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Appendices

MAIN POINTS OF THE ADVICE

The Commission for Environmental Impact Assessment considers the following points in this advice as crucial in the Environmental Impact Statement for the Korangi Environmental Management Plan (KEMP):

- In order to achieve sustainable results from project interventions they should be based on an approach that analyses the situation in the individual tannery and addresses its activities to and coordinates them with future developments in the individual tannery. In the environmental impact statement (EIS) realistic assessment of pollution abatement can only be achieved if it is based on this approach.
- Pollution and nuisance abatement is the main objective of the KEMP. Pollution and nuisance are the result of in-house activities. Therefore, tannery in-house activities must be addressed with priority.
- A limited number of alternatives must be composed of logical combinations of alternatives for implementation of the various components of the KEMP (in-house arrangements, effluent collection and conveyance, effluent treatment and solid waste collection, treatment and disposal). These alternatives must be fully worked out in the EIS and compared to each other.
- The EIS must describe the relation between the responsibilities taken up by the Pakistan Tanners Association (PTA) and the responsibilities of government agencies for monitoring and pollution control. The EIS must present the legal instruments that enable the PTA to warrant cost-recovery of central facilities.
- UASB technology in treatment of tannery waste water can only be considered as a proven technology in case of sufficient dilution with domestic waste water. In the EIS it should be described to which extent dilution will be done. Moreover, the EIS must describe whether alterations in the proven approach are intended (for instance based on the results of the pilot treatment plant).

With regard to the economic aspects of the EIS of the Korangi Environmental Management plan, the main points of advice are the following:

- As part of the Korangi project is to be considered for MILIEV financing, the consultants should follow as much as possible the criteria as stipulated by the MILIEV[1]] programme.
- The project should be financially sustainable. This means that it should be clearly shown that beneficiaries *are able* and willing to pay for the operation and maintenance (O&M) costs of the Central Effluent Treatment Plant (CETP).
- If local public funds are used to (partially) pay for the O&M costs of the CETP, this must be clearly shown in the (recurrent) government budget. In addition, there must be a formal statement from the government that there will be a *long term financial* commitment to support these costs.

1 *Programma Milieu en Economische Verzelfstandiging,* the Netherlands Industry and Environment Programme. This programme is established to co-finance initiatives that have a direct beneficial effect on the environment. Only Dutch commercial enterprises may apply for contributions of the MILIEV programme.

- Risks must be identified and classified as low, medium and high, with regard to non-recovery of O&M costs and investment costs. Qualification and quantification of these risks is to be based on results of sensitivity analyses.

1. INTRODUCTION

In the framework of the implementation of the ongoing Korangi Environmental Management Plan (KEMP) the Pakistan Tanners Association (PTA) has foreseen the realisation of a Central Effluent Treatment Plant (CETP) in order to provide central treatment facilities to effluent of the tannery clusters in the sectors 7A and 15 in the Korangi Industrial Area in Karachi, Pakistan.
A location for establishment of the CETP has been selected and office buildings have been realized.
A study has been made addressing the techno-economic aspects of combined effluent treatment plants for tannery clusters in Karachi.
The KEMP, besides establishment of the CETP, also includes realisation of a solid waste management system, upgrading of sewer systems, promotion of chrome recovery and chrome reuse, promotion of in-tannery improvements and formulation and implementation of an occupational health and safety programme for tanneries. Implementation schedules and organization charts have been elaborated for these components of the KEMP.
Objective of the KEMP is to control environmental pollution caused by tanneries and in this way comply with National Environmental Quality Standards (NEQS) and future international requirements for leather production.

In order to cover part of the investment costs of the CETP, the PTA applied for MILIEV[2]] funding. The decision on funding will be made by the Directorate General for International Cooperation (DGIS) of the Netherlands Ministry for Development Cooperation.

According to OECD[3]] standards, decisions on projects in the fields of water and sewerage and tanneries are subject to Environmental Impact Assessment (EIA). The World Bank suggests EIA for waste water collection, treatment, reuse and disposal and for solid waste collection and disposal systems.

