing.

7.2 As raw material for products

The rich CaSO4 content and metal hydroxide concentration suggests the possible utilisation of the sludge from CETP,Pallavaram in manufacturing constructional materials. However, we have noticed that the RRL Trivandrum and NPC is conducting research work on the subject matter and hence further studies in this line was discontued. The initial response from these agencies indicates that the research work is producing highly encouraging results.

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COST REDUCTION IN OPERATION OF CETP.

Art of Economisation

While considering the above figures, it is to be noted that the real optimisation in operation cost of the CETP depends on the planning and maximum utilisation of facilities by the Administrator of the CETP. There are many ways to improve upon the efficiency of the system such as:

1. Utilization of Cheap materials for chemical treatment : It is possible to use by-products in chemical manufacture or even industrial waste materials for chemical treatment of effluent. However, while opting for such chemicals, care should be taken to see that the materials do not introduce any hazardous or toxic material to the effluent. Such introductions may cause disturbances in biological treatment or may increase the toxicity of the treated effluent.

A typical example of the above point is the utilisation of hydrated lime from Acetylene Plants which is a by product in Acetylene manufacture from Calcium Carbide. Some times it has been noticed that this material contains cyanide, which is introduced into the process material due to the very high temperature maintained during the manufacturing process. Needless to say, if cyanide is present in the chemical, a portion of it may find its way to the chemical sludge and a portion will go to the Aeration Tank, which in either case could be dangerous.

Another example is the utilisation of Alum manufactured from the waste acid from Titanium Dioxide factories. Though this alum could be cheap, several impurities which was originally present in the digestor waste acid (The acid digestion is done to leach out impurities like Iron and other heavy metals from sand) such as Hexavalent Chromium, Zinc, Nickel etc and even radio-active materials will be introduced into the effluent and to the sludge. If the removal of Sulphides is not full in Equalisation Tanks, the addition of this alum can also result in blackening of treated effluent due to the formation of Ferrous Sulphide (which of course will get oxidised in Aeration Tanks- However, in case of any stagnation of treated effluent, it will get blackened again).

Addition of this alum also may result in increase of colour in

PERFORMANCE OF UNIDO EQUIPMENTS IN CETP, PALLAVARAM

1.0 Forword

The Equipments in CETP supplied by UNIDO has been observed for its performance during the one year period. In general, the equipments are observed to be functioning very well.

2.1 The Mechanical Self Cleaning Screen

The 'Konica' Screen manufactured by Italprogetti has been in operation since the start up of the operation and observed to be running smoothly. The filtered solids from the Screen is found to be generally leather pieces and occassionally some other materials like plastic pieces,cigeratte ends etc are also noticed in the filtered out solids.

The size of particles seperated generally ranges in between 2mm to 10 mm. However, it has been noticed that the screen can remove much finer particles in specific loading conditions. Annexure-1 indicates the performance of the screen as observed during the year.

The flow rate permissible through the Screen is found to be greately dependant on the solids concentration and their sizes in raw effluent. Generally it has been observed that the loading rate of 300 M3/Hr is easily handled by the Screen.

The quantity of solids seperated also varied much during the operational period. An average of around 30 Kg of solids are observed to be seperated every day from the effluent in Konica screen.

2.2 The Aeration System

The Aeration System comprising of Blowers and fine bubble diffusers surpassed all anticipations by its superb performance during the operational period.

The system has produced reduction rates upto 99.3% which is a record in the country.

So far no clogging of diffusers have been noticed in Aeration Tanks. The main reason for this condition was noticed to be the expandable nature of diffuser sheeths, the pores of which will automatically get shut off when the air supply stops. Hence the main disadvantage as regards to the diffused aeration system, viz clogging of diffusers has been prevented here in CETP, Pallavaram by the utilisation of Non-clog fine bubble diffusers.

The fixing arrangement comprising of dismountable flanges and end pipes in air subheaders made the maintenance of the diffusers very easy. In fact, we have lifted up this air sub header easily when we have tried this arrangement as a trial pipes. It requires less than 30 minutes to take out the diffusers.

The Blowers supplied also have been observed to be superior in nature. The sound produced by the blowers are observed to be very minimum, compared to indigenious models.

2.3 The Belt press Filter

The Filter also observed to be functioning good. However, we have noticed that the Belt is slipping to one side during operation and frequent manual adjustment was necessary. One of the level switch provided for automatic control of Roller levels have gone out of order and we are waiting for the spare for replacement and more informations regarding the performance of Belt Press Filter can be compiled only after regularising its functioning.

3.0 Summary

In general, Equipments supplied by UNIDO to Pallavaram CETP are functioning very well and their performance is being monitored regulary.

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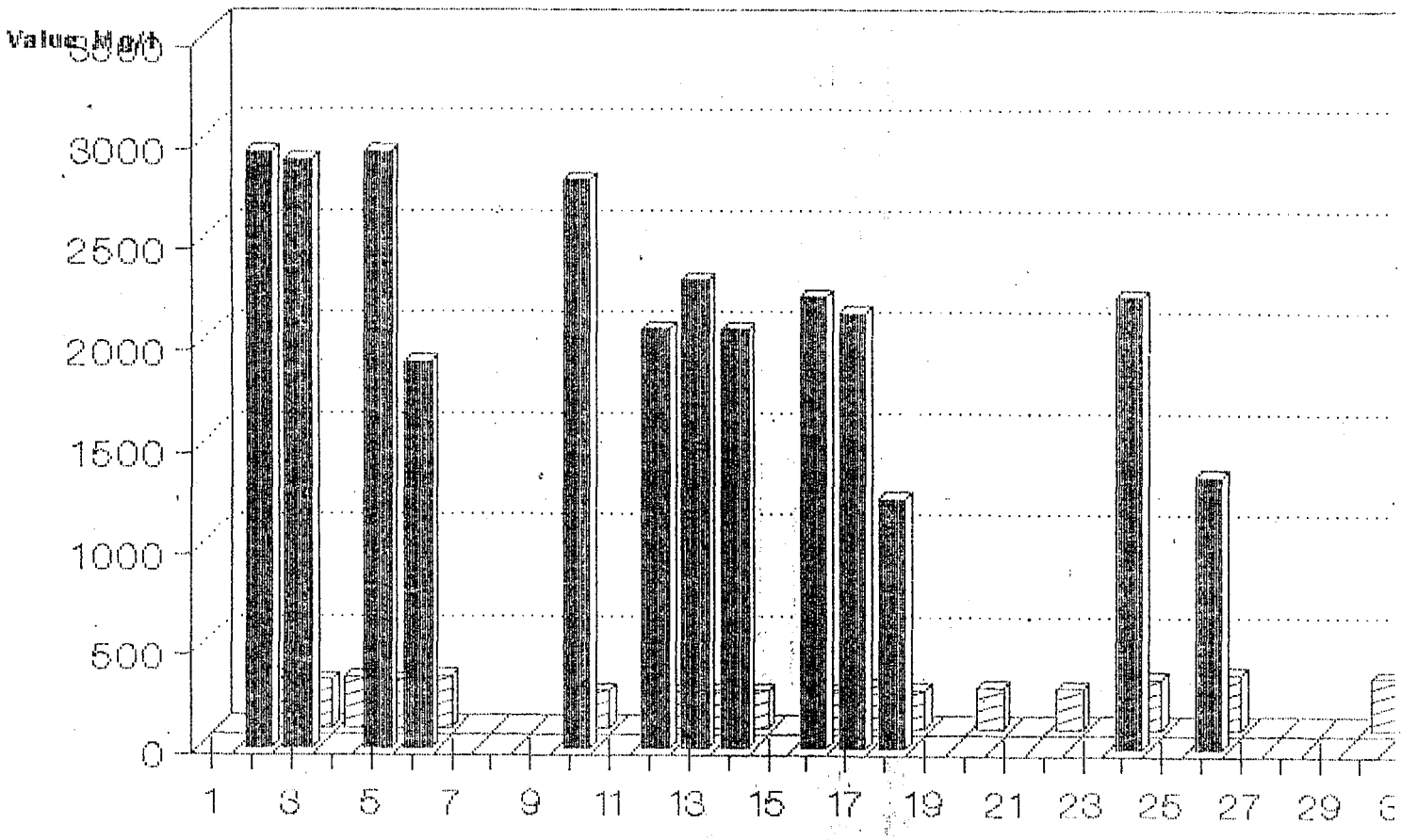
UEM-8
ANALYSIS-8



