Common Effluent Treatment Plant

A solution or a problem in itself

TOXICS LINK

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About TOXICS LINK:

TOXICS LINK is a non profit environmental organisation working towards freedom from toxic pollution. Operating since 1996, Toxics Link has three information outreach nodes in Delhi, Mumbai and Chennai respectively. The nodes provide information to grassroots groups and individuals and networks with others working on environmental toxicity issues.

Other Toxics Link reports, published and forthcoming:

- *Not so inert after all!* Flyash: an environmental and health perspective. 1997
- *Landfills Deconstructed*: Technology, Management and Experiences. 1998
- *Status of Hazardous Wastes in India.* 1999
- *Cloning Bhopal*: Exposing the dangers in Delhi's environment.1999
- *Pesticides in India:* Environment and health sourcebook. 2000
- *Trojan Horses:* Persistent Organic Pollutants in India

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Overview

During the past 30 years the industrial sector in India has quadrupled in size simultaneously, the major waste generators in India including the petrochemical, pharmaceutical, pesticide, paint, dye, petroleum, fertiliser, asbestos, caustic soda, inorganic chemicals and general engineering industries.

The bulk of industrial pollution in India is caused by the small and medium scale industrial (SMIs) sector. A small scale unit is defined as any industry whose plant and machinery are valued at less that 1 crore (Government is planning to increase this to 5 crores). Though the quantity of industrial waste generated by individual SMIs may not be large, it aggregates to be a large percentage of the total since almost 3 million SMIs are widely scattered throughout the country. SMIs account for over 40percent of the total industrial output in the country and generate over 44percent of hazardous wastes alone as compared to 13percent generated by the large scale industry (Gulati 1997; B.M. Prasad,). Also SMIs normally do not budget for resources to meet regulatory standards. The rate of growth of SMIs has also exceeded that of the industrial sector as a whole.

Government policies have been biased toward small industries as employment generators, even though small industries are highly polluting. The SSI policy has no thought on the environmental planning. Promotion of small enterprise is widely seen as a desirable way to achieve sustainable development; for that result, however, their pollution problems, among others, must be overcome. To deal with the effluent in these SSIs the concept of Common Effluent Treatment Plan (CETP) was introduced with a hope that not only it would help the industries in pollution abatement but also as a step towards the clean environment.

Accordingly the Ministry of Environment and Forests instructed various State Pollution Control Boards, to examine the possibilities of establishing CETPs in various industrial estates in the respective states. Even central assistance upto 25percent of the total cost of the CETP is being provided as a grant to the common effluent treatment plant on the condition that the State Governments would give a matching contribution. The remaining cost have to be met by equity contribution by the industries and the loans from financial institutions.

The concept of CETP which was hyped as a solution to manage water pollution has failed because of the heterogeneous nature of the effluent from different industries. It has only compounded the toxic content to larger volumes. And also with the changing nature of effluent many toxic substances like organochlorines, polychlorinated biphenyls (PCBs) and heavy metals have found their way into the waste stream. The various standards formulated for inlet and outlet effluent has no mention of these toxic chemicals and other volatile fugitives. The management of Persistent Organic Pollutants (POPs) and inorganic residues in fluid form goes beyond the capacity of primary and secondary treatment in CETPs. Reverse Osmosis, Granulated Activated Carbon, Ultra-filtration, ion exchange and other tertiary treatment methods which could be effective in this case are not used by CETPs mainly for economic reasons. This concept also faced many operational and institutional problems as many participating industries started withdrawing from the scheme. With the growing pace of industrialization these CETPs are unable to cater to the need of the industrial clusters, which has resulted in bypassing the treatment and directly discharging the untreated effluent in water bodies. The sludge which get settled in aeration tanks having concentrated amounts of heavy metals and organochlorines, is disposed openly as in the case of both Vapi and Kanpur CETPs.

World Bank is still promoting CETPs under "Pollution Prevention Programme" as a viable solution to control industrial pollution. Also in most of the water pollution cases the courts have given the ruling to abate the problem using this concept (M.C. Mehta vs Union of India 1987, Kanpur tanneries).This myopic vision about managing effluents with an end-of pipe technology has been ineffectual even in controlling the basic parameters of the effluents.

There is a need to approach this problem of waste generation at each stage of product life cycle, starting from the types of chemicals used, technology, final product, waste minimization and its proper disposal. The waste management hierarchy would seem to work best in individual waste-generator cases. Logically, after receptor-related treatment is ensured, waste minimisation efforts are taken up with the objective of progressively reducing the need for individual treatment. In India the paradox of starting backwards is legally enforced in that, no industry of the 'Red' or 'Orange' category can commence operations unless and until the end-of-pipe hardware is in place. Till this year, end-of-pipe pollution control hardware costs could be depreciated 100percent in the first year and import of ETP related equipment still get through with low duties. The same subsidy is not available for waste minimisation or preventive measures related hardware and software. These incentives coupled with command and control enforcement of standards, shifts the whole focus away from waste minimisation towards operation of treatment and disposal systems.

On the other hand "Clean Production" concept goes beyond "Pollution Prevention", which traditionally advocates reducing toxic material at their source in manufacturing process. Here each stage of the manufacturing process is not viewed separately but holistically and calls for multi-pronged approach in dealing with the problem rather than just focusing on the extreme tail end. Clean production ultimately means the use of renewable energy and materials, the minimal use of resources, the design of sustainable products, the production of food in sustainable way, and the generation of waste that is benign and returnable into the production process.

Clean production concept comprises of four main elements.

The precautionary principle: Under this principle, the burden is to proponent of an activity to prove there is no safer way to proceed, rather than on victims or potential victims of the victims to prove it will be harmful.

The Preventive Principle: Prevention requires examining the entire product life cycle, from raw material extraction to ultimate disposal.

The Democratic Principle: Clean production involves all those affected by industrial activities, including workers, consumers, and communities. Access to information and involvement in decision making, coupled with power and resources.

The Holistic Principle: There is a need to take a integrated approach to environmental resource use and consumption. We should be careful not to create a new problem while addressing old ones or shift the problems from one sector to another.

What is a CETP ?

Common Effluent Treatment Plant is the concept of treating effluents by means of a collective effort mainly for a cluster of small scale industrial units. This concept is similar to the concept of Municipal Corporation treating sewage of all the individual houses. The main objective of CETP is to reduce the treatment cost for individual units while protecting the environment.[1]

- To achieve 'Economics of scale' in waste treatment, thereby reducing the cost of pollution abatement for individual factory.
- To minimise the problem of lack of technical assistance and trained personnel as fewer plants require fewer people.
- To solve the problem of lack of space as the centralized facility can be planned in advance to ensure that adequate space is available.
- To reduce the problems of monitoring for the pollution control boards.
- To organize the disposal of treated wastes and sludge and to improve the recycling and reuse possibilities.

Status of CETP's in India

Provision of effluent treatment plants for individual industries especially in the small scale sector in the various industrial estates in India to produce the effluent of desired quality before discharging the effluent is not feasible in the Indian context. Firstly, it is expensive on both the capital and operating cost front and secondly, there is no guarantee of performance by the individual industries. Further the disposal of treated effluents is also problematic as every individual industry cannot reach the water body through it's own pipeline nor can it purchase land for inland irrigation. Thus, Government of India floated the idea of Common effluent treatment plant to overcome these problems. Accordingly Ministry of Environment and Forest, Government of India instructed the various State pollution control boards to examine the possibilities of establishing CETP's in various industrial estates. In response to the directive issued by the Central government, the State governments started identifying the various locations for CETP's. Work carried out in this context till 1990 was very limited. Till 1990 India had only one CETP in Jeedimetla near Hyderabad (Andhra Pradesh) and here effluent was collected by tankers.

Status of CETPs

Sl. No.	Name of the State/UT	GOI subsidy disbursed	No. of CETPs
1	Andhra Pradesh	132	3
2	Delhi	2300	15
3	Gujarat	735.42	7
4	Himachal Pradesh	12.6	4
5	Haryana	11.89	1
6	Karnataka	98.84	3
7	Madhya Pradesh	96	3
8	Maharastra	267.435	8
9	Punjab	19.95	4
10	Rajasthan	100	2
11	Tamil Nadu	1934.08	36
12	Uttar Pradesh	95.75	2
	Total	**5803.89**	**88**

Source: Ministry of Environment and Forests

Technological aspect of CETP

Feasibility assessment of Common effluent treatment plants

The feasibility assessment can be broadly classified into two parts.

Identifying institutional, environmental and infrastructural issues

The initial stage of a feasibility assessment involves gathering information on existing and proposed institutional, environmental and infrastructural issues in the particular geographic area. The study also aims at identifying and establishing various parameters that ultimately influence the design of the plant.

While determining whether a CETP is feasible for a group of firms, it is important to recognize that certain characteristics of industries, certain regional and regulatory considerations favour the establishment of CETPs. Preliminary investigation of the following factors is essential during the feasibility assessment -

- **Number of firms**- This is a very important factor as this decides the unit cost of treatment. The more the firms participate, the lower would be the unit cost of treatment for each firm.
- **Location of firms**- This factor has a major impact on the transportation costs which strongly influences the feasibility and cost-effectiveness of a CETP.
- **Presence of sewer system** - This also has a positive effect on the feasibility of CETP. Proper laid out sewer lines aid in conveyance of effluents from the individual factories to the centralized facility. If no sewer line is present then good roads are essential for truck access.
- **Volume and strength of waste**- Firms that produce waste of small volume of concentrated waste are more likely to benefit from CETP while firms that produce large quantities of waste are more likely to find that installing their own waste treatment system is more economical. In some cases a firm can reduce it’s waste flow using recovery, recycling and waste reduction practices and then join a CETP.
- **Firm size**- It is also an important factor that affects the applicability of CETP. Small firms often lack the ability to raise the capital needed to install pollution control equipment. Using CETP, small firms need to implement less costly waste reduction techniques and install small storage facility.
- **Existence and enforcement of waste water regulations-** Existence and enforcement of regulations is the key, otherwise if such regulations are absent, firms will not take initiatives for installing onsite pollution control equipment or utilizing a CETP.[2]

Conducting a waste inventory

The second stage of feasibility assessment involves conducting a waste inventory of the specific industries for which the CETP is being proposed. It involves the following steps-

- **Identifying industries in the geographic area**- Identification of the industries that are the potential users of the CETP, which includes determining the number and type of industries, sources such as industrial associations, trade organisations and local governmental organisations can be consulted.
- **Identifying types and volumes of wastes generated** - Collecting data on the types and volumes of wastes is a complex and difficult one. Data to be collected on this aspect should reveal enough information that can distinguish among types of wastes such as organic and inorganic and should reveal the volume of diluted and concentrated wastes and the amount of total waste to be received at the CETP. Depending on the waste stream to be treated, it is determined whether a centralized facility to treat hazardous and/or non-hazardous waste is needed and will affect how a CETP is designed and managed.

- **Estimating future waste loads-** Collecting data about future waste generation from the concerned industries is as important as collecting data about the present load. This may be a difficult task as most of the industries do not plan for more than 2 to 3 years but estimating future loads correctly could be very useful in designing the plant capacity. And to have a provision for new industries coming in that area so as to include them also in the CETP future waste load.
- **Identifying treatment options**- Once the types and volumes of wastes generated by the industries are identified, the next step is to examine their compatibility and to identify potential treatment options.
- **Evaluating cleaner technologies**- This is the last but the most important step in the feasibility assessment and the possibility of recommending changes in the raw material, manufacturing processes or finished products to reduce waste generation. For some industries adoption of cleaner technologies should be considered along with or in lieu of development of the CETP itself.

Design Basis

The impact of the plausible pollution prevention measures including waste segregation measures have to be assessed based on which characteristics of the combined waste water will have to be evaluated. Site characteristics and wastewater characteristics form an integral part of design basis. Pre-treatment standards for waters entering the collection system serving the CETP and treatment standards for effluents discharged from CETP also are significant design considerations.[3]

- **Site characteristics**- Characteristics such as topography, soils, geology, hydrology, climate and land use are to be considered while designing a sewer network and a CETP. Topography and depth to bedrock effect the cost of sewer installation, for example elevation distributions that allow gravity flow and adequate depth for burial of pipe are most desirable. Soil thickness and soil characteristics like clay content, sand content, permeability etc. play a major role while deciding on certain treatment options such as land and lagoon treatment or granular media filtration etc. Climatic factors such as precipitation is important when inflow is a problem with sewers and evaporation is important when treatment processes being considered rely on evaporation of treated waste water.

- **Wastewater characteristics**- Key characteristics that must be considered in designing CETP are flow and physical and chemical characteristics of the wastewater.

1. **Flow (m^3/day or MLD)-** It is important in determining the size of CETP. Minimum and maximum flows should be computed as they decide the hydraulic computations and the size of distribution pipes. Anticipated future increase should also be incorporated. Temporal flow variations require use of equalisation ponds to allow a constant flow rate through downstream processes. Mixing of waste water with lower concentration such as addition of sewage helps in reducing toxic shock on treatment processes.

Physical characteristics- Significant physical characteristics include-

- **Solids**- Solids in the form of floating debris, grease and oil slicks indicate a highly polluted stream and suspended solids contribute to turbidity and silt load and require sedimentation or filtration for removal.
- **Temperature -** It is an important criterion as it affects chemical and biological reactions and solubility of gases such as oxygen. For example high temperatures increase reaction rates and solubility to a certain extent.