In his letter of 16 January 1996 (see appendix 1) the Minister for Development Cooperation requested the Commission for EIA[4]] to advise on Terms of Reference for an EIS for the Environmental Management Programme for the Korangi Tanners (KEMP), including a CETP.
The Commission is aware of the fact that the KEMP is an ongoing programme.
The EIS for the KEMP is meant to assess the environmental, technical and economic risks of the approach chosen and will be written to support decision-making on co-funding of the initiative. According to the request the EIA should explicitly include economic aspects like feasibility and cost-effectiveness.

This advice is a third advice of the Commission for EIA relating to the tannery industry in Pakistan and is formulated in line with the strategy of the previous advices. A working group of the Commission (see appendix 2), composed of four experts (one of them of Pakistan nationality), visited Pakistan from 14 to 26 March 1996. The working group was assisted by the PTA and the Director General of the LIDO[5]] as resource person.

The Commission made extensive use of the various studies prepared by the PTA, which enabled rapid and thorough accomplishment of its tasks. The Commission expresses its gratitude for the

2 *Programma Milieu en Economische Verzelfstandiging,* the Netherlands Industry and Environment Programme. This programme is established to co-finance initiatives that have a direct beneficial effect on the environment. Only Dutch commercial enterprises may apply for contributions of the MILIEV programme.

3 Organisation for Economic Cooperation and Development.

4 Further referenced as 'the Commission'.

5 Leather Industries Development Organisation.

excellent reception and the support experienced from the PTA and the Royal Netherlands Embassy in Islamabad.

2. JUSTIFICATION OF THE APPROACH

EIA usually does not include financial and economic analysis. On the contrary, the specific objective of describing environmental aspects in a separate document (the EIS) is to emphasize the importance of environmental impacts in the decision-making process on economic activities.

The EIA for the KEMP compares alternative options for each of its components, including options for in-house improvement of process technologies and working routines. According to the Commission, it is not useful to describe alternative options if these options are not entirely realistic from the financial point of view. Any option must be checked for its acceptability for the stakeholders. It must be conceded that this acceptability mainly depends on its financial consequences.

Moreover, it must be acknowledged that financial and economic parameters often play a decisive role in decision-making. For instance, without adequate information on the financial and economic consequences of the CETP, no decision will be made about its funding.

Therefore, in this EIA procedure, information is provided not only on environmental and socioeconomic impacts and institutional and organisational consequences of the alternatives. Also information on financial consequences for the individual tannery and on the overall financial viability of the various project components is provided.

This approach has the advantage that all possible alternatives are compared on all relevant parameters at one time and no option is 'a priori' excluded from this comparison on the basis of analysis using a limited number of criteria.
Moreover, it has the advantage that all information required for decision-making will be available at the same time and decision-making can readily take place.

In order to sustain the objective and format of EIA, the financial and economic analysis of the options will not be included in the EIS but will be presented in a separate document. Paragraphs 5.5, 6.3 and 7.3 of this advice propose Terms of Reference for this financial and economic study.

The results of the financial analysis, however, will co-determine the formulation of viable alternatives and be included in the table of comparison of the alternatives in the EIS.

3. PROBLEM, PROBLEM ANALYSIS AND OBJECTIVES

3.1 The situation observed by the Commission

In Korangi 160 tanneries are clustered in zone 7A. Only a few other industries (mainly textile industries) are established in this zone. Some five tanneries are scattered over zone 15 of Korangi industrial estate.
The environmental situation in Korangi, and especially in the tannery zone, needs improvement. Effluents of the tanneries are conveyed by open channels into a central open drain – which is here and there partly choked – to join, downstream, part of the effluents and oil spills of the neighbouring

oil refinery in order to flow freely between newly reclaimed areas and finally discharge untreated in the Gizri Creek. Solid waste is covering greater parts of the road system and free areas surrounding the tannery section. Solid trivalent chromium containing waste heaps are burnt on the dumping areas, creating a risk of carcinogenic hexavelant chromium release into the air. A purulent and penetrating stench is omnipresent. Clouds of flies, birds and dust are found in the area. A partly illegal residential area is developing under the wind of the dumping site, close to the CETP site. Two extensive residential zones (Bilal Colony and Bulzan Colony) are located next to zone A7. These colonies may provide sewerage for dilution of tannery effluent, although they are located at considerable distance of the CETP site.