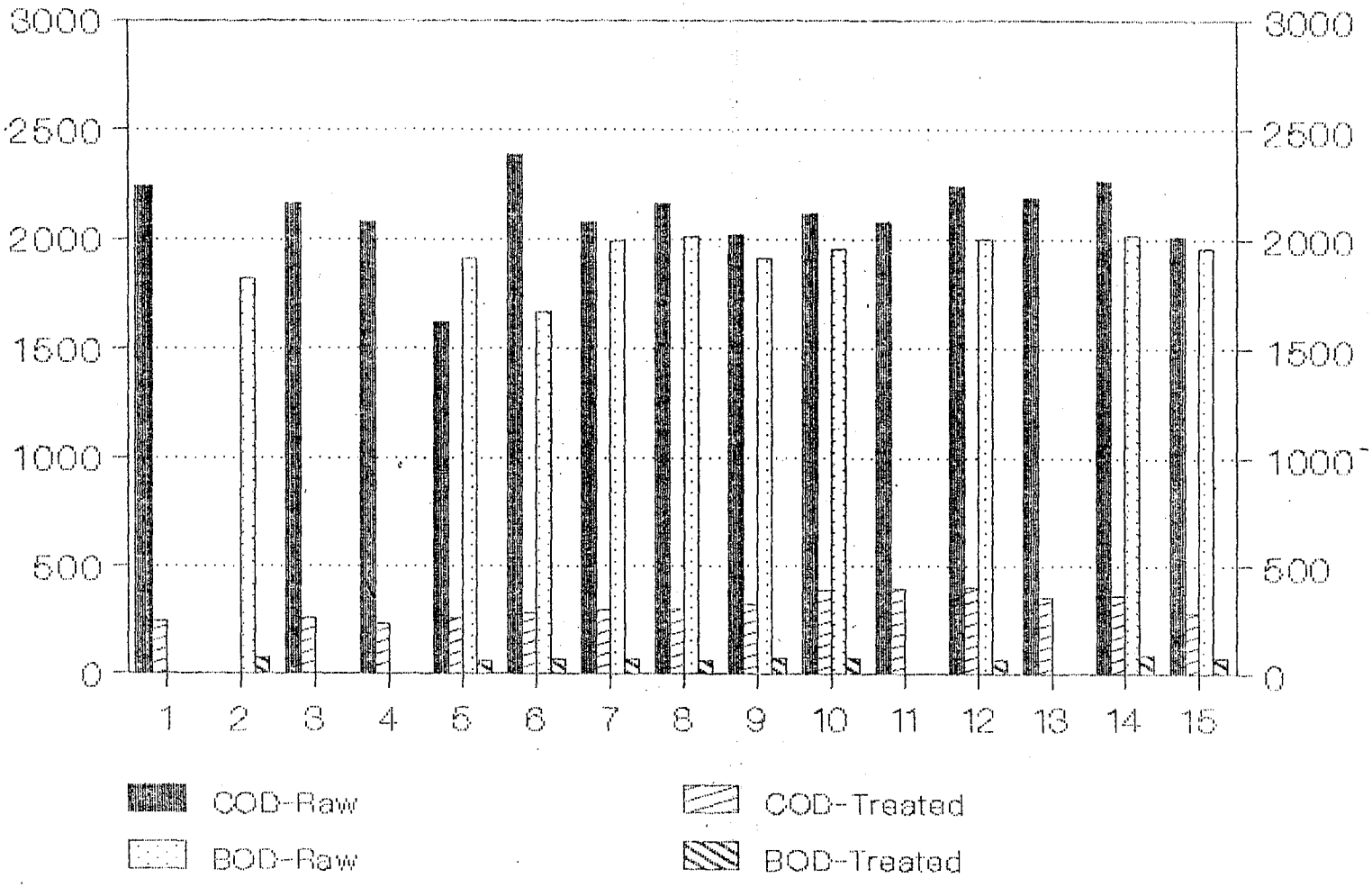
RAW EFFLUENT TREATED EFFLUENT

COD VALUES FOR RAW & TREATED EFFLUENT

FOR THE PERIOD : MAY,1995

LAB ANALYSIS REPORT

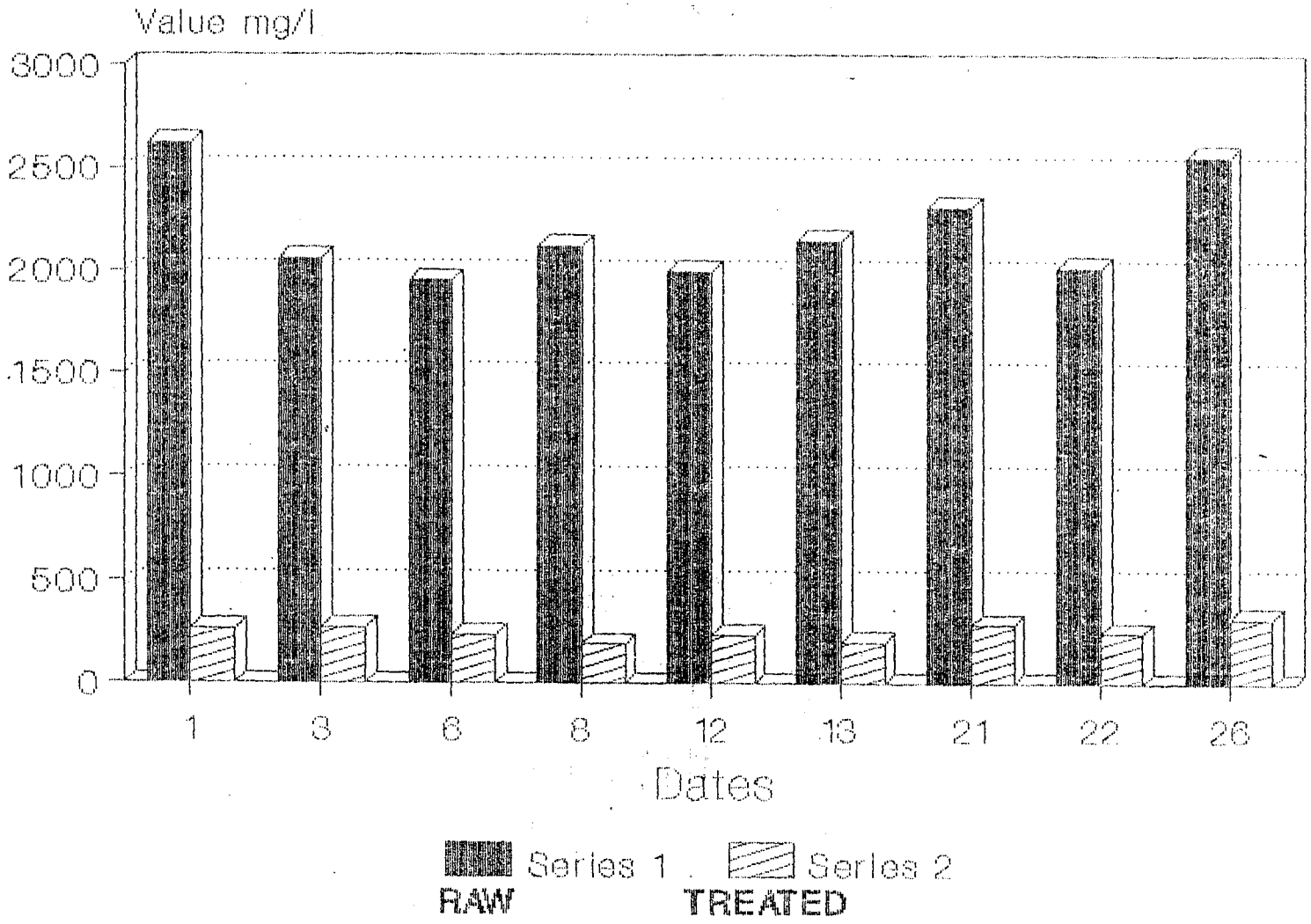
COD & BOD VALUE FOR RAW/TREATED