- **Colour and odour -** These serve as indicators of the degree of pollution of a waste stream and there presence in waste water indicate inadequate pre-treatment prior to discharge.

Chemical characteristics- Significant chemical characteristics include organics, inorganics in solution and gases. These are indicated by-

- **BOD (mg/l)-** Biological oxygen demand provides an indicator of the amount of organic substances of biological origin such as proteins, carbohydrates, fats and oils and biodegradable synthetic organic chemicals in water.
- **COD (mg/l)-** Chemical oxygen demand measures non-biodegradable as well as biodegradable organics. The ratio between BOD and COD provides an indicator of the ease of biological treatment.

- **Pre-treatment standards-** Wastewater from industrial processes requires some form of pre-treatment prior to discharge to CETP. This is mainly required 1) when waste water is carried through sewer lines to minimise corrosion and clogging of sewer lines and 2) to prevent reductions in biological treatment process efficiency by toxic effects from toxic concentration of organic and inorganic substances. Pre treatment standards for sulphides, sulphates and pH are concerned with preventing corrosion of concrete parts in sewers and limits to discharge of oil, grease, grit and heavy sediments prevent clogging of sewers. Limits to heavy metals and toxic organics ensure proper performance of biological treatment and minimise accumulation of contaminants in residual sludge.

Table 1 Inlet effluent quality standards for CETP

Parameter	Concentration
1. PH	5.5-9.0
2. Temperature,°C	45
3. Oil & Grease	20
4. Phenolic compounds	5.0
5. Ammonical Nitrogen (as N)	50
6. Cyanide (as CN)	2.0
7. Hexavalent Chromium	2.0
8. Total Chromium	2.0
9. Copper	3.0
10. Lead	1.0
11. Nickel	3.0
12. Zinc	15.0
13. Arsenic	0.2
14. Mercury	0.01
15. Cadmium	1.0
16. Selenium	0.05
17. Fluoride	15.0
18. Boron	2.0
19. Alfa emitters, Hc/ml	10^{-7}
20. Beta emitters Hc/ml	10^{-8}

1. *These standards apply to small-scale industries i.e. total discharge upto 25 KL/day*
2. *For each CETP and it's constituent units, the State board will prescribe standards as per the local needs and conditions; these can be more stringent than those prescribed above. However, in case of the cluster of units, the State board with the concurrence of CPCB in writing may prescribe suitable limits.*

Source: The gazette of India: Extraordinary- Part II- Sec.3 (i) pp10 Dt. 27th Feb 1991

- **Conveyance System-** Industrial effluents may be transported to CETP by tankers, piping system or a combination of these two.

1. Tankers- If the industrial estate is in early stage of development and has mostly small-scale industries then tankers are the best alternative and at some places topography of the region may allow only use of tankers. Advantage of using tankers is that money in construction of pipelines is not blocked in the early stages of development. Tanker works well when the small-scale industries are well spread and multiple liquid waste streams are to be handled. Specific design elements of this system include

- selection of container material that will suit the types of wastes to be transported
- choosing types and sizes of vehicles that are suitable for the transport routes
- choosing the number of vehicles and

- developing safe operating procedures for handling hazardous materials. [4]

Table 2 Treated effluent quality standards for CETP

Parameter	Into inland surface water	On land for irrigation	Into marine coastal areas
1. PH	5.5 – 9.0	5.5 - 9.0	5.5- 9.0
2. BOD 20°C	30	100	100
3. Oil & Grease	10	10	20
4. Temperature°C	40°C*	—	45°C at the point of discharge
5. Suspended solids	100	200	100-Process water 10percent above total suspended matter of influent - cooling water
6. Dissolved solids (inorganic)	2100	2100	—
7. Total residual Cl	1.0	—	1.0
8. Ammonia (as N)	50	—	50
9. Kjeldahl (as N)	100	—	100
10. COD	250		250
11. Arsenic (As)	0.2	0.2	0.2
12. Mercury (Hg)	0.01	—	0.01
13. Lead (Pb)	0.1	—	1.0
14. Cadmium (Cd)	1.0	—	2.0
15. Chromium (Cr)	2.0	—	2.0
16. Copper (Cu)	3.0	—	3.0
17. Zinc (Zn)	5.0	---	15
18. Selenium (Se)	0.05	—	0.05
19. Nickel (Ni)	3.0	—	5.0
20. Boron (B)	2.0	2.0	—
21. percent Sodium	—	60.0	—
22. Cyanide (CN)	0.2	0.2	0.2
23. Chloride (Cl)	1000	600	—
24. Fluoride (F)	2.0	—	15
25. Sulphate (SO4)	1000	1000	—
26. Sulphide (S)	2.8	—	5.0
27. Pesticides	Absent	Absent	Absent
28. Phenolic compound	1.0	—	5.0

Concentration in mg/l except pH and temperature
** Temperature shall not exceed 40°C in any section of the stream with in 15m down stream from the effluent outlet.*
Note: All efforts should be made to remove colour and unpleasant odour as far as possible
Source: The Gazette of India: Extraordinary- Part (I) Sec. 3(i) pp 11Dt. 27th

2.Piping system- Piping wastes is practical when participating firms are located close to CETP or we can say piping wastes are limited to an industrial estate. Design of piping system for CETP's require more attention to corrosion prevention and control which is mainly done by preventing sulphide content to enter the pipes. Pipe thickness can be increased to allow for some corrosion.[5]

3. A combination of these two may be adopted in practice. For example tanker conveyance to a terminal pumping station and pumping of waste from there to CETP.

- **Treated effluents discharge standards-** Waste water treatment processes differ in reducing the concentration of parameters of concern such as BOD or Suspended solids etc. and the standards of discharge determine whether a given combination of treatment processes provide an acceptable level of treatment. Thus before designing a CETP effluent discharge standards should be identified. Standards may vary depending on the point of discharge of treated wastewater. For example sewer standards, irrigation standards, drinking water standards are different.[6]

Outlet CETP (Sewer standards) norms

PH	6.5 to 8.5
BOD	less than 350mg/l
TSS	200 mg/l
COD	700-1200 mg/l
Oil & grease:	less than 20 mg/l

- **Treated water distribution system-** Depending on the use of treated water proper facilities should be provided. If the water is meant for recycling or reuse then proper holding capacity must be provided. Treated water depending on the quality can be either used for irrigation or disposed off in municipal sewers or in inland water- courses.

Wastewater treatment technologies

Wastewater treatment can be divided into four major categories or steps-

1. **Preliminary treatment** - It involves a number of unit processes to eliminate undesirable characteristics of wastewater. Processes include use of screen sand grates for removal of large particles, communitors for grinding of coarse solids, pre-aeration for odour control and some removal of grease.
2. **Primary treatment**- It involves removal of readily settable solids prior to biological treatment. Sedimentation chambers are the main units involved but various auxiliary processes such as floatation, flocculation and fine screening may also be used.
3. **Secondary treatment**- It involves purification of waste water primarily by decomposition of suspended and dissolved organic matter by microbial action. A number of processes are available but mainly used are land treatment, activated sludge process or the biological filtration methods.
4. **Auxiliary treatment**- This mainly includes large number of physical and chemical treatment processes that can be used before or after the biological treatment to meet the treatment objectives.

Design of the actual treatment system for a CETP involves selection of alternative processes based on the ability of individual treatment processes to remove specific waste constituents.

Physical treatment processes

Physical treatment separates solids from wastewater mechanically with screens or using density difference as with sedimentation and floatation.

Preliminary treatment- These are mainly physical processes. This includes-

- **Grit chambers** use gravity to remove grit and dirt which mainly consists of mineral particles and coarse screens strain out large solids and when organic material enters as large particles comminutors can be used to reduce particle size to enhance treatment in later stages.
- **Equalisation**- Equalisation is a process to equalise wastes by holding waste streams in a tank for a certain period of time prior to treatment in order to obtain a stable waste stream that is easier to treat. Equalisation helps in mixing smaller volumes of concentrated wastes with larger volumes at lower concentrations. It also controls the pH to prevent fluctuations that could upset the efficiency of treatment system, by mixing acid and alkaline wastes. Equalisation tanks are equipped with agitators that helps not only in proper mixing of waste water but also prevents suspended solids from settling to the bottom of the unit. [7]
- **Pre-aeration or pre-chlorination**- This process helps in controlling odours if wastewater becomes oxygen deficient while travelling through the sewer collection system. It also helps in grease removal during primary clarification.[8]

Primary treatment- These are also mainly physical processes. These include-

- **Sedimentation**- Removal of readily settleable inert and organic solids is accomplished in sedimentation. Fine screens may also be used in the treatment process. Sedimentation chambers may also include baffles and oil skimmers to remove grease and floatable solids and may include mechanical scrapers for removal of sludge at the bottom of the chamber.

- **Dissolved air floatation-** It is the process of using fine bubbles to induce suspended particles to rise to the surface tank where they can be collected and removed. Gas bubbles are introduced into the wastewater and attach themselves to the particles, thus reducing their specific gravity and causing them to float. Bubbles may be generated by

  1) dispersing air mechanically
  2) by drawing them from water using vacuum or
  3) by forcing air into solution under elevated pressure followed by pressure release.

  This is called dissolved air floatation. It is used to remove suspended solids and dispersed oil and grease from oily wastewater. It reduces the sedimentation times of suspended solids that have a specific gravity slightly greater than 1.0. Wastewater is pressurised and contacted with air in a retention tank. The pressurised water that is nearly saturated with air is passed through a pressure-reducing valve and introduced into at the bottom of floatation tank. As soon as pressure is released the supersaturated air begins to come out of solution in the form of fine bubbles. The bubbles get attached to suspended particles and become enmeshed in sludge flocs, floating them to surface. Float is continuously swept from the surface and sludge may be collected from the bottom. Addition of certain coagulants increases the oil removal efficiency of DAF units.

- **Flocculation-**It is physical- chemical process that encourages the aggregation of coagulated colloidal and finely divided suspended matter by physical mixing or chemical coagulant aids. Flocculation process consists of a rapid mix tank and a flocculation tank. The waste stream is initially mixed with a coagulant in the rapid mix tank and after mixing the coagulated waste water flows to the flocculation basin where slow mixing of waste occurs which allows the particles to agglomerate into heavier more settleable solids. Either mechanical paddles or diffused air provide mixing. Three different types of chemicals used in coagulation are inorganic electrolytes, natural organic polymers and synthetic poly electrolytes. The selection of a specific chemical depends on the characteristics and chemical properties of the contaminants.

- **Emulsion breaking-** It involves addition of chemicals and/or heat to cause dispersed oil droplets to coalesce and separate from the wastewater. This process mainly used for pre-treatment of oily wastewater. Commonly used method is acid cracking where sulphuric or hydrochloric acid is added to the oil water mixture until pH reaches 1 or 2. Another alternative to this is where emulsion breaking chemicals such as surfactants and coagulants are added to the mixture and the contents are mixed. After the emulsion bond is broken, oil residue is allowed to float to the top of the tank. Heat may be applied to speed the separation process. The oil is then skimmed by mechanical means or the water is decanted from the bottom of the tank.

- **Clarification-** Clarification system utilise gravity to provide continuous, low cost separation and removal of particulate, flocculated impurities and precipitates from water and generally follow the processes which generate suspended solids such as biological treatment. In a clarifier wastewater is allowed to flow slowly and uniformly, permitting the solids more dense than water to settle down. The clarified water flows from the top of the clarifier over the weir. Solids get collected at the bottom and sludge must be periodically removed, dewatered and disposed.[9]

- **Granular media filtration**- Many processes fall under this category and the common element being the use of mineral particles as the filtration medium. It removes suspended solids by physical filtration, physical chemical sorption and biological decomposition.

  1) Sand filters are the most common type which consists of either a fixed or moving bed of media that traps and removes suspended solids from water passing through media.
  2) Dual or multimedia filtration consists of two or more media and it operates with the finer, denser media at the top and coarser, less dense media at the top. Common arrangement being garnet at the bottom, sand in the middle and anthracite coal at the top. Flow pattern of multimedia filters is usually from top to bottom with gravity flow. These filters require periodic back washing to maintain their efficiency.

  Granular media filters can separate particle size (generally less than 2 mm) smaller than biological filters which increase their efficiency over other treatment process. These processes are most commonly used for tertiary treatment in municipal wastewater treatment plants and for supplemental removal of residual suspended solids from the effluents of chemical treatment processes.

- **Land treatment**

Major types of land waste water treatment system include

1) Slow rate where waste water is applied using pipes or sprinklers to a vegetated land surface at such a rate so as to avoid runoff. Wastewater is treated by the plant soil matrix and the rest enters the ground water system.
2) Rapid infiltration where wastewater is applied to unvegetated flooding basins on soils with high percolation rates.
3) Sub surface infiltration where wastewater is subsurface soil absorption drain fields.
4) Overland flow where waste water is applied to the upper reaches of grass covered slopes and is allowed to flow over the vegetated surface to runoff collection ditches. Land treatment is suitable for waste waters coming from food processing industries, provided suitable land is available nearby while waste water from the manufacturing industries are unsuitable for land treatment.[10]

Chemical treatment Processes

Chemical treatment may be used at any stage in the treatment process as and when required. Mainly used methods are-

- **Neutralization**- This process is used to adjust pH of the waste water to optimise treatment efficiency. Untreated wastewater has a wide range of pH values and may require neutralization to eliminate either high or low values prior to certain treatment. Acids such as sulphuric or hydrochloric may be added to reduce pH or alkalis such as sodium hydroxide may be added to raise pH values. Neutralization may take place in a holding, rapid mix or an equalisation tank. It can be carried out mainly at the end of the treatment system to control the pH of discharge in order to meet the standards.