According to individual tanners the first aquifer is so heavily polluted that the water cannot be used for industrial purposes. The tanneries extract their water, which contains chloride, from down to 50 metres of depth. A small part of the required water is provided by the Karachi Water and Sewerage Board. Modern and old-fashioned dying and finishing methods and equipments are used. Toxic vapours from the tanning and finishing processes are emitted inside or directly outside the tanneries. Working conditions in the tanneries are far from optimal in most of the tanneries. There is not enough light, too little protection against contact with hazardous substances. Safety precautions and devices are mostly absent, worn out or not used. Little protection is provided against high noise levels. Temperatures in the factories may rise well above 45 degrees Celsius.

The Karachi Water and Sewerage board apparently does not provide any services with the exception of part of the water needed. The Karachi Municipal Council and the Korangi Development Authority do not have plans to improve delivery of services.

From 1 July 1996 the NEQS will be in force. The Sindh Environmental Protection Agency (EPA) under the Forestry and Environment department of the Government of Sindh is responsible for monitoring and enforcement of the NEQS. This body, however, is still developing and does neither have the necessary staff nor the technical and financial means to monitor and enforce NEQS in the approximately 25000 industries in Karachi. The Additional Chief secretary of the Government of Sindh therefore welcomed the initiative of the PTA to act as lead agency in reducing environmental pollution of tanneries and saw only a supporting role for Government Agencies. This is in accordance with the official line as expressed by the secretary of environment of the government of Pakistan.

A start has been made with the implementation of the KEMP. Solid waste from the tanneries and sludge from the open sewer system, piled up in the streets since a long time, is systematically removed and dumped at the Municipal Dumping Site in the context of a provisional solid waste management plan. This dumping site has no facilities to prevent soil pollution. The site selected for establishment of a CETP has partially been fenced and cleaned from solid waste. Five bigger sized tanneries have installed financially profitable chrome recovery units. On the institutional level a private company has been founded by the PTA to manage the KEMP. Staff has been contracted and an office building constructed and equipped. The great majority of the 165 tanneries in the Korangi Industrial Estate zones 7A and 15 is member of the PTA. They proved to be susceptible for all suggestions securing and improving their position, particularly on international markets (e.g. standardisation of their products according to ISO[6]).
Due to competitive environment, tanners are reluctant to reveal their tanning processes and provide information on production output and target markets.

3.2 Problem statement and problem analysis

The project document for the KEMP was published in September 1993. As part of the implementation of the KEMP a 'Techno-economic study of CETP for tannery clusters in Karachi' has been published in January 1996. These reports contain a lot of quantitative information on the problem. On the basis of this and additional information a quantification must be given of the environmental problem, specified for type of waste stream generated/emission caused.

From the PTA studies it is clear that the importance of the environmental problem is directly related to the technology used in the tanneries and to the discipline required for application of these technologies. This means that the control of environmental pollution must start in the tanneries by adopting improved technologies and better working routines. According to the PTA and the Commission cleaner technologies and better working routines are presently available.

3.2.1 **The in-house problem**

The in-house problem may thus be redefined as possible reluctance to adopt cleaner technologies and reluctance to adopt improved working routines. In the EIS this problem must be analysed as follows:

The scope of the problem

6 International Organisation for Standardisation.

In the PTA studies substantial quantitative information on the problem is given. On the basis of this information and information to be collected in the framework of this EIS a quantification must be given of the significance of the environmental problem, specified for the types of waste stream generated and associated emission, specified for each of the two zones where tanneries are located.

Possibilities to reduce the problem

The EIS must assess the feasibility of introduction of cleaner technology and analyse (assess the reasons for) possible reluctance against adoption thereof.

For the following reasons an individual approach is necessary:

- The EIS must describe the processes, the technologies used and the working routines practised, giving a description of their environmental performance. As stated above, the technology and chemical processes are specific for a given tannery.
- Resistance against adoption of cleaner technology is also an individual feature of the tannery. Probably only cost-effective alternatives for environmentally poorly performing processes, technologies and routines will be acceptable for the tanner. These cost-effective solutions must be tailor-designed for each individual tannery[7]] and fit in its planning. Realistic reduction figures for environmental pollution can only be obtained from an individual approach.

Therefore, the problem must be formulated and the problem analysis must be made for every individual tannery. Only then impacts of alternatives can be reliably assessed.