MONTH OF AUGUST '96

LAB ANALYSIS

C.O.D. VALUE



FOR THE MONTH OF JULY 1996

G. VENKATESWARAN

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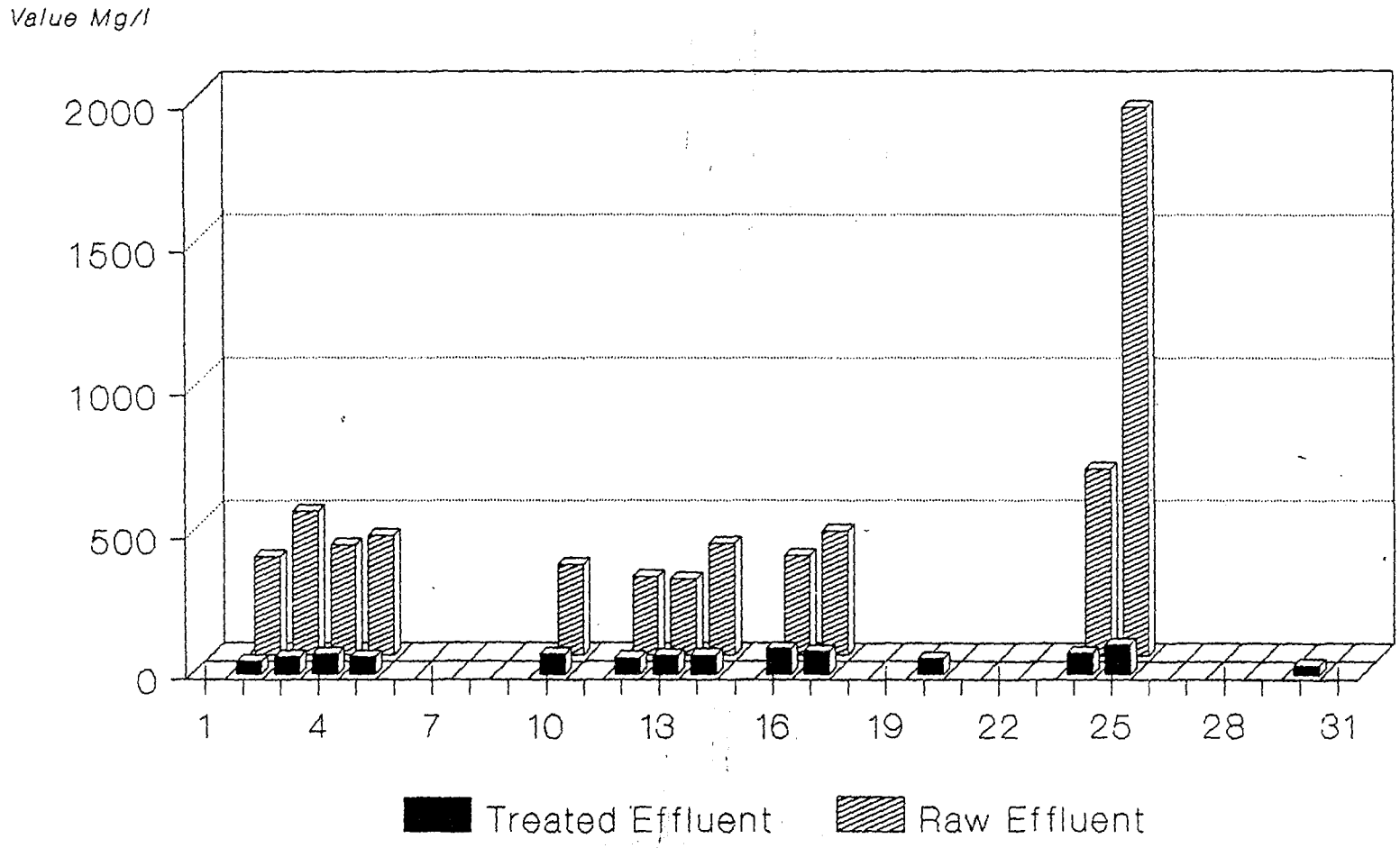
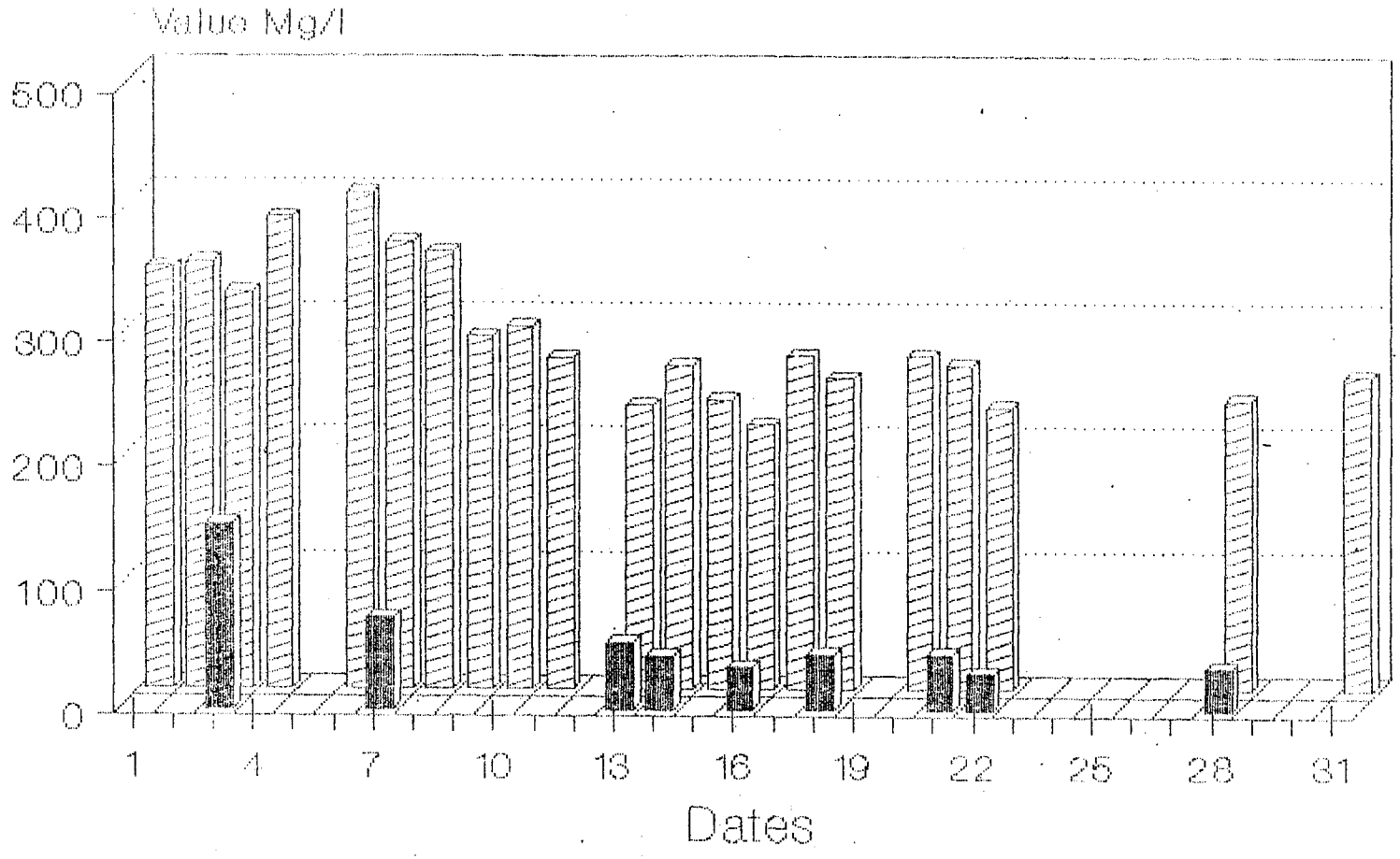
ANALYSIS-6