- **Precipitation**- It is carried to remove metal compounds from waste water. It is a two step process. In the first step precipitants are mixed with wastewater allowing the formation of insoluble metal precipitants. Detention time depends on the wastewater being treated, chemical used and the desired effluent quality. In the second step precipitated metals are removed from wastewater through filtration or clarification and the resulting sludge must be properly treated, recycled or disposed. Various chemicals used are lime, sodium hydroxide, soda ash, sodium sulphide and ferrous sulphate. Normally hydroxide precipitation which is effective in removing metals like antimony, arsenic, chromium, copper, lead, mercury, nickel and zinc and sulphide precipitation which is used in removing lead, copper, silver, cadmium etc. may be used.

  Other than the chemical other important thing in chemical precipitation is pH. Metal hydroxides are amphoteric in nature and can react chemically as acids or bases and their solubility increases towards higher or lower pH. Thus, there is an optimum pH for hydroxide precipitation for each metal. Wastewater generally contains more than one metal selecting the optimum treatment chemical and pH becomes more difficult and involves a trade off between optimum removal of two or more metals. Other chemical treatment methods used include oxidation This is mainly done to control disinfection and odour. The methods used are chlorination, ozonation and ultraviolet radiation.[11]

Biological treatment Processes

Biological treatment processes are used primarily for secondary treatment and use microbial action to decompose suspended and dissolved organic wastewater. Microbes use the organic compounds as both a source of carbon and as a source of energy. Success of biological treatment depends on many factors such as the pH, temperature, nature of pollutants, nutrient requirement of microbes, presence of inhibiting pollutants and the variations in the feed stream loading.

Biological treatment can be either aerobic where microbes require oxygen to grow or anaerobic where microbes will grow only in absence of oxygen or facultative where microbes can grow with or without oxygen. Micro-organisms may be either attached to surface as in trickling filter or be unattached in a liquid suspension in activated sludge process. Biological treatment methods either requires large area such as land treatment and stabilisation ponds/lagoons or small area requirement using engineered methods such as activated sludge process, biological filters and anaerobic treatment systems.

- **Stabilisation ponds/lagoons**- Also called oxidation ponds, treats waste water by the interaction of sunlight, wind and algae with or without assistance of mechanical aeration equipment. Lagoons are smaller than ponds and have a second pond to remove suspended solids. Lagoons are simple in design and require low operation and maintenance costs and the control of discharge may eliminate the need for additional treatment. Disadvantages include large area requirements and bad odours.[12]

- ***Activated sludge process***- It is continuous flow, aerobic biological treatment process that employs suspended growth aerobic micro organisms to biodegrade organic contaminants. In this process a suspension of aerobic microbes is maintained by mechanical mixing or turbulence induced by diffused aerators. Influent is introduced in the aeration basin and is allowed to mix with the contents. A series of biochemical reactions is performed in the basin degrading organics and generating new bio mass. Micro organisms oxidize the matter into carbon dioxide and water using the available supplied oxygen. These organisms agglomerate colloidal and particulate solids. After a specific period the mixture is passed to a settling tank or a clarifier where micro organisms are separated from the treated water. Major portion of the settled solids are recycled back to the aeration tank to maintain a desired concentration of micro organisms in the reactor and the remainder of the settled solids are sent to sludge handling facilities.

To ensure biological stabilization of organic compounds adequate nutrient levels of nitrogen and phosphorous must be available to the bio mass. The key variables to the effectiveness of the system include -

1) organic loading which is described as food to micro organism ratio (F/M) ratio or Kg of BOD applied daily to the system per Kg of mixed liquor suspended solids (MLSS). F/M ratio affects BOD removal, oxygen requirements and bio mass production.
2) Sludge retention time or sludge age is the measure of the average retention time of solids in the system and it affects the degree of treatment and the production of waste sludge.
3) Hydraulic detention time determines the size of the aeration tank and
4) Oxygen requirements are based on the amount required for biodegradation of organic matter and the amount required for endogenous respiration of micro organisms.[13]

Various modifications in activated sludge process are possible by changing one or more of the key parameters. Sequencing batch reactor is a form of the activated sludge process where aeration, sedimentation and decantation processes are performed in a single reactor.[14]

- **Biological filters** - These filters provide a surface that is repeatedly exposed to wastewater and air and on which a microbial layer can grow.
  1) In trickling filters treatment is provide by a fixed film of microbes that forms on the surface which adsorbs organic particles and degrades them aerobically. Wastewater is distributed over a bed made of rock or plastic and flows over the media by gravity.
  2) In a rotating biological contactor which consists of a series of corrugated plastic discs 40percent of the area is immersed in waste water and the remainder of the surface is exposed to atmosphere, provide a surface for microbial slime layer. The alternating immersion and aeration of a given portion of the disc enhance growth of the attached micro organisms and facilitate oxidation of organic matter in a relatively short time and provide a high degree of treatment.

- ***Anaerobic treatment systems***- They are rarely used in wastewater treatment systems except as a means for sludge stabilisation. These processes more slowly than aerobic degradation and when sulphur is present obnoxious hydrogen sulphide gas is generated. But many toxic organic compound specially chlorinated hydrocarbons that are not amenable to aerobic degradation can be anaerobically treated.

Ownership and Management

Formulation of the appropriate institutional and jurisdictional arrangements for ownership and operation of a CETP is as important as a good engineering design. Main questions to be answered in this connection are-

- Which or how many governmental jurisdiction should be involved and
- Should the form of ownership be public, private or a combination of these two.

Answers to these questions are specific for a specific project based on the distinctive history, culture, politics and economics of the area to be served.

Ownership options

Facility ownership and management possibilities for a CETP ranges from full public ownership to full private ownership.

- **Full public ownership**- government finances construction and operates the plant. The most obvious public sector agency is the State industrial development corporation and is responsible for the day to day operation of the industrial estate which includes water supply and other infrastructural facilities. Operation of CETP would be an additional service provided by SIDC. Advantages of such type of ownership would include easy enforcement of legal and financial obligations on the individual industries but the main drawback associated is the potential inefficiency in public sector and the involvement of politics and corruption. Though a public sector undertaking would be in a better position to co-ordinate activities of other government agencies involved directly or indirectly with the functioning of CETP but suffers due to lack of flexibility in operation and choice of staff. Other government agencies such as the pollution control board can also be made the incharge of CETP but again the drawbacks of lacklustre attitude of government remains the same.

- **Private ownership**- It includes two types of arrangements-

1. First is where an outside agency specialising in operating effluent treatment plants or a supplier of effluent treatment equipment is contracted to manage the CETP. In order to attract outside agencies a minimum profit must be guaranteed to the agency to enter into contract. This contract arrangement is not a very common site in India but their is a trend, however for industries to operate treatment plants on contract basis where public sector owns and constructs the plant and private sector is contracted to manage and operate the facility.
2. Secondly a co operative company of individual industries in the industrial estate can be formed. The company would be a separate entity and Industries association or individual units within that state should come forward for the formation of such company. It is beneficial that the industries producing waste are directly involved in the financial and legal aspects in the company managing CETP and their active involvement in the operation and management of CETP will increase the probability of success of a CETP. Main drawback associated is the satisfaction of all the parties bearing in mind the considerable variation in the size and type of industries.[15]

- ***Combination of public and private sector***- This would include a joint sector company where the SIDC and /or both the individual industries and the industries association will be members of a registered co operative society or shareholders in a company formed solely for the management of CETP. Another variation could be tripartite arrangement which has three parts;
  1) Ownership and financing of CETP by SIDC.
  2) SIDC would have a contract with a private company to design, construct and operate CETP for a designated number of years. The company would recover operating and maintenance expenses and a profit from the charge levied on individual waste producers in accordance with the volume and composition of the waste.
  3) The operating company would enter into contracts with individual waste producers so that legal action can be initiated in case of breach of contract. This company can incorporate individual industries and Industrial association as shareholders. The legal relationship between the operating agency and the user of CETP must be well defined by a contractual arrangement between the parties. Advantages of this arrangement include improved possibilities of securing funds and all the other benefits of public sector.

Government's Policy for Pollution Prevention

The Government of India issued a policy statement for the abatement of Pollution in February 1992. The policy emphasises that it is not enough for the Government to notify laws which are to be complied with, and affirms the Government's intention to integrate environmental and economic aspect in the development planning, with the stress on the preventive aspects for the pollution abatement and promotion of technological inputs to reduce industrial pollutants. The overall policy objectives is to integrate environmental considerations into decision making at all levels. Specific steps identified to meet this objective are:

- Prevent pollution at source,
- Encourage, develop and apply the best available practical technical solutions,
- Ensure that the polluters pays for the pollution and control arrangements,
- Focus protection on heavily polluted areas and river stretches,
- Involve public in decision making,
- Increase safety of industrial operations.

Subsidies and funds for CETPs

Central assistance upto 25percent of the total cost of the CETP would be provided as a grant to CETP on the condition that state government gives a matching condition and the remaining cost should be met by equity contribution by the industries and the loans from financial institutions.

Central assistance will be provided for only capital cost and not for recurring costs. The assistance will be released in three equal instalments. The first assistance of 25percent will be released when a body has been identified for the purpose of implementing of the project, financial arrangements have been tied up, institutional arrangements have been finalised, consent has been obtained from the State Pollution Control Board and state government has committed it’s contribution.

The second instalment of 50percent and the last instalment of 25percent will be realised after the utilisation of the previous money and adequate progress of work subject to release of their proportionate shares by state government. Central assistance will be limited to 25percent of the capital cost of the project or 25 lacs, whichever is less. However assistance upto 50 lacs can be considered subject to other conditions such as matching grant of the state government etc.[a]

The World Bank aided “ **Industrial Pollution Control**” project was approved in 1991 to assist Government of India's effort to prevent environmental degradation caused by industrial operations and assist in the attainment of the short and medium-term targets of its environmental policy. Under the project following activities were financed:

- An institutional component designed to strengthen the Central and State Pollution Control Boards in the state of Gujarat, Maharastra, Tamil Nadu and Uttar Pradesh.
- An investment component designed to support efforts by industry to comply with regulations including support for the setting up of common treatment facilities.
- A technical assistance component designed to support the MoEF and the Development Finance Institutions in providing specialised technical assistance for the evaluation of environmental problems and the assessment of their solutions[16].

There is a provision of loan and grant assistance for proposals of construction of CETP for treatment of effluents from a cluster of industries particularly of small-scale. A total of $24 million loan assistance and $12 million grant assistance is available under this component.[b]

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[a] Source: Central Pollution Control Board, Delhi
[b] Common Effluent Treatment Plant, NEERI Report, Pg. No. 2-13

The proposal from project proponents should be forwarded for evaluation by a select group of officials which include Deputy Director, World Bank Implementation Cell MoEF, New Delhi; GM or Manager, IDBI, Mumbai; Head Wastewater Engineering Division, NEERI, Nagpur and Chairman of respective State Pollution Control Board.

CETP and Court's rulings

The Supreme Court of India has been playing a very proactive role in trying to save the further degradation of environment. In order to save Ganga from water pollution, a public interest litigation (PIL) was filed by Advocate M.C. Mehta as many leather tanneries in Kanpur were discharging untreated effluent in it ***(M. C. Mehta vs. Union of India, 1986)***. There were not many disputes that the discharge of the trade effluents from these tanneries were causing considerable damage to the life of the people who use water from Ganga and also to the aquatic life.

A fiscal plan for setting up of common effluent treatment plants for Indian Tanning Industry (March 1986) was prepared by the committee constituted by the Directorate General of Technical Development (GOI).

This committee observed that Tanneries situated all over the country have faced with the problem of treating their effluent. Seized with the problem of finding out a solution, Central Leather Research Institute, (CLRI) Madras has brought out a Management Investment Report, as early as 1976. A monograph entitled " Treatment of Tannery Effluents" was prepared by the scientist of CLRI, which recommended four types of waste water treatment so far the tanneries were concerned. This was for the first time when court recommended the concept of common effluent treatment plants under the Ganga Action Plan, to check the further pollution of the river. As per the first phase of the Ganga Action Plan (GAP), a Common Effluent Treatment Plant for treating the wastewater generated by tanneries in Jajmau was established with the help of Dutch government. CETP project is one part of the GAP that is meant for cleaning river Ganga. Later, the courts in all their judgements regarding water pollution started suggesting CETP as a solution. The CETPs have also become an eyewash to run dirty operation as it merely becomes a formality to evade any legal action.

Case study 1: Delhi CETPs.

Delhi Pollution Control Committee (DPCC) has divided Delhi (National Capital Territory) into 28 industrial estates. Industrial estates in Delhi houses a number of small-scale industries and pose a serious threat to the environment of Delhi. Small-scale sector is not ready to invest in pollution control measures because of unprofessional lack of financial measures, lack of technical expertise, unavailability of land etc. In order to control water pollution in the state idea of installing Common Effluent Treatment Plants was promoted by the DPCC. For this a detailed project has been prepared by National Environment Engineering Research Institute (NEERI), Nagpur along with DPCC for 28 industrial estates 15 CETP's have been proposed. These 15 CETP's cover 21 industrial estate in Delhi and for the remaining area need was not felt for installing CETP's.