As the information needed for qualification and quantification of the environmental problem requires knowledge of individual in-tannery processes, as tanners are reluctant to reveal these processes due to competitive environment and as the success of pollution abatement in the tannery sector depends on the cooperation of the individual tanner, confidentiality and discretion in handling sensitive in-tannery information is a prerequisite. Tanners have proven to be sensitive to measures improving their market position. Therefore, the analysis of actual and future emissions of the individual tannery may best be linked to a company development plan that works towards ISO standardisation. Coupling the in-house improvements as much as possible to ISO[8]] 9001/2 and ISO 14001 requirements would give the tanning industry in Pakistan a comparative advantage on international markets.
An industrial counselling team may be needed to assist in designing such plans. This team is then the best placed to collect the environmental information required for EIS writing.

The Commission recommends that for this individual problem analysis the following information is to be provided:

Base a a

- origin of raw material (cow, buffalo, sheep, goat, et cetera);
- type(s) of tanning processes (vegetable, chrome, et cetera);
- type of raw material (raw, semi-finished);
- type of end product (wet blue or finish);
- installed capacity[9]] in (square metres of) hides or skins processed per day;
- unit processes applied;
- number of individuals exposed to health threatening factors;

an on he basis o ins alle apa i

- chemicals (qualitative/quantitative) in unit processes used;
- water consumed (in litres/day, or litres/(hide or skin)/day);

7 Related to type of raw material used and market segment served.

8 ISO 9001/2 refers to product quality, ISO 14000 refers to environmental quality of production processes.

9 Installed capacity gives an indication of the maximum production capacity possible. Therefore, this is the capacity that will result in the maximum load to the effluent treatment plant.

- waste water produced (in litres/day, or litres/[hide or skin] /day and seasonal variations) (composition)[10]];
- mass of solid waste produced, differentiated according to origin of solid waste[11]].

O erall pro ess hanges en isage in ne i e ears in erms o
- origin of raw material (cow, buffalo, sheep, goat et cetera);
- type(s) of tanning processes (vegetable, chrome et cetera);
- type of raw material (raw skins, semi-finished, finish);
- type of end product (wet blue or finish);
- installed capacity in (square metres of) hides or skins processed per day;
- unit processes applied (including possibilities for high-exhaust tanning);
- number of individuals exposed to health threatening factors;

an on he basis o ne ins alle apa i
- chemicals (qualitative/quantitative) in unit processes used;
- water consumed (in litres/day, or litres/(hide or skin)/day);
- waste water produced (in litres/day, or litres/[hide or skin] /day and seasonal variations) (composition)[10]];
- mass of solid waste produced, differentiated to origin of solid waste[11]].

De aile pro ess hanges en isage
- application of cleaner unit processes and consequences of each in terms of impact on:
  - water consumption;
  - chemical consumption;
  - effluent quality (COD, inorganic compounds, metals);
  - solid waste produced;
- possibilities for segregation of liquid waste streams (salt stream, chromium stream, et cetera) and solid waste flows;
- availability of physical space for application of cleaner unit processes.

Mis ellaneous
- financial feasibility of envisaged process changes;
- reasons for reluctance to implement in-house improvements.

3.2.2 Cumula e emissions en -o -pipe problem an i s resul s

For the problem statement in the EIS only the information on actual emissions[12]] is of interest. This information may be best presented in tabular form. The cumulated figures for all tanneries may be presented in a similar table.
In addition to the quantified and qualified emissions of the tanneries, the EIS must give a description of the functioning of end-of-pipe facilities for conveyance and treatment of these emissions. The organisational structure for operation and maintenance must be concisely described. Moreover, the EIS must concisely describe in this chapter the environmental situation that has emerged from the emissions (a more detailed description will be asked in the chapter addressing the existing situation of the environment). The EIS must also describe the occupational health and safety situation in the tanneries in terms of numbers of individuals exposed to health threatening factors.

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10 The average waste water discharge and composition may best be estimated via conversion factors, for example based on data in the Kanpur project and/or from literature, and on the processing capacity for each type of process.