TSS VALUES FOR RAW & TREATED EFFLUENT **FOR THE PERIOD: MAY,1995**

UEM
ANALYSIS REPORT

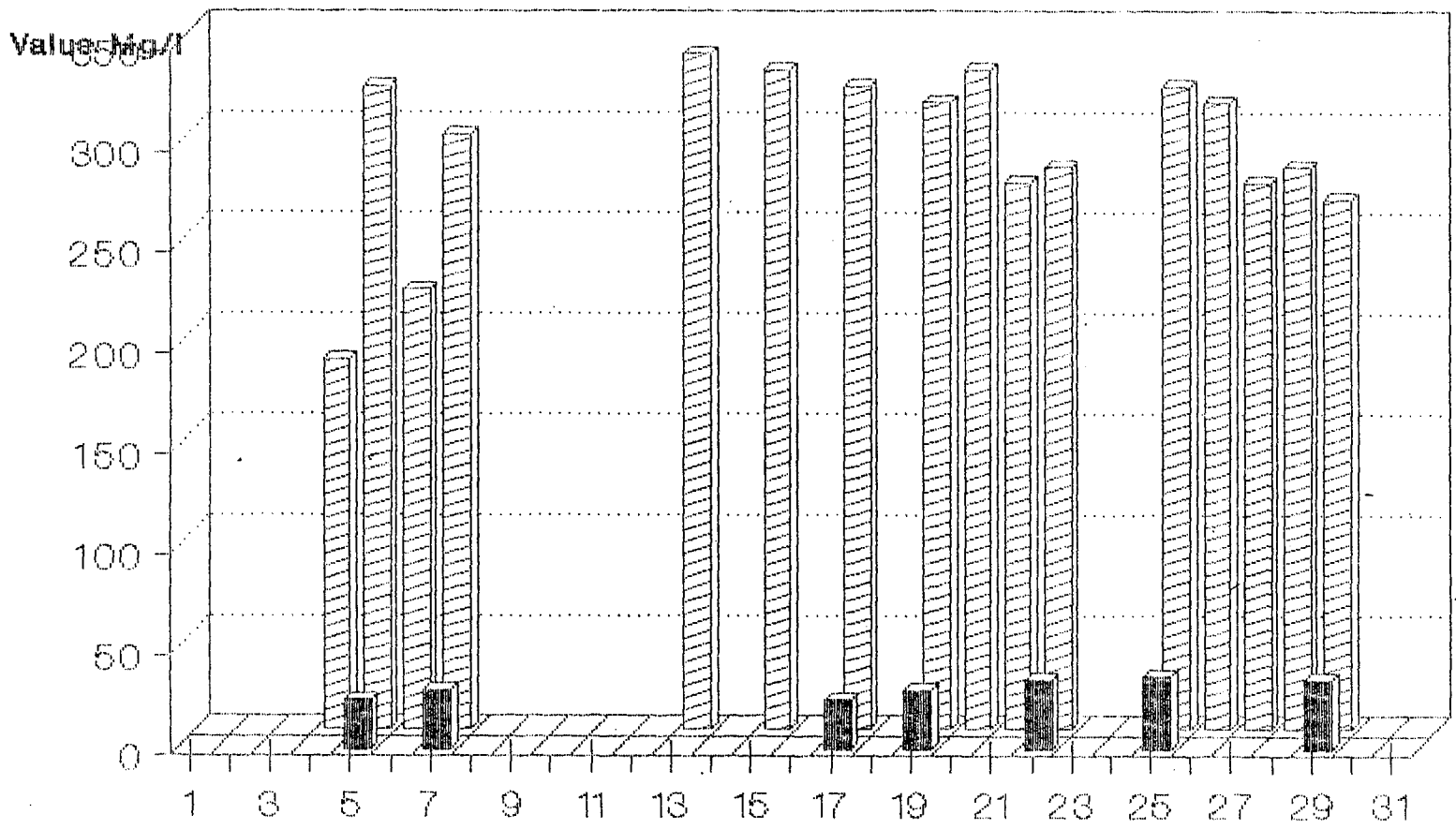


VALUES FOR TREATED EFFLUENT FOR THE MONTH OF MARCH,1995

TREATED EFFLUENT

UEM

ANALYSIS-4



B.O.D & C.O.D OF TREATED EFFLUENT

FOR THE PERIOD : APRIL,1995

ANNEX 6

COMMISSIONING AND PERFORMANCE REPORTS ON UNIDO SUPPLIED EQUIPMENT FOR CETP RANIPET

ENKEM ENGINEERS Pvt. Ltd.