A total cost of 90 crores has been estimated by NEERI. These CETP's will be constructed under the World Bank's "Industrial Pollution Control Scheme", for which 50percent cost is contributed by the industry itself out of which 30percent can be taken as soft loan from IDBI and direct contribution of the industry is only 20percent. Remaining 50percent is given as a subsidy by the government of India.

Table 3 Location of proposed sites for industrial estates in NCT of Delhi

S No.	*Location of CETP site*	*Industrial Estates Served*
1.	Anand Parbat Industrial Estate	Anand Parbat Industrial Estate
2.	Badli Industrial Estate	Badli Industrial Estate
3.	DSIDC Industrial Estate, Nangloi	DSIDC Industrial Estate, Nangloi
4.	Jhilmil Industrial Estate	Jhilmil & Friends colony Industrial Estate
5.	G.T Karnal Road Industrial Estate	G.T Karnal Road Industrial Estate
6.	Naraina Industrial Estate	Naraina & Kirti Nagar Industrial Estate
7.	Lawrence Road Industrial Estate	Lawrence Road Industrial Estate
8.	Mongolpuri Industrial Area	Mongolpuri Industrial Area
9.	Mayapuri Industrial Estate	Mayapuri Industrial Estate
10.	Mohan Cooperative Industrial Estate	Mohan Cooperative Industrial Estate
11.	Najafgarh Road Industrial Area	Najafgarh & Moti Nagar Industrial Estate
12.	Okhla Industrial Area	Okhla Industrial Area
13.	Okhla Industrial Estate	Okhla Industrial Estate
14.	S.M.A Industrial Area	Rajasthan Udyog Nagar, SMA & SSI Industrial Area
15.	Wazirpur Industrial Estate	Wazirpur Industrial Estate

Source: Delhi Pollution Control Committee (DPCC), Delhi

***Note** :*

1. *Wastewater from SMA, SSI and Rajasthan Udyog Nagar Estates can be mixed with wastewater of G.T Karnal Road Industrial Estate to be treated at G.T Karnal Industrial Estate 2. Wastewater from Lawrence Road Industrial Estate can be mixed with wastewater from Wazirpur Industrial Estate to be treated at Wazirpur Industrial Estate.*

Salient features of the proposed project

1. NEERI has estimated a total of 165 MLD of wastewater to be treated by the 15 CETP's.
2. Separate scheme for storage and handling of hazardous waste has also been proposed.
3. Quality of treated water should be such that it can be reused in the operations as Delhi faces water shortage especially in summer season.
4. Total estimated annual maintenance cost for all the CETP's would be 60 crores.
5. Total land requirement is 20 hectares.
6. Sludge storage capacity is 580 m^3
7. Land requirement for sludge disposal is 90 sq. m
8. Sludge is proposed to be disposed off in engineered landfills.

Present Scenario

There has been a phenomenal growth of industries in Delhi in the last 2-3 decades, where a sharp increase in the number of industrial units from 26,000 in 1971 to 1,37,000 in 1999 has been recorded. Due to public pressure against the increasing pollution and congestion in Delhi, the supreme court (M.C. Mehta vs. Union of India) directed that hazardous industries be moved out of the city. The order also stated that other industries falling under the conforming areas should comply with the various environmental standards. For which construction of 15 CETP's in 1997 were commissioned and plants were scheduled to be completed by Dec 31st 1998.

DSIDC LAPSES

- *Land allotment issues not sorted out.*
- *Issues related to contribution of industries share not settled*

According to the Ministry of Environment and Forests 15 CETP's are to be set up as per the directives issued by Supreme Court and further steps are to be taken by the Delhi government for expediting the construction and commissioning of CETP's. Delhi State Industrial Development Corporation (DSIDC) is the sole agency for construction and implementation of the CETP project.

Cost Apportionment problem

The Central and State governments have already contributed their 50percent of the total share (Rs.90 crore) of Rs. 45 crore to the project. Industries are supposed to give 20percent i.e. Rs. 18 crore but have only given 7 crore.

Many industries are not agreeing to the cost apportionment formula designed by NEERI.

Badli Industrial area having number of steel rolling mills is generating wastes that continuously corrodes the drain pipes. Pickling process which generates lot of acids has led to ground water contamination and the residents have stopped using water.[43]

- **Lack of efforts**: NEERI never did a survey from the very basics of collecting data. NEERI experts say that they were not given enough time by the Supreme Court to prepare the report. NEERI worked on the data which was provided by the DPCC.
- **Misleading Data:** The data related to the number of employees , area, horse power, water consumption etc. on which the cost formula is based was not correctly mentioned by many of the industries. Some of the industries have stated 0 employees, 0 water consumed, 0 area etc. which has greatly resulted in unpractical results[c].
- **Wrong estimate of charges**: Industries giving correct data have been heavily charged and industries showing incorrect data are minimally charged. This is the point of debate and many industries individually and some of the CETP societies have filed cases in the Supreme Court.

1 Other problems

- Installation of pre-treatment plants: In 1999 another directive was issued to the industries to install pretreatment plants as CETP's cannot treat all kind of wastes and specific pollutants are required to be removed by individual industries.

What different agencies say?

NEERI	Report on Delhi CETP prepared in a hurry. There is a lot of scope for improvement. Unless a professional agency is hired again the problem cannot be solved. Survey is required to be done from the very basis of collecting the primary data.
DPCC	CETP, the only solution for Delhi's situation Puts all the blame on DSIDC & industry for the non-commencement of construction of CETP's.
DSIDC	CETP project progressing well but unable to explain the delay in project implementation. Puts blame on other agencies for delay in the implementation of the project.
MOEF	Not responsible for the delay in the project. Have already done their work of bringing the agencies together.
Industries	CETP won't start in the next 20 years if the situation persists. Unable to understand the cost apportionment formula.

[c] A survey conducted by DPCC

- **Under estimate of land requirement**: DSIDC claims, that land requirement for CETP's is more than double the estimate made by NEERI. Additional land is required for the pumping station, storage of chemicals, sub-station and so on.

- **Inadequate infrastuctural facilities:** Facilities like proper sewer lines, drainage and road are lacking. Municipal Corporation of Delhi is responsible for providing the basic infrastuctural facilities and until these are problem of water pollution will remain.

Anand Parbat Industrial Estate which is located in the heart of city is highly congested and on single premises three different kinds on industrial activities are carried out. There is hardly any space for the construction of CETP.[44]

Industry is not satisfied by the government attitude specially the cost apportionment formula and have thus filed case in Supreme Court. Some industries have filed individual cases while some CETP societies have also filed cases separately. Court has ordered that all the defaulters either pay their share or close down the industries. Thus until a consensus is reached between the government authorities and the industry, construction and functioning of CETP cannot begin.

Jhilmil & Friends colony Industrial areas are dumping their wastewater into storm water drains. The poisonous wastewater is dumped untreated into the Shahadra Nullah from where it goes into Yamuna river.[45]

Case study 2: Vapi, Gujarat

The Vapi industrial estate constitutes of around 1500 industrial units mainly comprising of chemicals (inorganic and fine), pesticides, dyes and dyes intermediates, pharmaceuticals, texturing units, plastic processing and paper & pulp. In 1992 a PIL was filed by Advocate Ajit Mehta in the Ahmedabad High Court regarding the increasing pollution., which led the court to issue closure order to these industries. In order to come out with a solution to run their operation the Vapi industrial association (VIA) and GIDC commissioned NEERI to do a feasibility study for construction of a CETP and in 1993 the work on CETP started. In 1997 the VIA took charge of the CETP from the GIDC and formed a Vapi Waste Management Committee to look after the various aspect regarding the running, operation & maintenance and management of the CETP. The committee appointed a Canadian consultants (Anderson and PHE consultants) to run the plant and in January 1997 the plant was commissioned and started operating.

The total capital cost estimated by the GIDC was about Rs. 26 crores, of which 20 percent was shared by 650 member industrial units, 58percent term loan payable with an interest rate of 15percent from IDBI under the World Bank financing scheme and about 22percent contributed by the State and Central subsidy grant. Project and running costs are collected every three months from member units depending upon the water consumption. The total running cost of Vapi Cetp is about 50 lakhs per month.

The total area under the CETP is about 72 acres, out of which the constructed area is about 34 acres. The total capacity of the plant is 55 million liters per day and in 1998 this facility was extended to sewage currently the combined waste effluent is treated. On an average 42,000 m^3 of industrial effluent is generated by member units and conveyed to the CETP by a 93 km long underground pipeline with four pumping stations.

Facts and findings

The whole Vapi industrial complex looks like a chemical warehouse, with various industries spewing out toxics fumes and effluents. The smell of chemicals is so potent as one walks in Vapi. Even during the peak monsoon the whole area gave a very colourful look as ditches and drains were overflowing with concoction of effluents. According to Mr. Sangappa, (CEO, Vapi Waste and Effluent Management Co.Ltd) "*it is mandatory for all the effluent generating units to be a member of CETP and no effluent is discharged in open drains".*

> ***As per Mr. Deepak Davda (Manager, CETP) "even in most developed countries the standards are not maintained all 365 days and moreover we are treating a major portion of the effluent, and this much of untreated effluent will not have much impact".***

The treated effluent is discharged in Daman Ganga river, which is at distance of 300m from the CETP and further meets Arabian sea. Everyday, approximately 50 million liters of "treated waste water" is discharged into the river, which is red in colour and generates froth. Another drain emerging from CETP discharges untreated effluent in the river.

In a sampling carried out by Greenpeace, (Lubanska,I. 1999) near the discharge point (treated effluent), stream carrying untreated effluent from CETP and sediment samples beneath the untreated stream, revealed heavy contamination of organochlorine compounds. Both treated and untreated effluent showed the presence of 18 and 35 organic compounds respectively. The classes of organochlorines detected in the samples included di, tri, tetra chlorobenzenes and chlorinated benzamines. Diphenyl ether along with chlorinated pyridine derivatives, nephthalene were also reported in these two samples.

The sediment sample contained 17 organohalogen compounds, including di, tri, tetra, penta and hexa chlorobenzenes, chlorinated benzamines, chlorinated diazobenzenes and Polychlorinated biphenyls (PCBs). Other organic compounds found in the sample included cresol, a phthalate ester (DEHP), benzaldehyde, benzothiazole derivatives and N-alkylated benzamines, a carbazole derivative, chloropyrifos (a pesticide), and linear aliphatic hydrocarbons

> ***According to Mr. Sangappa, (CEO of the Vapi CETP committee), " the pollutants present in industrial effluent are converted into carbon dioxide and water during the treatment process in CETP".***

Heavy metal analysis revealed that both effluent and the sediment collected are contaminated with heavy metals cadmium, chromium, copper, lead, mercury, nickel and zinc. The effluent, which has been through the CETP contained high levels of cadmium and detectable levels of chromium, copper, lead, manganese, mercury, nickel and zinc. This leads to the probability of high levels of contamination in the sludge.[17]

The sludge or solid waste generated during the process is dumped at the periphery of CETP behind the tree screen. No storage facility or engineered landfill exists to contain the waste, as one can see these huge dumps and during rains all the runoff goes into the river. According to the villagers of Chandor, the installation of CETP has not made much difference in the water quality of the river. The downstream community which use to sell fish, had to look for other means of sustenance because of pollution and decrease in the fish catch.

Case study: Jajmau, Kanpur

Introduction

As per the first phase of the Ganga Action Plan (GAP), a Common Effluent Treatment Plant for treating the wastewater generated by tanneries in Jajmau was established under the bilateral co-operation programme signed between Government of India and Netherlands government. CETP project is one part of the GAP that is meant for cleaning river Ganga and was setup in December 1994. This CETP is unique in itself that it treats homogeneous kind of wastes. Previously all the effluent from tanneries containing heavy metal such as chromium was dumped untreated into the river Ganga.

Jajmau belt has around 300 tanneries which are sending their effluent to CETP. Kanpur CETP is a 36 MLD Upflow Anaerobic Sludge Blanket (UASB) plant which can be divided into three main parts-

Phase wise distribution of construction of Kanpur CETP

S No.	Phase	Total Cost
1.	Common effluent treatment plant phase I - It includes construction of wastewater conveyance system for northern belt, Jajmau	390.81 lakhs
2.	Common effluent treatment plant phase II- It includes construction of 36 MLD UASB wastewater treatment plant at Jajmau	1188.14 lakhs
3.	Common effluent treatment plant phase III- It includes first stage post treatment plant for 36MLD UASB plant	629.95 lakhs

Source: CPCB performance evaluation project report of UP, November 1999

Out of the total cost 65percent was provided Dutch Government (loan to GOI), 17.5percent by the Uttar Pradesh government and rest 17.5percent was contributed by the tanneries and other UP institutions. The operation and maintenance cost comes to around 106.02 lakhs/year (8.8 lakhs/ month) and is borne jointly by the municipality and tanneries (CPCB Nov.1999).

Treatment plant description

For collection of tannery wastewater from all the tanneries, 12 Km long collecting drains have been constructed. These drains bring all the waste at 4 pumping stations from where it is pumped to the 36 MLD UASB treatment plant through 5.3 Km long pipeline. At present around 300 tanneries that are generating around 8 MLD waste and 27 MLD of domestic wastewater is screened and pumped to the treatment site. The tannery wastewater and domestic wastewater are mixed in a mixing tank in a ratio of 1:3 and ultimately pumped into the UASB reactors.

Upflow Anaerobic Sludge Blanket Reactor (UASB)

The UASB technology which was promoted as an ideal solution for waste with high BOD levels (like that from tanneries) fell short of the stipulated norms therefore post treatment units were commissioned in May 1996.

The UASB reactors is relatively a new technology, which was earlier experimented as a pilot study and was later adopted to at a large scale. According to the UP Jal Nigam the UASB technology is ideal for tropical regions as the temperature maintained inside is best suitable for the micro-organisms to grow thus the climate in Kanpur is best suitable for this technology. The bio-gas produced is utilised to generate electricity, which can fulfil 1/3 of the total energy required to run the treatment plant.

Table 4Characteristics of composite wastewater from tanneries at Jajmau, Kanpur (Inlet values to CETP)

Parameter*	Value
Alkalinity(as CaCo3)	2000-2750
BOD (Total)	1950-3100
BOD (Soluble)	1670-2600
COD (Total)	4500-7500
COD (Soluble)	3000-3800
Total solids	25600-37600
Chloride as Cl_	10700-14900
Sulphate as SO4	1540-3300
Chromium(III)	160-275
pH	8.2-9.2

** All values except pH are in mg/l, Source: CETP, Jajmau, Kanpur, U.P*

To meet the standards laid down by the National River Conservation Directorate, G.O.I an aerobic post treatment is also built. Effluent that comes out from the reactor is send to a pre-aeration tank from where it is pumped to the clarifloculators. Clear effluent is pumped for land application for irrigation as per the standards laid down by the Environment Protection Act 1985. The sludge separated in the clarifloculator is send to sludge thickener and then dewatered in sludge drying beds.

Management and Monitoring

Uttar Pradesh Jal Nigam which is a government of India undertaking is presently managing the operations of Kanpur CETP. Operation and maintenance cost required for running CETP is shared jointly by the tanneries and the Kanpur Nagar Nigam. 60percent of the cost is borne by the tanneries and the remaining 40percent Kanpur Nagar Nigam. A special committee comprising of people from UP Pollution Control Board, Tanners association, Kanpur Nagar Nigam, and Jal Nigam looks after the plant.

Facts and Findings

According to the study conducted by the CPCB, in 1995 high levels of alkalinity, hardness, dissolved solids, iron and lindane (an organochlorine) was found in the groundwater. CPCB recommended, to declare these areas unsafe for drinking water borewells.

Table 5 CETP outlet standards for the treated effluent

Parameter	Value
BOD (mg/l)	< 100
SS (mg/l)	< 200

Source: CETP, Jajmau, Kanpur, U.P

It has been eight years since the CETP was commissioned but with the increasing demand for raw leather has led to threefold increase in the number tanneries from 1992 till now. Out of 300 odd tanneries only 14 has the chrome recovery plants, whereas rest send their effluent without any pretreatment.

Two channels were built to convey the treated water CETP to sewage farm but due to one the channels being under repair, two third of the effluent is discharged into the river and the rest goes to into the irrigation canal (CPCB, Nov. 1999)

Huge pile up toxic chromium sludge is dumped by the CETP in the plants vicinity. During rains the hazardous heavy metals get leached into the ground water, making the problem even more acute for the villagers.

Adding to the problem is the phenomenal quantum of sludge generation at the rate of 15 tonnes/day from UASB and 7 tonnes/day post treatment plants. According to CPCB, the content of total chromium in USAB sludge is 22.58 mg/gm and in post treatment units is around 19.64 mg/gm (CPCB, Nov. 1999). As per the specifications waste category-III of "Hazardous Waste (Management and Handling) Rules, these sludges are of highly hazardous nature, therefore should be properly disposed in an engineered hazardous waste landfill.

According to Rakesh Jaiswal of Ecofriends (an ngo in Kanpur), people in 20 villages living in the vicinity of Jajmau tannery area in the grip of epidemic like conditions while most of the elder have stomach ailment and skin diseases, the worst affected are the children. It is alleged that the cause of the malady is the tannery discharge, which finds its way into the irrigation canal reaching these villages. "*Till 1992, the water we got in the canal carried Kanpur sewage but was diluted by the water from Ganga. The agriculture produce was excellent as this area was famous for its roses. But after the construction of a CETP at Jajmau, the canal was polluted by the effluents",* says Sukhadev Yadav, a village elder from Motipur who has witnessed pollution take its toll on their lives.

Case study 3: Patancheru, Hyderabad-a stamp to run the operations

Introduction

Patancheru and Bollaram Industrial areas, located about 25 Km west of Hyderabad have about 300 pharmaceutical, heavy engineering, paints, paper and chemical factories established over the last two decades. They generate approximately 8 MLD of effluents, most of which is directly discharged to natural hydrological system causing imbalance to the environment. This entire belt is situated on the Nakkavagu sub basin of Manjira river basin. Before industrialization this river basin was a source of fresh water and supported agriculture. Quality of ground water has deteriorated considerably over the years and the level of pollution has increased continuosly.[55]

This has led to increasing concentrations of BOD, COD, TDS, carbonates, bicarbonates and sulphides in local surface and subsurface waters.[56] However no attempts were made to control the discharge of toxic pollutants into the river basin.

The entire industrial belt has no proper drainage system and the waste water before the start of CETP used to flow to natural drains by gravity and it was not possible for all the industries to treat their effluents to the prescribed standards. In view of this a Common effluent treatment plant was proposed for both this industrial area. NEERI was hired to investigate into this matter and the analysis revealed that entire basin is contaminated and water has become unfit for irrigation. Thus there to rectify this situation a CETP and proper sewer system was proposed.

Patancheru Enviro-Tech Limited (PETL)

A group of several industries located in Patancheru Industrial Development area(IDA), with active support from the government owned infrastructure corporation (APIIC) promoted a public limited company called Patancheru Enviro-Tech Limited (PETL) in the year 1989. It's main objective was to provide full fledged facility for collection, treatment to the prescribed standards and final disposal of industrial waste water generated in Patancheru industrial area.

[55] Biksham et al 1995, "Toxic Trace Element Pollution In Ground Waters Around Patancheru & Bollaram Industrial Areas, Andhra Pradesh, India"
[56] Investigation Report, "Environmental Pollution Caused by Patancheru & Bollaram Industrial Estates in nearby Villages of Medhak District, Andhra Pradesh

This Common effluent treatment plant has presently 128 member industries out of which 60 are active members. The Industrial area has mainly bulk drugs, paints, paper, steel and oil mill industries. The total cost was Rs. 3 crores and operational costs is about Rs.1crore per annum

Salient features of PETL

1. **Conveyance and collection system-** There is no drainage system and effluent from various industries to the CETP is carried in 10 m^3 capacity tankers.
2. **Treatment plant capacity-** The CETP is designed to treat 7500 m^3/day of effluents. Presently it is treating 1300m^3/day of industrial effluent and 500m^3/day of raw sewage from the nearby BHEL township. The total land area is around 16 acres and the total cost of the project was approximately 8 crores.

Overview of the situation

Prior to setting up of the CETP's all the industries were discharging their effluents into Nakkavagu canal, thus polluting it to the maximum. In the initial years nothing concrete came up on this issue.The Supreme court of India in it's orders dated 16th Nov, 1995 in writ petition No.1056 of 1990 directed Andhra Pradesh State government to provide calculated compensation to the local farmers and also asked District judge (Medhak District) to submit reports on the progress of the work done on treatment plant and it's outcome.

At present almost all the industries are making arrangements for the preliminary treatment but only 7 industries are having pre-treatment plants. No steps are being taken by the industrialists to analyze or to remove the hazardous chemicals from sludge. In Patancheru Industrial area, there are different kinds of industries discharging different types of effluent. It is difficult to treat all kinds of waste in a single treatment plant unless some pre-treatment is given.
The concept now is to try and achieve land standards after post-treatment mixing with sewage at 1:6 ratio. The pipeline is proposed only between BHEL and the Patancheru CETP to transfer 10MLD of raw sewage for treatment and mixing with treated trade effluent at the CETP. There is also a complicated proposal of pipeline transfer of mixed/treated effluent from the Bollaram and Patancheru CETPS to the Musi river, 22 kms away. We are trying to find alternatives to this idea. The Patancheru CETP is meanwhile almost meeting Land standards.

Facts and Findings

In order to improve the situation of the entire industrial belt APPCB has to enforce various measures decided in a strict way and at the same time monitor the outlet effluent standards maintained by individual industries. Outlet standards are mainly tested for COD, TDS and SAR and inlet standards for the CETP is fixed at 15000 mgl for both COD and TDS. The Bollaram CETP is closed and its members are now using the more efficient Patancheru CETP. Though effluent generated is of hazardous nature, there is no provision for heavy metal removal from the effluent.

According to Tishya Chatterji (Member Secretary APPCB), "CETPs cannot handle heterogenous toxic organics and inorganic loadings cost effectively. I feel that TSDFs are a more manageable temporary solution in this regard".

Case study 5: Chennai

Tamil Nadu has the distinction of being the state that has the maximum number of CETPs. This follows the fact that it is the hub of activity when we talk of the garment or the leather industry. All these, being small-scale industries could not individually afford to set-up individual treatment plants to meet the pollution control norms prescribed, and so was born the concept of common treatment facility. The following are the total number of Common Effluent Treatment plants (CETPs) in Tamil Nadu:

Tanneries -12 in operation (2 in Chennai), 11 under construction.
Dyeing and bleaching units - 14 in operation, 10 under construction.
Hotels and lodges - 1 in operation (kodaikanal)

The technology

The individual units are grouped into what are called 'clusters' and each of such clusters is provided with one CETP.

- all the effluents of the individual units are transported via pipelines.
- the effluents are first collected in a receiving sump and then subjected to different stages of treatment.

First the effluents are passed through screens to **separate floating substances and solids** and sent to the equalisation tank for **mixing and homogenizing**. Following this it is subjected to **chemical dosing** using lime/alum and allowed to settle in a settling tank. This causes the **precipitation** of the different components (including Chromium from tanneries). Lastly the effluent undergoes **biological treatment**, where it is aerated to reduce the levels of organic matter. After this it is subjected to further refinement and then let off into the nearby water body.

The practical problems with the functioning of these CETPs are:

- TDS has never been brought under control.
- sludge disposal

There are overall about 900 tanneries, of which some have been closed as per the Government order. Presently there are12 CETPs and 130 IETPs (Individual Effluent Treatment Plants) handling about 20000-30000 cu.m/day of effluent.

1. Salt (from the individual units) - This is a major contributing factor for the presence of TDS. Unless some Reverse Osmosis-like technologies (that are very expensive) are used, TDS factor cannot be curtailed.

2.Organic Matter (hides, skin, etc.)-Mostly discharged as solid waste.

3.Sulphide (used for unhairing the skins) - Enzyme treatment is gradually taking over to encounter this problem.

4. Chromium (used in the actual tanning process) - Experimentation on to replace Aluminium for Chromium.

Recycle and recovery of Chromium:

UNIDO claims it has been the first to install a system for chromium recovery in the Pallavaram plant. Dr. Swaminathan, an expert in environmental engineering now associated with UNIDO, feels the problem of chromium presence is directly dependent and inversely proportional to the amount of sulphides used. More sulphides result in formation of non-toxic, trivalent chromium, while less of sulphides cause toxic, hexavalent chromium production.

The Pallavaram Tannery Cluster and CETP, Chengulpet District

The individual leather manufacturing units had been discharging effluent in roadside gutters, to join the surface water or seep into the ground to contaminate groundwater. The first of its kind plant for tannery effluent treatment was set up in Pallavaram in 1993, a suburb situated South of Chennai and is considered a "model plant". Constructed by M/s Emkem Engineers, the plant's design was approved by the Tamil Nadu Pollution Control Board and the plan certified by IIT.

A total of 152 (originally 113) tanneries are connected to this CETP. The plant has a volume load of 3000 cu.m/day and also handles effluent from 3 apartment blocks nearby. (Only 6 of the units in this cluster perform the actual tanning process.)

Process:

Each tannery pretreats the effluent (primary treatment). Then the effluent is reached to the CETP through a collection system consisting of 24 kms of sewer lines, 5 collection wells and pumps. The primary treated effluent first passes through a screen chamber and grit chamber and then to an equalisation tank. In a flash mix tank alum and lime are added followed by di-ammonium phosphate nutrient. After a primary clarifier the mixture passes through an aeration tank. A polyelectrolyte is added and the wastewater reaches a secondary clarifier. Sludge from the clarifiers is pumped into the sludge thickener and filter press. The so treated effluent is sometimes used for irrigation in the dry months but is otherwise let off into the Adayar river[d].

Sludge is being retained in the campus itself as no proper disposal site has been earmarked so far. Chromium recovery unit has also been set up for reuse of the chromium. But its efficient functioning is a question mark.

Recent studies in the tannery belt in the Pallavaram has revealed extensive environmental degradation, especially due to chromium. Levels of the heavy metal in groundwater, soil (in certain pockets) and in plants is in exceeding high levels than the norms prescribed [e]. The study reveals that the presence of the CETP has not made any significant improvement in the present situation.