824, Poonamallee High Road,
Near KMC, Madras - 600 010.
Phone : 6411362, 6428992
Telex : 041 - 8814 ENKM-IN
Fax : 044 - 6411788
Grams : " ENKEM "

A-6

ENK/385/96

TEH - PROJEKT,
JABLANOVAC 27,
41000 ZAGREB,
CROATIA.

19/03/96

KIND ATTN: Mr. SRDJAN SELANEC

Dear sir,

SUB: UNIDO equipments in Talco-CETP - Approval for installation & commissioning.

We have forwarded the original bill alongwith other reports to UNIDO, Austria for processing the same. We are also enclosing the same for your approval. We request you to approve and send it to UNIDO, Austria for us to receive the payment.

Thanking you,

Yours faithfully,
for ENKEM ENGINEERS PVT LTD.,

P.SUBRAMANI,
DIRECTOR.

Humboldt Wedag India Limited
12A, Camac Street, Calcutta-700 017
Phone : (033) 2422097/2427366/2420618 Telefax : 91 33 2425284/2428068
Telex : 021-5097 HWIL IN Cable : HUMWEDAG, Calcutta

HUMBOLDT WEDAG

24/12/95

MINUTES OF MEETING

BETWEEN M/s HUMBOLDT & M/s ENKEM ENGINEERS

PROJECT : TALCO-CETP

1. The centrifuge was commissioned on 12/12/95 after mechanical trial run & initial checkup.

2. The thickened sludge was fed into the centrifuge at the rate of 10 m^3/hr and the performance was checked for various dosage levels of Polyelectrolyte. The results have been furnished in the report enclosed herewith.

3. The percentage of solids concentration in dewatered sludge was analysed and found to be satisfactory and the same has been furnished in the report.

4. Based on the results, the optimum level of dosage of Polyelectrolyte is fixed at 2 Kg/ton of dry solids.

5. 1 Set of Operation & Maintenance manual has been given to M/s Enkem engineers for necessary reference and perusal.

6. M/s Humboldt strongly recommends for belt conveyor which has to be provided to collect & dispose dewatered sludge from centrifuge instead of chute arrangement. This is to prevent the accumulation of dewatered sludge in the absence of free fall and hence the choking of centrifuge outlet.

for HUMBOLDT WEDAG INDIA LTD.,

Mr. A.K.DE
Service Engineer.

for ENKEM ENGINEERS PVT LTD.,

G.RAJENDRAN,
Project Engineer.

Humboldt Wedag India Limited
12A, Camac Street, Calcutta-700 017
Phone : (033) 2422097/2427366/2420818 Telefax : 91 33 2425284/2420008
Telex : 021-5097 HWIL IN Cable : HUMWEDAG, Calcutta

HUMBOLDT WEDAG

PROJECT : TALCO - CETP.
Report : Performance of Centrifuge
BY : HUMBOLDT & ENKEM

Date	Flow rate of sludge pump (m3/hr)	Polyelectrolyte concentration (%)	Flow rate of Polyelectrolyte dosing pump (lph)	% of Solids in centrifuge inlet	% of solids in dewatered sludge	Dosage of polyelectrolyte (kg/ton of dry solids)
12.12.95	10	0.00	0	5.4	16.0	0.00
		0.15	400	5.4	17.2	1.11
		0.20	400	5.4	18.2	1.48
		0.25	400	5.4	19.1	1.85
		0.30	400	5.4	20.4	2.22
14.12.95	10	0.00	0	5.4	16.1	0.00
		0.15	400	5.4	17.4	1.11
		0.20	400	5.4	18.4	1.48
		0.25	400	5.4	19.3	1.85
		0.30	400	5.4	20.3	2.22
15.12.95	10	0.00	0	5.6	16.5	0
		0.15	400	5.6	17.8	1.07
		0.20	400	5.6	19.0	1.43
		0.25	400	5.6	20.2	1.78
		0.30	400	5.6	21.5	2.14
17.12.95	10	0.00	0	5.8	16.5	0
		0.15	400	5.8	18.0	1.03
		0.20	400	5.8	19.1	1.38
		0.25	400	5.8	20.4	1.72
		0.30	400	5.8	21.7	2.07
23.12.95	10	0.00	0	5.8	16.5	0
		0.15	400	5.8	18.1	1.03
		0.20	400	5.8	19.0	1.38
		0.25	400	5.8	20.3	1.72
		0.30	400	5.8	21.8	2.07

Note: The dosage has been optimised at 2 kg/ton of dry solids

PROJECT - TALCO-CETP
Report on Performance of Centrifuge

Date	Flow rate o sludge pu (m3/hr)	Polyelectrolyt concentration (%)	Flow rate of Polyelectrolyt dosing pump (lph)	% of Solids i centrifuge inlet	% of solids i dewatered sludge	Dosage of polyelectrolyt (kg/ton of dry solids)
07.03.96	10	0.00	0	5.6	16.0	0
		0.15	400	5.6	17.5	1.07
		0.20	400	5.6	18.6	1.43
		0.25	400	5.6	19.7	1.78
08.03.96	10	0.00	0	5.4	16.2	0
		0.15	400	5.4	17.6	1.11
		0.20	400	5.4	18.5	1.48
		0.25	400	5.4	19.5	1.85
		0.30	400	5.4	20.7	2.22
09.03.96	10	0.00	0	5.6	16.1	0
		0.15	400	5.6	17.5	1.07
		0.20	400	5.6	18.7	1.43
		0.25	400	5.6	19.8	1.78
		0.30	400	5.6	21.0	2.14
10.03.96	10	0.00	0	5.8	16.5	0
		0.15	400	5.8	18.0	1.03
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		0.25	400	5.8	19.8	1.72
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11.03.96	10	0.00	0	5.8	16.5	0
		0.15	400	5.8	17.8	1.03
		0.20	400	5.8	19.0	1.38
		0.25	400	5.8	19.6	1.72
		0.30	400	5.8	21.2	2.07

ENKEM ENGINEERS PVT. LTD.

Continuation Sheet

28/12/95

INTERNAL REPORT ON 5 Nos. 20 H.P. FLOATING AERATORS
PROJECT TALCO - CETP

1. The 5 Nos. Floating Aerators were commissioned on 26/12/95 after mechanical trial run.

2. The Floating Aerators were found to be taking following current rating(Amps) and it is within limits.

Aerator 1	-	26 Amps
Aerator 2	-	26 Amps
Aerator 3	-	25 Amps
Aerator 4	-	26 Amps
Aerator 5	-	25 Amps

3. Throw of flow from the centre of aerator.

Aerator 1	-	1.3 mts
Aerator 2	-	1.3 mts
Aerator 3	-	1.2 mts
Aerator 4	-	1.3 mts
Aerator 5	-	1.3 mts

S. Bally

Site Engineer.

Humboldt Wedag India Limited
12A, Camac Street, Calcutta-700 017
Phone : (033) 2422097/2427366/2420818 Telefax : 91 33 2425284/2428008
Telex : 021-5097 HWIL IN Cable : HUMWEDAG, Calcutta

HUMBOLDT WEDAG

24/12/95

MINUTES OF MEETING

BETWEEN M/s HUMBOLDT & M/s ENKEM ENGINEERS

PROJECT : TALCO-CETP

1. The centrifuge was commissioned on 12/12/95 after mechanical trial run & initial checkup.

2. The thickened sludge was fed into the centrifuge at the rate of 10 m^3/hr and the performance was checked for various dosage levels of Polyelectrolyte. The results have been furnished in the report enclosed herewith.