CETP in North Chennai

A plant of a much less capacity than the one in South Chennai, it is situated in Madhavaram, a suburb situated North of Chennai. This plant treats the effluent of 14 tanneries. The effluents (2.5 lakh litres/day) are collected from the 14 units via pipelines into the receiving sump. Then it is subjected to, Equalisation, Flocculation (and chemical dosing), Precipitation, Settling and biological treatment. The sludge once again is collected in the campus itself, as a landfill is still not ready for its disposal.

Facts and Findings

Consequently, there are problems of functioning and maintenance. Some plants are not handling the stipulated amount of the effluents, like the one at South Chennai, which is actually getting more effluent than what it can handle. Future designs should therefore, incorporate facilities for dealing with additional units as and when they are set-up.

The amount of sludge generated depends on the quality of lime that is being used. Poor quality of lime usage forms more sludge thereby increasing sludge handling costs. On the other hand if

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[d] Source: Asian Development Bank, Tamil Nadu Environmental monitoring and pollution control, Final Report - vol 3; July 1994; Stanley Associates Engg. Ltd., Canada

[e] R. Kavitha; effect of chromium pollution in Chengulpet East District;1999

the operators are advised as to the quality of lime used, then the overall cost of sludge disposal and effluent treatment becomes cheaper. Also chromium recovery from sludge has to be made mandatory to improve efficiency of the CETP and other emerging technologies like sludge stabilisation could take care of sludge effectively.

Certain basic parameters like pH, BOD and DO have to be properly and constantly monitored with proper instrumentation to check decline in efficiency of operation.The amendments brought to Hazardous waste rules now clearly specify that the generator of waste is held responsible for its disposal. So the claims so far by the CETP operators that the state PCBs have to earmark a site for disposal is nullified.

For the purpose of studying, reviewing the function, and monitoring of CETPs, a separate body called the Loss of Ecology Authority under the aegis of the TNPCB was constituted. According to Dr.Thomson Jacob Ph.D, who has worked in the area of damage assessment and who is part of the Authority, "***the operation and maintenance of the CETPs is just an eyewash. Whenever the monitoring team arrives the whole plant is made to look in order. He also adds that the workers are suffering from certain skin ailments and diseases and the ground water in the whole region is totally polluted. Unfortunately, the workers in these regions are entirely dependent on this occupation for their livelihood and their options are limited***".

Recommendations

In industrial wastewater treatment, the last option gets further prioritised when common facilities are found to be more cost-effective on aggregates of scale-economies. To be economically and environmentally cost effective actually, these common facilities like the Common effluent Treatment Plants (CETPs) and the Common wastewater Treatment must treat and dispose effluent at surface water or land-application standards. Merely providing an economically acceptable outlet for individual industries makes these common facilities more an 'excuse' than a solution. Common wastewater treatment facilities not only keep thoughts on waste-minimisation away but actually require waste-guarantees to continue economically viable operations. Even industries that are recovering dissolved material from effluent individually, have to dilute high concentration residues to some level to make these acceptable to common facilities. This increases hydraulic loads and waste volumes.

CETPs also provide an opportunity for large effluent generators to externalise their treatment costs and responsibility. These large industries lead the organisation of the CETPs and control the quality, quantity and tipping-fees of the facility, mixing their effluents with others (which could be of less hazardous nature) in equalisation tanks and actually ending up making a profit! Further, the concept of 'sewer' standards has encouraged low-levels of removal of corrosive dissolved solids like sulphates and chlorides. Without any limiting standards, these not only damage the pipeline but also depend on downstream links of sewage for dilution. Dilution if available, can only conceal the problem. It cannot stop the continuous bioaccumulation of inorganics/toxic organics at the final receptor point, which is usually natural water. Terming a pipeline with no effective treatment at its end, as a sewer, is prima facie incorrect. It extends the CETP as an 'excuse' to levels where increasing effluent generation makes good business sense. Based on the findings of this report, we have a set of recommendations towards the controlling pollution not only at the outlet but also looking into the other aspects of clean production and waste minimisation.

- **Restriction on new cetps from coming up**: The findings reveal that, no cetp has been able to serve the purpose of controlling the pollution but only act as an expensive conduit for carrying the effluent. Therefore, new cetps should not be granted permission.

- **Proper monitoring of the existing cetps**: The existing cetps should be monitored in accordance with all parameters prescribed by the Central Pollution Control Board. The analyses results should be made public. The management committee should be held liable for any violations of the prescribed standards.

- **Inventory of the chemicals used by the member units:** It should be mandatory for the member units to reveal the information regarding the types of raw materials, its quantity, by-products, production process and the final product. Any industry using hazardous chemicals should be asked to minimise the use and take corrective measures to finally phase out such chemicals. These should not be diluted in the larger volumes to aggravate the problem.

- **Emphasis on the cleaner production:** Even the industrial policy advocates end of the pipe solutions as intermediary steps and not the solution to the pollution. To start with, the Board and the individual units shall take steps to identify key toxic chemicals in their raw material and effluents, and commit to reducing the release of the same to any media (air, water, land) through process changes, and material and product substitution expeditiously (from one to five years depending upon individual units' economic capacity).

  The "National Cleaner Production Centre" (NCPC) in India, has been established as an initiative taken by the United Nations Industrial Development (UNIDO), United Nations Environment Programme (UNEP). This centre brings out many publications and has demonstration projects in sectors like paper and pulp, dyeing, electroplating etc., which could be replicated at other places rather then only looking into the end-of-pipe solutions.

- **Communities right to know:** Most of these cetp's discharge into the water bodies and land, which is a common property resource. There are many communities which are dependent on these resources for their livelihood, thus making it the fundamental right to know the contamination levels. And also the authorities shall make available to the communities the memorandum and articles of association of the CETP company and the proposed agreement between the CETP company and the member industries.

Annexes

Central Effluent Treatment Plants (CETPs) and the World Bank in India.
[Background Note]

CETPs in India. The CETP concept was originally promoted by the Indian Ministry of Environment and Forests (MoEF) in 1984 to treat waste waters from a large number of small- and medium-scale industries. This concept was conceived as a way of achieving end-of-pipe treatment of. combined industrial waste waters by full-time professionally trained specialists at lower unit costs than could be achieved by individual industries, and to facilitate discharge monitoring and enforcement by environmental regulatory authorities. The first CETP in India was constructed in 1985 in Jeedimelta near Hyderabad, Andhra Pradesh, to treat waste waters from pharmaceuticals and chemicals industries – long before the World Bank became active in this sector. This CETP was followed by others in Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, and Tamil Nadu. As of June 1994, in the State of Gujarat, one CETP – which had been constructed by the Gujarat Industrial Development Corporation (GIDC) in Nandesari – could not be commissioned for several years because the member industries had failed to provide the necessary primary treatment. At that time, construction work at the CETPs in Ankleshwar, Sachin, Sarigam, Panoli, and Vapi (the subject of Greenpeace's protest) had not even been initiated.

Extensive public interest litigation and numerous verdicts by the Indian courts provided a major impetus to construct CETPs at an accelerated pace, and the World Bank was asked to provide assistance toward this process in the early 1990s, at a time when this appeared to be a viable solution to the problem. Most of the court verdicts were given in the State of Tamil Nadu, followed by New Delhi, and the State of Gujarat.

Changes in World Bank thinking on CETPs. By the mid-1990s, the Bank's Environment Department was already starting to recognize the possible drawbacks of CETPs and the traditional approach to pollution control (as opposed to pollution prevention and cleaner production). In the process of preparing our *Pollution Prevention and Abatement Handboo*k, we held discussions with Greenpeace, and consulted Greenpeace's excellent "Inventory of Toxic Technologies" published in May 1994. The thinking contained in our *Handbook* gradually found its way into operational practice.

At the same time, we started an arduous process of working with our counterparts to restructure and cancel parts of the existing projects, and to work with the Government of India on a CETP Policy Note. At the end of last year, we also closed the Industrial Pollution Control Project which had been approved in 1991, and prepared a detailed analysis of the outcome of that project. The report is quite critical of the approach pursued as well as of the Bank's handling of the issue. Copies of the Implementation Completion Report, which was endorsed by the Bank's independent Operations Evaluation Department, can be obtained directly from the Government of India. Unfortunately, not all state agencies and court justices in India, not to mention many colleagues in bilateral and multilateral funding institutions, share the view that CETPs are not an appropriate pollution control strategy. One reason is the continued erroneous belief that public subsidies for pollution abatement can make up for weak regulatory capacity. Interestingly, larger companies in the private sector -- who do not expect subsidies -- may be the first to recognize the benefits of cleaner production and to adopt alternative measures because it is in their own interest. In detailed discussions with some companies, we feel we have already made significant advances in persuading them to improve their environmental performance on the basis of intrinsic process modifications and above all better industrial management.

Lessons Learned from the CETP Projects. As of January 1998, there were 77 CETPs in India approved by MoEF. Of these, 15 had been completed (though many were not functioning properly), and 62 were in various phases of construction. At that time, we commissioned an internal review to review the performance of the Industrial Pollution Control and Industrial Pollution Prevention Projects. This review highlighted the procedural delays in subproject approvals, problems with ownership structures of CETPs (especially in Gujarat, with GIDC taking the lead to form CETP companies jointly with the industries in the estate), cost overruns, management of the sludge from the CETPs, need for review of the subsidy policy, membership fees and charging systems at the CETPs, and management of risks. In particular, it is evident that enforcement of pretreatment requirements by CETP member industries is difficult, resulting in an effluent quality that is out of compliance with respect to several parameters established by the Gujarat Pollution Control Board (GPCB).

Although discharge parameters have been established, GPCB lacks the necessary enforcement action because of the high cost of compliance. Most seriously of all, CETPs generally fail to address toxic effluents, which must be addressed as an intrinsic part of industrial production or, at a minimum, as part of pretreatment of wastes flowing to CETPs.

A New Approach for CETPs. The first-generation CETP projects in Gujarat are basically centralized end-of-pipe (effluent) treatment plants for industrial discharges. However, it is crucial that pollution prevention concepts should be applied to an integrated system consisting of: (i) wastewater generators discharging to a CETP, (ii) the CETP, and (iii) the receptors for the CETP discharges (wastewater discharges, sludge disposal, and air emissions). The CETP Policy Note (Attachment 2) takes this approach, and we have objected to the financing of all but two CETPs because we did not see any progress in dealing with the underlying issues. The two acceptable subprojects are implementing the steps outlined in the CETP Policy Note, as follows:

The original cost recovery formulae for the CETPs – which were based only on the wastewater flow rate – have been revised in such a manner that member industries discharging less hydraulic and organic loads will benefit while those discharging higher hydraulic and organic loads will be required to pay additional charges. The new formulae will allow member industries to reduce hydraulic and organic pollutant loads in discharges to the CETPs, facilitate CETPs' operation, and improve CETPs' compliance with environmental requirements.

Recycling/reusing of effluents from CETPs to member industries is being evaluated through pilot-scale testing and compared with the originally-conceived scheme of discharging to the surface water. If the studies show that the recycling/reuse option is feasible and more cost-effective than the originally conceived options, then hydraulic and pollutant loads in CETPs' effluents will be curtailed or eliminated.

The legal agreement between the CETPs and their member industries have been revised to include pollutant discharge requirements relevant to the type of industries. In[f] addition, GPCB has been alerted to the relevant pollutant parameters that should be monitored in the CETP discharges.

Detailed environmental management plans (EMPs) have been prepared for the CETPs. The EMPs will standardize the environmental management activities of the CETP personnel and improve the compliance status of the CETPs and their member industries.

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[f] Currently, CETPs rely on GPCB for enforcement of pre-treatment standards on its members instead of having the power to act on their own.

Environmental awareness created through the Industrial Pollution Prevention Project has led a number of CETP member industries to implement pollution prevention measures and obtain positive results in reducing hydraulic and pollutant loads in their discharges. Some industries have formed waste minimization circles (WMC) and one industry is applying for ISO14001 certification. The Bank has been supporting the industry's efforts by providing industry-specific technical assistance on pollution prevention.

Through Bank involvement, sludge disposal has become an integral part of the CETP projects. The original sludge disposal plans have been revised for disposal in secure landfills.

CETP POLICY NOTE

Central/Common Effluent Treatment Plants (CETPs) in India are currently viewed as "central end-of-pipe (effluent) treatment plants" for industrial dischargers. This practice can be made much more effective if the pollution prevention concept is applied to an integrated system consisting of the following three components: (i) wastewater generators discharging to a CETP, (ii) the CETP, and (iii) the receptors for the CETP discharges (wastewater discharge, sludge disposal, and air emissions). This Policy Note lists certain recommendations based on CETP-related experience in Bank-supported projects in India.

Benefits of pollution prevention at member industries to CETPs. The benefits of pollution prevention at industries discharging to CETPs are not yet appreciated in India. Resource conservation with cost savings by the industry, CETP, and the CETP discharge receptors (e.g. landfill) can be achieved through implementation of pollution prevention measures by industrial generators. It is important that these measures be explored through pollution prevention audits at industrial dischargers prior to wastewater characterization and treatability work conducted for CETP designs. Then savings in capital as well as operation and maintenance (O&M) costs can be achieved. For example, if the inflow to a CETP can be reduced by 30 percent, then as much as 20 percent in capital and O&M costs can be saved by CETPs and associated landfills. Given the large number of CETPs financed in India (including the central and state government subsidies), the amount of potential savings would be considerable. However, for the already constructed CETPs, the benefits would be limited to the O&M costs for the CETPs and associated landfills. It is critical to create awareness for this concept in India.
It is also important that environmental agencies (e.g. State Pollution Control Boards) require pollution prevention audits at industries that are wastewater dischargers to CETPs as part of the CETP permitting process. Industry can establish incentive schemes for their workers who contribute to identification of implementable pollution prevention measures at their facility. IDA funds under the Industrial Pollution Prevention Project can be used to conduct pollution prevention audits.