3. The percentage of solids concentration in dewatered sludge was analysed and found to be satisfactory and the same has been furnished in the report.

4. Based on the results, the optimum level of dosage of Polyelectrolyte is fixed at 2 Kg/ton of dry solids.

5. 1 Set of Operation & Maintenance manual has been given to M/s Enkem engineers for necessary reference and perusal.

6. M/s Humboldt strongly recommends for belt conveyor which has to be provided to collect & dispose dewatered sludge from centrifuge instead of chute arrangement. This is to prevent the accumulation of dewatered sludge in the absence of free fall and hence the choking of centrifuge outlet.

for HUMBOLDT WEDAG INDIA LTD.,

Mr. A.K.DE
Service Engineer.

for ENKEM ENGINEERS PVT LTD.,

G.RAJENDRAN,
Project Engineer.

Humboldt Wedag India Limited
12A, Camac Street, Calcutta-700 017
Phone : (033) 2422097/2427366/2420018 Telefax : 91 33 2425284/2420008
Telex : 021-5097 HWIL IN Cable : HUMWEDAG, Calcutta

HUMBOLDT WEDAG

PROJECT : TALCO - CETP.

Report : Performance of Centrifuge

BY : HUMBOLDT & ENKEM

Date	Flow rate of sludge pump (m3/hr)	Polyelectrolyte concentration (%)	Flow rate of Polyelectrolyte dosing pump (lph)	% of Solids in centrifuge inlet	% of solids in dewatered sludge	Dosage of polyelectrolyte (kg/ton of dry solids)
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		0.20	400	5.8	19.0	1.38
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PROJECT - TALCO-CETP
Report on Performance of Centrifuge

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		0.15	400	5.6	17.5	1.07
		0.20	400	5.6	18.6	1.43
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		0.15	400	5.4	17.6	1.11
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		0.15	400	5.6	17.5	1.07
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28/12/95

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Aerator 3	-	1.2 mts
Aerator 4	-	1.3 mts
Aerator 5	-	1.3 mts

S. Bally

Site Engineer.

TNGST. No. 1120152/95-96 CST. No. 57813/16-4-87

Area Code No. | 0 | 5 | 7 |

ENKEM ENGINEERS Pvt. Ltd.

824, POONAMALLEE HIGH ROAD,
(Near KMC) MADRAS-600 010
Telex : 041 - 8814 ENKM - IN
Fax : 044-6411788 Tgm. : "ENKEM"
Phone : 6411362, 6428992

To

THE RESIDENT REPRESENTATIVE
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
55, LODI ESTATE
P.O.BOX.3059
NEW DELHI -110 003.

INVOICE No. R BILL II

DATE 05.03.96.

Your Order 15-4-4043W dt.31.01.94 (PROJECT:US/IND/90/244)

Despatched through LR / RR No.

Consigned to UNIDO (Talco Ranipet)

Payment DEMAND DRAFT/CHEQUE

PRODUCT CODE	DESCRIPTION	QUANTITY	RATE	AMOUNT
			US $	US $
	INSTALLATION & COMMISSIONING			
1...	High Speed Floating Aerator Type TEFC,IP 55, 20HP,1440 rpm	5 Nos.	50,000 (10%)	5,000
2.	Screw Pumps(Thicened Sludge Transfer Pumps) 10 cub.m/hr 960rpm, 5HP	2 Nos.	14,000 (10%)	1,400
3.	Sludge Dewatering System compl. with one bowl decater centrifuge cap.not less than $10m^3/hr$ of thickened sludge with solid concentration 3-8% compl.with feed chamber, pulley,18.5KW motor, wetted parts in stainless steel piping + wiring,control panel.	1 set	80,000 (10%)	8,000
4.	Dosing System. (1,000 l HDPE Tank, agitator, mixer, two metering pumps,all piping & wiring)	1 set	10,000 (10%)	1,000
	TOTAL EQUIPMENT			15,400
	INSTALLATION			3,000
	GRAND TOTAL			18,400

Rupees EIGHTEEN THOUSAND FOUR HUNDRED U.S. DOLLORS ONLY.

1. Interest at 24 percent P.A. will be charged for Payment after due date.
2. All payments to be made by DD/Cheque crossed A/c payable in favour of Enkem Engineers (P) Ltd.
3. The charges of your bankers will be of your A'c
4. No complaints of shortage/demage will be entertained unless received within 5 days from the date of delivery.

For ENKEM ENGINEERS PVT. LTD.

TNGST. No. 1120152/95-96 CST. No. 57813/16-4-87

Area Code No. | 0 | 5 | 7 |

ENKEM ENGINEERS Pvt. Ltd.

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(Near KMC) MADRAS-600 010
Telex : 041 - 8814 ENKM - IN
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PRODUCT CODE	DESCRIPTION	QUANTITY	RATE	AMOUNT
			US $	US $
	INSTALLATION & COMMISSIONING			
1...	High Speed Floating Aerator Type TEFC,IP 55, 20HP,1440 rpm	5 Nos.	50,000 (10%)	5,000
2.	Screw Pumps(Thicened Sludge Transfer Pumps) 10 cub.m/hr 960rpm, 5HP	2 Nos.	14,000 (10%)	1,400
3.	Sludge Dewatering System compl. with one bowl decater centrifuge cap.not less than $10m^3/hr$ of thickened sludge with solid concentration 3-8% compl.with feed chamber, pulley,18.5KW motor, wetted parts in stainless steel piping + wiring,control panel.	1 set	80,000 (10%)	8,000
4.	Dosing System. (1,000 l HDPE Tank, agitator, mixer, two metering pumps,all piping & wiring)	1 set	10,000 (10%)	1,000
	TOTAL EQUIPMENT			15,400
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DATE 05.03.96.

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Despatched through LR / RR No.

Consigned to UNIDO (Talco Ranipet)

Payment DEMAND DRAFT/CHEQUE

PRODUCT CODE	DESCRIPTION	QUANTITY	RATE	AMOUNT
			US $	US $
	INSTALLATION & COMMISSIONING			
1...	High Speed Floating Aerator Type TEFC,IP 55, 20HP,1440 rpm	5 Nos.	50,000 (10%)	5,000
2.	Screw Pumps(Thicened Sludge Transfer Pumps) 10 cub.m/hr 960rpm, 5HP	2 Nos.	14,000 (10%)	1,400
3.	Sludge Dewatering System compl. with one bowl decater centrifuge cap.not less than $10m^3/hr$ of thickened sludge with solid concentration 3-8% compl.with feed chamber, pulley,18.5KW motor, wetted parts in stainless steel piping + wiring,control panel.	1 set	80,000 (10%)	8,000
4.	Dosing System. (1,000 l HDPE Tank, agitator, mixer, two metering pumps,all piping & wiring)	1 set	10,000 (10%)	1,000
	TOTAL EQUIPMENT			15,400
	INSTALLATION			3,000
	GRAND TOTAL			18,400

Rupees EIGHTEEN THOUSAND FOUR HUNDRED U.S. DOLLORS ONLY.