The fee structure of water for industrial use or wastewater discharged by industries (i.e. water cess) can have a large incentive effect for industry to conserve water and reduce (or eliminate) discharge of pollutants. For example, at the Karur Vanchi (Tamil Nadu) CETP visited by a Bank team, because industrial water is free of charge, there is no incentive for water conservation and pollution prevention. As a result, high pollutant loads are accompanied with excessive water discharges. In Sachin (Gujarat), by contrast, industrial water is supplied at a cost of Rs. 11/m 3 to Rs. 14/m 3 , and a significant percentage of industries discharging to the Sachin CETP already recycle water. In locations where groundwater with acceptable quality is accessible, high rates of water cess or groundwater extraction fees (along with an enforceable groundwater policy) can be used as mechanisms to discourage excessive discharge of water and pollutants from industries. The Bank strongly recommends that this policy option be used by State Governments to encourage industry to conserve water (especially in water scarce areas) and prevent pollution.

Benefits of recycling/reusing the CETP effluent. The benefits of the CETP effluent being recycled to the member industries are not yet fully appreciated in India. Recycling of the CETP effluent for agricultural use might also be viable option. However, the time constraint for preparing a CETP project may be a deterrent to evaluate thoroughly, through long-term studies, the potential impacts of pollutants in the CETP effluent on the food chain. The strong interest for recycling/reuse by member industries is generally expressed from industries located in states where industrial water is not a free good (e.g. Gujarat). Construction of the treated water discharge pipe from CETPs to the receptor (i.e. surface water body) by Industrial Development Corporations (IDCs) may also be a disincentive for the CETP/discharging industries as this may constitute a hurdle for the evaluation of alternatives for the CETP effluent (i.e. recycle to member industries with or without tertiary treatment at the CETP, reuse for agricultural use with or without tertiary treatment at the CETP, and direct discharge to a surface water body). The Bank strongly recommends that State Governments encourage CETPs to submit an evaluation of alternative options for the CETP effluent as part of the documentation for CETP approval. Furthermore, if the study recommends direct discharge of the effluent to a surface water body and if an IDC is involved in construction of the pipeline, the Bank further recommends that the IDC be fully compensated for the associated expenses by CETP. The IDA funds under the Industrial Pollution Prevention Project can be used to conduct evaluations of alternative options for the CETP effluent.

Characterization of the CETP sludge for hazardousness is not conducted in India because the current Indian hazardous waste legislation lists categorically that “sludges from wastewater treatment (Waste Category 12)” are hazardous. The Bank recommends that this legislation for the CETP sludges be reviewed and possibly revised to consider potential savings associated with the requirements of handling, transporting, and disposing of hazardous versus non-hazardous wastes. Characterization of sludges from the primary and secondary treatment as well as the combined sludge from the CETP can be conducted through leachate testing. Results of these studies can form the basis of background studies for amending the legislation, if necessary.

Central and state government subsidies. There is enough evidence that central and state government subsidies are not essential for CETPs represented by medium- and large-scale industries. In a revised estimate of sources of financing for a CETP recently visited by a Bank team, while the total central and state subsidies remained about the same, the reduction by more than half from the previously approved loan amount was compensated by doubling the capital equity. In addition, based on experience from the Industrial Pollution Control Project and the variation in the performance of CETPs in India, the Bank strongly believes that the element of central and state government subsidies be limited for CETPs that receive wastewaters only from small-scale industries and that are well-managed by professional teams, preferably by private professional firms independent of the CETP member industries. The Bank recommends that such subsidies be preferably in the form technical assistance (such as evaluation of alternatives, pollution prevention audits) rather than contribution to the investment cost of CETPs.

Sludge management as part of CETP projects. The Bank team who recently visited several CETPs in India noted that sludge management has mostly come as an afterthought during the CETP projects. The Bank strongly recommends that State authorities insist that sludge management (including disposal) be an essential part of CETP projects, which should be addressed along with the CETP design.

Private sector-funded hazardous waste facilities. There are examples of well designed, built, and managed hazardous waste facilities by the private sector in the State of Gujarat. Examples include those by the Nandesari Environment Control Ltd. (Nandesari), Enviro Technology Ltd. (Ankleshwar) for the common hazardous waste facilities, and those by Gujarat Alkalis and Chemicals Ltd. (Baroda), India Petrochemicals Ltd. (Baroda), and Chemsynth (Surat) for single company-dedicated hazardous waste facilities. The Bank recommends that these good practice examples be emulated at other sites/states in India independent of national and state government funding.

CETP monitoring of industrial discharges. The Bank views the CETP concept to be an excellent opportunity for the private sector (the CETP operators in this case) monitoring the quality of wastewater discharges from its member industries. This concept --which is equivalent to "industry self-monitoring"-reduces the monitoring effort required of the SPCBs. In particular, SPCBs could only monitor the discharge from the CETP, and not the many discharges from individual industries that supply it. The Bank recommends that SPCBs be relieved of their responsibilities for monitoring industrial discharges to CETPs, and instead focus only on discharges to the environment. We also understand that there are practical difficulties for the CETP in enforcing its legal agreements with the member units. The Bank strongly suggests that this issue be investigated and a practical solution to this problem be implemented.

Lack of industrial safety measures. At some of the CETPs recently visited by the Bank, a major lack of safety measures was observed. As avoidance of loss of human life should be a priority, the Bank strongly recommends that enforcement of safety measures be given serious attention by State authorities.

Lack of industrial hygiene measures. During visits to typical member industries of CETPs in Tamil Nadu, a Bank Team observed workers with no personal protection equipment (no gloves, no shoes, no special work clothes) working in operations where they were in direct contact with bleaches, dyes, and hazardous chemicals. The plant representatives did not answer sensitive hygiene-related questions asked by the Bank Team. The Bank recommends that measures be taken –possibly as a condition for the approval of license to operate the CETP-- to ensure adoption of appropriate industrial hygiene measures by member industries. Successful implementation of such measures requires good cooperation between the state environmental institutions (SPCBs) and industrial safety departments.

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Addendum

PATANCHERU Common Effluent Treatment Plant, in Medak, Andhra Pradesh (INDIA): A Convenience for Flouting Rule of Law

Industrialization in Medak started with the promise of Smt. Indira Gandhi, the then Prime Minister in 1974. Since then, the government has established an industrial estate in four phases. Thus the total area developed is 1091.68 acres. Except Phase II located on the south of NH 9, all other phases are located on the north of the Highway. The area acquired for Phase I, III, IV, and V are 350, 63.86, 177 and 39.40 acres respectively. The total area acquired for Phase II was 405.16 acres. The size of the plots ranges from 0.05 hectares to above 25 hectares. Small industries occupying a plot area of 1 hectare plot are more than 75 percent of the total 276 industries.

In 1962, the Industries Department of Andhra Pradesh has earmarked an area of 56.26 acres for industrial development just besides two tanks - Gadidala Kunta, and Posani tank, near the village Bandlaguda. With the formation of Andhra Pradesh Industrial Infrastructure Corporation, in 1973, Patancheru was sought to be developed as major industrial center. This was done in five phases in addition to the industrial estate already established by the Industries Department. Presently, there are 276 units in all the five phases, apart form 31 industries in and around Patancheru. The entire Patancheru industrial area has been provided with all infrastructural facilities like roads, electricity and water, excepting sewer system.

Initially, the industrial effluents were being discharged outside the industrial premises which ultimately end up as a pool of waste water or join the natural water course. “There are two water courses in the area, the northern drainage water course receiving waste water from Phase IV area of APIIC, 2) the southern drainage water course receiving waste water from Phase II area of APIIC, the effluents from other phases collect in lagoons or natural pools nearby. During monsoon, the flow comprises of rainwater and effluents. In other seasons only effluent water flows (O.S. Reddy Committee Report, 1990, Page 6). Only Phase I, II and IV areas have large or major polluting industries. Industries in Phase II and V are mostly small scale industries” (NEERI Report, 1991, Page 2).

Apart from the industrial estates, industries have been established wherever, spreading over the entire area, including Bollaram, Jinnaram, Pasha Mailaram, Sangareddy, Sadashivpet, Bonthapally and other areas, within a radius of 50 Kms. Most of these industries are pharmaceutical and chemical companies.

Highly toxic effluents discharged by hazardous industries in and around Patancheru and Bollaram area in the district of Medak, Andhra Pradesh, are creating havoc with the lives of people, their cattle, their crops, their wells, drinking and irrigation water sources, and flora and fauna. Pollutants such as toxic effluents, hazardous wastes, fumes, odor and gas emissions have caused extensive and intensive damage. Parts of Patancheru and 14 other agriculturally-prosperous villages, with cumulative population of about 50,000 are surrounded with severe air, water and soil pollution.

Considering the situation, and following public protests and people’s campaigns, a full fledged facility for collection, treatment and disposal of industrial waste generated in Patancheru industrial area to the standards prescribed, a common effluent treatment plant, was promoted in the private sector under the name of Patancheru EnviroTech Limited (PETL).

PETL in its report dated 22-12-1995 has briefly mentioned the stages of operation. Each industry will provide the necessary pre-treatment to the waste waters in their own premises. After which the waste waters will be let out into sewers. This pre-treated waste water from all the industries will be brought to the combined waste water treatment plant by sewerage system. In the combined waste water treatment plant, the waste water will be treated to the dischargable standards for inland stream... But the effluent discharged from PETL into Nakkavagu is a highly toxic effluent collected from various industries. (District Judge Report, Sangareddy, Medak, 23-10-1996, submitted to the Supreme Court).

An analysis of treated effluents showed that all the user industries of PETL are dumping their waste waters into the common E.T.P. which is in turn is letting them out into the natural stream, i.e., Nakkavagu, without fully treating it, if not at all .

The reasons are not difficult to fathom. Originally, when the project was conceived, the collection of waste water was to be done by a sewer system. But this has not been implemented, citing the reason of huge financial outlay. Presently, effluents are being collected through lorry tankers directly from various industries.

There are broadly nine types of heterogeneous industries which are dumping their effluents into the common effluent treatment plant. They are:

Bulk drugs and intermediaries,
Pulp- paper and other cellulose based industries,
Metal finishing,
Resins and chemicals,
Pesticides,
Paints,
Rubber,
Edible oil refineries, and
Textile processing.

Presently, 128 industries are registered for the use of the facility of PETL. These units are located, besides Patancheru, in areas as far as Jeedimetla, Kajipally, Medchal, Kothur and Pashamylaram, covering the districts of Rangareddy, Hyderabad, Medak, Nalgonda, Mahaboobnagar of Andhra Pradesh and Bidar of Karnataka. It is clear that the membership is not restricted to Patancheru area only. This is highly questionable, and casts a doubt over the intentions and objectives of both the PETL and the Pollution Control Board. The initial objective and design of the PETL was to treat the effluents of the Patancheru industries in order not only to mitigate the problems associated with haphazard dumping of effluents into Nakka Vagu, but also to help the industries in collectivizing their financial and technical capabilities in addressing the problem. Resultantly, due to heterogeneous membership, and in addition to other factors, the performance of PETL has not been on the expected lines. Realizing this, the APIIC requisitioned the services of M\S. Bhagavati Ana Labs Ltd., consulting Environmental Engineers, to study the problems of the plant and suggest remedial measures. They have collected samples, noted the contracted loads and submitted a report.

Nakkavagu is now receiving more waste water after setting up Common Effluent Plant than the waste water flowing earlier in the vagu. This is because now the plant is receiving effluent by road tankers not only from industries located in Patancheru but also from different areas. But for the CETP, effluents of these industries had no scope to reach Nakkavagu. In other words PETL is now collecting polluted effluents from several polluting industries in the garb of commercial viability. And, by not treating these additional effluents fully to the standards prescribed, the PETL has further magnified the problem of pollution in Nakka Vagu. Instead of a treatment plant, PETL has become a polluting industry, much more dangerous than the individual industries. With the immunity of a treatment plant, PETL is pumping waste water into Nakkavagu with a electric motor. With the increase in the volume of waste water, pollution is reaching far off places through Nakka Vagu and Manjira river (into which Nakkavagu ultimately joins). Manjira river joins Nizam sagar from there it joins river Godavari .

Financial management and problems associated with the management of the PETL has not been understood, studied or analyzed so far. It indicates two things: financial viability or the persipacity to sustain a system of subverting pollution control laws.

Common effluent treatment plant should be of those industries which are compatible. There are dissimilarities in the effluents in the dissimilar industries. Thus, the treatment methods and systems vary according to the characteristics of the effluents. Some of the waste water is not amenable for biodegradation and in some cases there is no organic matter to degrade as well. There are total dissolved solids in many.

In fact, at the design stage of CETP, the industries agreed to send waste only after pre-treatment to the required standards. This in a way determines whether a particular industry is sending its effluents beyond its capacity

Primary waste treatment includes screens, sedimentation tanks, pre-aeration units and chemical precipitation and oxidation. This treatment was not adopted in PETL, basically because the project design includes the collection of waste water by a sewer system, which has not been implemented. Lack of sewerage system rendered the entire project non-functional. Due to lack of pretreatment, the suspended solids are carried over to the down stream units resulting in accumulation of suspended solids to the tune of 7000-8000 mg/L which are chemical in nature as against 2500-400 mg/L of biological suspended solids required to be maintained in an extended aeration system.