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PRODUCT CODE	DESCRIPTION	QUANTITY	RATE	AMOUNT
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	INSTALLATION & COMMISSIONING			
1...	High Speed Floating Aerator Type TEFC,IP 55, 20HP,1440 rpm	5 Nos.	50,000 (10%)	5,000
2.	Screw Pumps(Thicened Sludge Transfer Pumps) 10 cub.m/hr 960rpm, 5HP	2 Nos.	14,000 (10%)	1,400
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	TOTAL EQUIPMENT			15,400
	INSTALLATION			3,000
	GRAND TOTAL			18,400

Rupees EIGHTEEN THOUSAND FOUR HUNDRED U.S. DOLLORS ONLY.

ANNEX 7

COMMENTS AND RECOMMENDATIONS ON
Mr. Buljan's "Broad Overview of Possible Topics to be Addressed, Studies to be Undertaken and/or Pilot Units to be Set-Up for Development, Demonstration and Training Under Regional SE Asia Program"

A-1

COMMENTS AND RECOMMENDATIONS ON MR. BULJAN'S OVERVIEW OF POSSIBLE STUDIES TO BE UNDERTAKEN UNDER REGIONAL SE ASIA PROGRAM IN POLLUTION CONTROL

Ad A: POLLUTION PREVENTION

All the measures to decrease pollution within the leather processing should be supported. This especially goes for salt content reduction since still there is no economical process to solve this problem end of pipe.

Although generally positive, reduction of water consumption might not have positive effects on effluent treatment results.

Ad B: WASTE TREATMENT

(3.1) All the legislative acts from the participating countries should be collected, studied and systematized/categorized. Consequently, it should be necessary to negotiate (when/where possible) modification towards technically and economically realistic application of standards (gradual approach).

(3.2) It should be absolutely useful to establish comprehensive data base on:

- investment costs,
- operation data (such as; flow, chemical and power consumption etc.)
- treatment analytical results (input/output and throughout the process)
- O/M costs (for the system in whole as well as for the particular steps)

(4.0-5.0) The list of treatment systems is absolutely acceptable. Only it could be re-ordered in technological manner.

(6.0) It could be useful to purchase transportable nitrification/denitrification pilot plant providing that trained staff and/or consultants to use it are available. Explore possibility to combine biological reactor and ultrafiltration?!

(7.0) We are of the opinion that the following locations in T.Nadu can be suitable for some of the recommended advanced systems/equipment:

(7.3)	Flotation/filtration:	CETP Ranipet and ETP PKL
(7.4)	Electrolytic system:	In a tannery with appropriate technological level (very sophisticated system requiring well trained operating and maintenance staff)
(7.6)	Selected/adapted microorganism:	ETPs Meera Hussain and Erode (ENKEM plant)
(7.7)	"Sewage farms":	PKL
(7.8)	Screw sludge press:	PKL
(7.9)	Membrane technology:	In a tannery with appropriate technological level and appropriate effluent treatment system. (very sophisticated system requiring well trained operating and maintenance staff) Ranipet tanners have expressed their interest for treated effluent reuse.

Ad C: (8.1) Coordinate with the existing Ministry for Non-Conventional Energy project (ENKEM/Dr. Mariapan)

Ad D: Divide the classification according to:
- problem magnitude
- optimum sitting

NOTE: The proposed activities/studies would be extremely useful for solving tannery waste management problem, providing that all the collected data are properly processed and results disseminated to the end users (consultants, tanners, ETP operators, pollution control agencies, legislative agencies etc.)

Madras, 2 March, 1996

Sub-contractor I

ANNEX 8.

Comments on the reports prepared by the UNIDO Experts;
Mr. M. Aloy and Dr. G. Clonfero

1. INTRODUCTION

The two UNIDO experts have been fielded to asses the situation at Tamil Nadu tannery effluent treatment plants as a result of unsatisfactory environmental situation reported by TNPCB (Jan. 1996) and NEERI (Feb. 1996). The reports had even caused Supreme Court to order immediate actions for improving the performances of existing plants (to reach the prescribed standards) and to forbid the operation of all the tanneries not connected to efficient plants.
In May 1996, Mr. G. Clonfero has visited the sites of 7 operating CETPs including the CETPs Pallavaram and Ranipet which were the subjects of this project.
In June 1996, Mr. M. Aloy has visited the sites of 19 tannery effluent treatment projects including the CETPs Pallavaram and Ranipet as well as ETPs PKL and MHT which were the subjects of this project.
Apart from the comments made below, we would like once again to stress the importance of the Project follow-up with the purpose to eliminate deficiencies of the "hardware" implemented and to continue with the strengthening of the "software" (abilities of the local people to cope with the O/M problems as well as to designing necessary pollution measures). Also it seems necessary to assist local authorities to plan actions, gradually achieving required standards with the respect of present techno-economical abilities.

2. COMMENTS ON THE REPORT PREPARED BY Mr. M . ALOY IN JUNE, 1996

Although most of the remarks and recommendations made in Mr. Aloy's Report have been already elaborated within one or more of the SC-I reports we would like to stress importance of them by the following comments:

2.1 "GENERAL RECOMMENDATIONS"

2.1.1 Construction recommendations

a) **Flow-Measurement and Sampling** - SC-I had insisted that the devices are installed, (especially at CETPs) from the beginning of the Project (PROGRESS REPORT-PHASE I, Nov. 1992). The flow-meters have been installed at both CETPs but measurement at Pallavaram is not accurate (because of constructional reasons) and at Ranipet the data cannot be transmitted to the main control board. Although SC-I had recommended and UNIDO has purchased 3 automatic, computerized samplers we are not aware if they had ever been used!? Our opinion is that technical and education difficulties in India should be overcome as soon as possible and that the devices should be introduced in daily practice (with the assistance of local pollution control authorities and foreign consultants, if necessary)!

b) **Recording of the O/M Parameters** - SC-I had even prepared written instructions and charts for each plant (INSTRUCTION MANUALS-DRAFT, Oct. 1993). Since adequate recording was witnessed only at ETP MHT, we are of the opinion that better attention should be paid to recording and using the information in daily O&M (reports on inadequate recording and consequently inadequate O&M were made in all of the recent SC-I field reports).

c) **Mechanical Screening** - Manual coarse screening has been introduced at all the CETPs and ETPs mainly because of economical reasons. Whenever suggesting the mechanical screens the sub-contractor was reminded that man-power is no problem in India. However, present situation especially at CETPs treating effluent from R-F tanneries proves the need of mechanical screens to be used at the very inlet to the system.

d) Mixing & Aeration of Equalization Tanks - at CETP-Pallavaram (min. 28 W/m^3) and at ETPs MHT & PKL (>>30 W/m^3) should be sufficient for mixing and oxidation of sulfides. In the case of CETP-Ranipet we recommended capacity of the installed aerators (only 14.8 30 W/m^3) to be increased as early as Nov. 1992 (PROGRESS REPORT-PHASE I) but although UNIDO has tendered new (2 x 25 HP) aerators, they were never purchased because of financial reasons.

e) Chemical Dosage - automatic regulations (at CETP Pallavaram even with PLC) have been recommended at all plants (except MHT) but even where installed (Ranipet, PKL) were never properly used. It is obvious that the extent of automatization in India should either be kept at lower level or O/M staff should be better educated. Also, low quality of the equipment and lack of spare & consumable parts presents great problem.

f) Scum Removal - the importance of efficient systems at primary settling has been stressed in almost all of the SC-I reports.

g) Corrosion - the importance of adequate corrosion-proof coating has been stressed in almost all of the SC-I reports.

h) **Anaerobic Treatment** - reasons for the poor effect at the existing systems should be carefully studied and profitability of further use examined.

i) **Secondary Settling** - SC-I had recommended the same (as early as Nov. 1992 in the PROGRESS REPORT-PHASE I) but CETP Ranipet has been already in advanced stage of construction. The need is now proved in practice and extension has been recommended in the SC-I FINAL REPORT. At the other plants, the tanks are of adequate sizes.

j) **Nutrients** - generally we feel that the need for nutrients should be studied in better/expertly manner and the optimal (qualitatively, quantitatively and economically) nutrient selected.

k) **Tertiary treatment** - Pilot studying has been recommended in all the recent reports with a main purpose to decide upon technical and economical feasibility of the methods to achieve the requested effects for TDS, color, and COD removal. (FIELD MISSION REPORT, June 1995; PROGRESS REPORT FOR PHASE 2, Oct. 1995 and DRAFT FINAL REPORT-PHASE 2, March 1996)

l) **Sludge Treatment** - practical results should be monitored, recorded and adequate methods for improvements selected (within the tanneries as well as at CETPs)

2.1.2 Pollution limits to be taken in account

Gradual approach in achieving the desired results was always recommended, especially in a view of still inadequate technological abilities (equipment, staff experience) and especially in a view of lack of funds. (see also 1.1.1 k).

2.1.3 Safety on effluent treatment plant

SC-I has always paid special attention to the problem giving specific instructions (INSTRUCTION MANUALS FOR o/m OF THE TANNERY EFFLUENT TREATMENT PLANTS - Draft, Oct. 1993 and AN OUTLINE OF THE TRAINING PROGRAM FOR STAFF TO OPERATE, MAINTAIN AND MONITOR THE EFFLUENT TREATMENT PLANTS, Jan. 1994) as well as explicitly commenting poor performance and giving recommendations for necessary improvements (FIELD MISSION REPORT, June 1995; PROGRESS REPORT FOR PHASE 2, Oct. 1995 and DRAFT FINAL REPORT-PHASE 2, March 1996)

2.2 "VISIT REPORTS AND RECOMMENDATIONS FOR EACH CETP AND ETP"

2.2.1 Presidency Kid Leather

We fully agree that unusually high financial and human effort invested (for developing country) have resulted in good performance which could be hardly improved in rational manner. The recommended methods could have sense, in this moment, only if the plant is used as testing ground for researches to serve broader community of tanners (even in other countries).

2.2.2 Control Laboratory in Pallavaram CETP

The poor shape of the laboratory and equipment has been commented in all the SC-I reports and improvements recommended. We even recommend stronger approach to the problems if UNIDO is going to use the plant as demonstration facility!

2.2.3 Meera Hussain Tannery ETP

We are surprised that more data had not been supplied to the expert, since they are supposed to be available (at least with ENKEM), which would enable him to give more coherent comments and recommendations!?

2.2.4 Ranipet (Ranitec) CETP

a) **Manual Screens** - Problems and inadequacy of the system have been broadly discussed in the DRAFT FINAL REPORT-PHASE 2, March 1996. We fully support the seriousness of the H_2S problem. (see also 1.1.1 c).

b) **Konica Screen** - Problems have been broadly discussed in the DRAFT FINAL REPORT-PHASE 2, March 1996 and recommendations made.

c) **Aerators in the equalizing tank** - see 1.1.1 d).

d) **Submersible Equalizing Pumps** - have been recommended by SC-I for similar purposes within the Project but in Ranipet all the pumps were already selected before the SC-I engagement.

e) **Lime dosage** - we fully support the comments. Optimal system should be used.

f) **Coagulation** - introduction of the baffles into the existing open channel was the least expensive modification. Optimal quantity and type of chemicals should be selected not only at CETP-Ranipet. More studious approach (jar-tests, characteristics of sludge and effluent) is strongly recommended!

g) **Anaerobic Lagoon** - the effect has been improved since our last visit, as foreseen in the last report.

h) **MLSS** - identical opinion is given in the DRAFT FINAL REPORT-PHASE 2, March 1996.

i) **Tertiary Treatment** - Since the effect of existing plant is considerably good (BOD = 40-50 mg/l) and can be still improved we would think twice before introducing any additional (costly) full-scale treatment immediately!?

j) **Thickening** - although SC-I had recommended the thickener (dia. 12 m) with mechanical scraper, only the buffer/thickener has been constructed because of financial reasons.

k) **Centrifuge** - should be definitely fine-tuned and PE addition optimized. UNIDO has supplied adequate type of PE, proven in practice and it should be, in our opinion, taken/borrowed from Pallavaram since otherwise it can be only spoiled there!

l) **Flow-meter & Sampler** - should be purchased if possible.

m) **Primary settling** - the problems have been broadly discussed in the DRAFT FINAL REPORT-PHASE 2, March 1996 and recommendations made.

n) **H_2S** - once again we support the importance of adequate staff protection

3. COMMENTS ON THE REPORT PREPARED BY Dr. G . CLONFERO IN JUNE, 1996

The report expertly elaborates the problems of tannery pollution control in India and we fully support all the recommendations which should be followed-up on the local and international (especially UNIDO assistance) level.

3.1 KEY- SENTENCES

a) "... such important realizations implemented in this enough little number of years."

b) "... problem is the same faced by the tanners of other countries (either industrialized or developing) when started up the new plants: the incapability of making the plants at optimal expected performance and efficiency."

c) "... to obtain significant data useful to interpret the plant's performance, controls must be made on representative samples (not limited to the final treated effluent) and test must be correct and carried out according to the standard methods."

d) "There are no fixed rules suitable for all the plants. every plant is a unique case, and the best operational conditions must be found and tailored on the basis of the result practically experimented on the site."

e) " ... realistic period of time in order to give tanneries the possibility to survive and improve."

3.2 FINDINGS AND RECOMMENDATIONS

Since all the technical findings and recommendations basically correspond to those presented in Mr. Aloy's report (see above) and we fully support them, we do not feel the need to repeat them but would like to point out some important details:

a) The most common design, technical and O/M errors recorded are:

- ineffective mechanical pre-screenings,
- poor mixing/aeration of equalization tank,
- improper chemical dosage,
- improper design of secondary settling,
- poor sludge dewatering,
- unsolved sludge disposal,
- poor O/M of the biological step,
- limited skill and expertise of the staff

b) It is absolutely necessary to immediately evaluate most common design, technical and O/M errors and avoid their repetition in future.

c) To evaluate the errors and to correct the problems as well as to enable proper O/M of the plants it is necessary to:

- obtain design (with detailed technological calculations of each operation), as-built drawings, O/M Manuals for each plant,
- train the staff in accordance with specific requirements of the plant,
- enable the plant laboratory to perform all the necessary analyzes,
- interpret the determined data in proper manner (self or in assistance with local and international consultants)

3.3 ADDITIONAL NOTE

We would expect Dr. Clonfero to comment the problem with the Pallavaram sludge dewatering press in details and even to give explicit instructions for its solution.