Despite being known all along that PETL is essentially a secondary treatment plant, none of the industries have undertaken to treat the effluents in their own premises to the required standards as prescribed by the rules. They enlisted themselves with PETL only to shed their responsibility of treating the effluents. While it has become convenient for the Pollution Control Board to cite CETP as the best answer in the circumstances. Such a situation helps the PCB in covering up its lapses in monitoring pollution treatment measures in individual industries, as long as they are members of the CETPs.

PETL was designed to receive the pre-treatment waste water from the member industries through pipelines into the permanent pumping station located in its premises and from that pumping station the waste water goes through detritor and Bar Screen into the equalization tanks where pH would be measured and equalized to '7' to rule out acidity and alkalinity, from there the effluents will be pumped into anaerobic digesters for anaerobic treatment of the effluents, where 70% of the BOD will be removed and from there it will flow into aerobic tank where the aerobic reaction takes place to reduce the BOD level in the waste water. Standards are prescribed for inlet effluent quality as well as treated effluent quality for common effluent treatment plants. Sl. No. 55 of Schedule-I to the Environment (Protection) Rules (Second Amendment) 1991, the standards of CETP are prescribed (Ref. Table - I).

TABLE-I

INLET / OUTLET - EFFLUENT QUALITY STANDARDS FOR CETP

PARAMETER	CONCENTRATION	
	INLET	OUTLET (into inland surface waters)
pH	5.5-9.0	5.5-9.0
BOD 20 deg. C	-	30
Temperature	0 deg. C	45 shall not
exceed 40 deg. C in any section of		stream within 15m
down stream from the		effluent outlet.
Oil and Grease Phenolic Compounds (as C6 H5 OH)	20	10
Suspended solids	-	100
Dissolved Solids (Inorganic)	-	2100
Total residual Chlorine	-	1.0
Phenolic compounds (as C6H5OH)	5	-
Ammonical Nitrogen (as N)	50	50
Total Kjeldhal Nitrogen (as N)	-	100
Cyanide (as CN)	2-0	-
Hexavalent Chromium (as Cr +6)	2	-
Total Chromium (as cr)	2	2
Copper Cu	3	3
Lead Pb	1	0.1
Nickel Ni	3	-
Zinc Zn	15	5
Arsenic As	0.2	0.2
Mercury Hg	0.01	0.01
Cadmium Cd	1.0	1
Selenium Se	0.05	0.05
Fluoride F	15.0	-

Boron B	2	-
Radioactive materials :		
Alpha emitters, uc/ml	10.7	
Beta emitters,uc/ml	10.6	

Concentration in mg/L except pH, Temperature and Radioactive materials.

Note: 1. These standards apply to the small scale industries, i.e., total discharge up to 5 Kl/day.

2. For each CETP and its constituent units the State Board will prescribe standards as per the local needs and conditions; these can be more stringent than those prescribed above. However, in case of clusters of units. the State Boards with the concurrence of CPCB in writing, may prescribe suitable limits.

Naturally the CETP can only accept the effluent if the individual industry sends the effluents conforming to the inlet standards. These standards were fixed obviously keeping the characteristics of effluents and capacity of the plant to treat. The treated effluent quality standards for CETP is noted as Sl. No. 55 B and they are shown in under outlet (into inland surface waters) ref :table –I

The characteristics of a sample of raw effluent and treated effluent dt. 4--6-1996 analyzed by A.P. Pollution Control Board reveal that efficacy of Common ETP of PETL in treating the effluent.

A mere perusal of the above facts reveals that the so called treatment is a facade. The pollution is enormous beyond expression . For example when untreated / raw effluent with BOD 3,900 was fed. The BOD of treated effluent was 3,500 a mere reduction of 400, The standard prescribed for treated effluent into a stream is 30. Equally in regard to suspended solid and Dissolved solids. While the standards prescribed are 100 and 2100, the treated effluents from PETL were 1077 and 33,578 respectively. These characteristics reveal the enormity and dangerous levels of pollution in water. When such hazardous and dangerous toxic effluents are discharged into natural stream the ramifications of the pollution cannot be even imagined. A number of villagers sustain on these waters for their survival not only for drinking but also for irrigation and host of other functions.

The plant was partially commissioned in 1994 with the aerobic section. Importantly, the anaerobic section was not commissioned which is supposed to take care of 70% of BOD load. The non-commissioning of this UASB reactors I and II may be due to high concentration of suspended solids. The sludge dewatering centrifuge has not been commissioned to blend the high solids content of aerobic tank through the secondary sedimentation tank. Actually it was proposed to feed with an influent BOD of 1500 mg/L to the anaerobic section an effluent BOD of 450 mg/L was expected. Therefore , two units of 3750 cu.m. were proposed. The analysis report shows that influent BOD is beyond its capacity and too without commissioning anaerobic section.

2 The Ana Labs in its report observed :

Reception tank :

There is a reception tank of 10.0 mx4. 5 m x 3.0 m SWD having a holding capacity of 135 cu.m equipped with two pumps of 12.5 HP to deliver 180m3 / hr of waste water to the grit chamber and detritor. This sump is not in use as it was originally conceived that the waste water will be received into the sump through a network of sewer system. This entire unit is not in use at present.

Grit Chamber and Detritor :

There is a grit chamber, detritor and measuring flume connected to the above mentioned facility, which are not in use.

Equalization tank :

There is RCC equalization tank of 30m x 30m x 3m SWD with partition at the centre to serve as two equalization tanks connected through a grit chamber and detritor which are not in operation and only the equalization tanks are in use to receive waste water from user industries. The two equalization tanks of equal capacity are having 2700m3 total holding capacity. Presently, the effluent tankers are unloading the waste water into both the compartments. This tank is not equipped with mixing device to homogenize the characteristics of the waste water which is essential to provide a more or less consistent waste water characteristics for biological treatment. Consequently the suspended solids in the waste waters received are settling in the tank reducing the capacity of equalization. Normally , the equalization capacity should be around 3-5 days and at the present flow rate of 1300-1500 m3/day, its retention capacity is 1.8 days. Some of the suspended solids are getting carried over into aeration tank through the suction of pump located at the bottom of these tanks. Presently there is about 1 to 1.2 mts. height of accumulated solids at the bottom of these tanks. This is being desludged manually at present.

It is found that there is a lot of foam and floating matter on the surface of the waste water. The Ana Labs, in their report, observed :

"Considerable foam formation was observed through out the period of study which naturally inhibits oxygenation of the system to some extent. The four fixed surface aerators of 10 HP are expected to take care of the 30% of the originally 11250 kg of BOD load. This is theoretically possible. In actual practice there is a backlog of 70% of BOD of 11250 kg which was supposed to be taken care by the UASB reactors which are not put into operation. Besides this, the carryover of the suspended solids into the aeration tank has aggravated the situation leading to its poor performance. Presently, there is a COD reduction of around 50% and BOD reduction of 55% (approx.) which is due to stripping of solvents and other volatile organic from the influent, and if cannot be termed as biological degradation as there is no agglomeration of the suspended particulate during settling, which is typical in any biological aeration system. Clarity after settling is not as is expected from a conventional extended aeration system though the sludge is settling. The system was designed for F/M ratio of 0.1 and the average F/M ratio works out to be 0.9 indicating that the system is overloaded nearly nine times which obviously because of the non-functioning of the UASB reactors I and II."

Due to lack of pre-treatment of the units of origin coupled with lack of pre-treatment facilities at PETL, incompatibility of waste water, high BOD/COD ratio, non-commissioning of anaerobic section, non- availability of arrangements for collection, storage, and disposal of the solid waste, accepting waste water from industries beyond standard characteristics are some of the reasons for its poor performance.

The Ana Labs, in its report, after sampling of various effluents and after considering the requirements of PETL observed "the treated waste water from this plant even after implementing the above measures, can take care of primary pollutants and organic pollution and will not be fit for discharge into the present natural stream as per the existing provisions of Water Act, 1974 and EP Act, 1986, and their subsequent amendments. The PETL should make arrangements for collection, storage and disposal of the solid waste as it attracts the Hazardous Waste Management Rules of 1989".

That the solid wastes from a number of industries are dumped on road side clandestinely. Ultimately the very same percolates into the sub soil or carried into streams. No industry with such toxic effluents shall be allowed to run.

A difficulty in enforcing water standards arises when the combined load of several discharges exceed the self purification capacity of the receiving water. Ideally effluents standards should be strict enough to protect the discharges fairly in so far as possible tailored to character and volume of water at each point of discharge. The plant was designed for a flow of 7500m3/day with a BOD load of 1500 mg/L. The over load in the aeration system was computed at 5.03 times (vide Ana Labs report , Page 38).

Of the 128 units, about 71 units are contributing the waste water and on an average 140 tankers of effluents are being lifted per day from various industries .

The Environmental Engineer reported that barring seven industries, the others are not having any pre-treatment plant. They are only having collecting/settling tanks. They are simply lifting effluents to the tankers after correcting the pH levels. The industries that are having pre-treatment plants are Deccan Leathers, Ambuja Petrochemicals, Asian Paints India Ltd., Voltas Limited, Standards Organics Ltd., Reliance Cellulose Products Ltd. and Sri Sai Baba Cellulose Pvt. Ltd.. That even in the case of those industries which are having pre-treatment plants, the effluents did not conform to the standards. The Environmental Protection Rules, 1989, laid down tolerance limits, parameters and standards of effluents for each of the industry. Section 7 of Environmental (Protection) Act, 1986, prohibits carrying on any industry, operation or process to discharge or emit or permitted to be discharged or emitted any environmental pollutants in excess of such standards as prescribed under the rules. Here the industries are sending their effluents to a common effluent treatment plant, the results of which have already been mentioned.

There is not even a single industry which comes anywhere near the standards including those industries which are having pre-treatment plants. Analysis reports of A.P. Pollution Control Board show that chlorides, Sulphates and dissolved solids of all the industries except one are more than 1,000, 1,000 and 2,100 respectively prescribed for Patancheru. All these industries are sending effluents beyond their capacity.

In fact, all agreements with CETP should append a proforma - A, wherein broad characteristics of processed waste waters (indicating range) are to be noted. All these industries might have given their parameters of effluents, after pre-treatment since most of them tallied with the contracted loads furnished by PETL. These parameters might have been fixed, based the capacity of the user industry. PETL cannot allow the effluent if it is beyond the capacity of the plant. If any industry transgresses the limits, it can be said that it is letting its effluents beyond its capacity. The fact is reinforced by the clause wherein the user industry agreed to pre-treat to the above standards. It could not be otherwise since the parameters given are of untreated effluent and beyond the inlet standards of CETP.

Every industry has to obtain consent of the Pollution Control Board to permit them to discharge the effluents from its premises by an application in Form XIII of A. P. Water (Prevention and Control of Pollution) Rules, 1976. Columns 16 and 23 of the Form relate to process of treatment and the details of the composition of effluent. There the contacted loads given by each industry in Form XIII under Table "effluent before treatment" can be safely taken as capacity of a particular industry to send its effluents. It is reported that none of the industries had satisfied the parameters mentioned. This itself is sufficient to hold that the industries are sending the effluent beyond its capacity, wherever be the parameters, each of the industries had transgressed the same .

These parameters establish irrefutably that a particular industry is sending effluent beyond the capacity of plant.

This sort of treatment cannot be said to be pretreating the effluent. The various standards of effluents indicate none of the industries are fully pre-treating the effluents, though with some more effort that can reduce T.S.S. Obviously they are taking protection under the agreements with PETL which, without any compunction and beyond the terms of contract, is receiving effluent beyond the capacity.

That PETL itself represented that the influent BOD is 6,000 mg/L, while treated effluent BOD 1785 mg/L and efficiency is 70.25%. As on today, PETL is discharging about 1,100 M3 per day in the Nakkavagu and they have expressed the need for improving the efficiency of the plant by commissioning of the Diesel Generator set, additional aerators, additional secondary settling and upgradation of laboratory facilities. They have received quotations from M/s Krotta Engineers Ltd, Chandigarh and M/s Hindustan Dorr Oliver Ltd, Bombay to install/construct the units for removal of suspended solids in the influents. They are taking steps to acquire 200 acres of land to load the treated effluents. They have entered into contract with BHEL and Housing Colony and lifting daily about 50 tankers of domestic effluents. **The PETL should not be allowed to enter into contract beyond its capacity to treat the effluents. It is aware of its parameters. It is beyond anybody's understanding as to how it could enter into contract with 128 industries , when it is evident that it cannot treat their effluents**. Moreover the membership is proliferating day by day. It shows that they cannot adhere to the standards.

From the various reports it can be concluded that 4 industries out of 80 industries mentioned in D1 and D3 are sending effluents within the range. The remaining 38 industries are either closed or not sending effluent to PETL.

To conclude, PETL an industry by itself is a major contributor for pollution, on par with the individual industries. All of them individually as well as cumulatively are discharging almost untreated effluents into the stream, the main source of water supply to the residents of several downstream villages. The net result is a pollution of staggering dimensions and poisoning of natural resources inflicting untold suffering on innocent rural humanity.

As per rule of Law, this action amounts to **centralized collective criminal act.**

Endnotes

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