11 A similar approach as used for estimation of waste water production can be used to estimate solid waste components.

12 In kgs pollutants, nuisance and noise levels.

3.3 Objectives

The overall objective of KEMP is to reduce environmental pollution caused by tanneries. In the EIS this objective must be made more specific, for instance by setting targets for:

- In-house reduction measures focusing on both solid waste streams, liquid waste streams and other emissions per individual tannery. This can for instance be done by assessing maximum reductions that may be achieved by application of available best technology, applicable in the specific case of the tannery and subsequent fixing of a target reduction percentage to be achieved by every individual tannery.
- End-of-pipe reduction measures.

Effluent of the CETP will have to comply with NEQS. Cost-effective realisation of this standard may be observed as an additional objective of the KEMP.

4. SETTIN OF THE EMP

4.1 Legal setting

The EIS must enumerate the laws and regulations which are applicable for the activities undertaken under the KEMP and a concise description must be given of their implication for the KEMP. The EIS must also list the policy decisions that have been made in the past and will be made in the near future that may be of influence to the implementation of the KEMP.

The EIS must describe voluntary targets and non-voluntary requirements with regard to environmental performance of production processes for tanneries as required by consumer countries (e.g. Eco-label). The EIS must also indicate to what extent the KEMP may assist tanneries to comply with ISO requirements, for example ISO 14001, referring to environmental management systems.

The EIS must describe how the KEMP and its programmes and activities relate to and fit in development plans of the city of Karachi in general and Korangi industrial estate in particular.

Relevant legal requirements, policy decisions and existing plans form the conditional framework for any environmental management programme for Korangi. The KEMP in its actual form and in alternative forms that will be described in this EIS must be checked for compliance herewith. Clear criteria for comparison must be derived from the framework. Chapter 8 gives some criteria. Other criteria may surface in the process of EIA-preparation.

4.2 Institutional setting

The EIS must describe the existing institutional structure that is presently responsible for management of the Korangi industrial estate and for public services to the estate. Responsibilities, tasks and available means must be specified for each contributing institution.

Special attention should be given to institutions for law enforcement and regulatory control. A description must be given of the mandate given to these institutions by the government.

4.3 General overview of donor assistance to the environmental sector

With special reference to the tanning sector in Pakistan, the EIS must present an overview of assistance programmes in the field of industrial pollution control and cleaner production which have been or are being developed with international donor assistance (for example ETPI). Also, those programmes that have not yet materialized must be mentioned (for example the World Banks project to assist Sialkot Industrial Estate).

4.4 Public involvement

Many interest groups are affected by the environmental consequences of the functioning of tanneries. Labourers in the tanneries, residents in and around the tanneries, residents living downstream the sewers carrying effluents, farmers, fodder collectors and grazers who have their land inundated with effluent or who have to irrigate with polluted water, fishermen, environmentalists representing affected ecosystems et cetera.
The EIS must demonstrate to what extent the interested parties were given the opportunity to participate in the preparation of the EIS.
Participation may be realized by organisation of public hearings and summarizing in the EIS the results of these hearings. Special attention must be paid to vulnerable groups in the society (eg. women, children labourers, who may not have direct possibilities to express their views and defend their interests).
As occupational health and safety (both preventive and curative aspects) are important issues, labour organisations must be invited to express their views.

5. THE PROPOSED ACTIVITY THE EMP AND ALTERNATIVES

5.1 General

5.1.1 **In ro u ion**

The EIS is meant to provide the information for a decision on the system choice and the choice of the capacity of the CETP. Alternatives, therefore, will concern proven effluent treatment systems for tanneries. Alternatives will also concern alternative levels of pollution-reduction for in-house technology and end-of-pipe technology. In addition to the points mentioned above, the EIS will concern effluent collection and conveyance systems.
Having observed this, the EIS must also provide information on solid waste collection and treatment systems and other components of the KEMP. Alternatives that will be described must be realistic. This means that there is a fair chance that alternatives are feasible and that they will materialize. Phasing of project activities in an alternative contributes to a rational and effective solution of the problem. The EIS must give an indication of the time schedule for implementation of the activities in each alternative.

In describing the activity in its various components, distinction must be made in a design phase, a construction phase and a phase of exploitation. Moreover, the description must include an enumeration of protective and mitigating measures and identify indicators for monitoring and evaluation. These indicators must form the basis for the monitoring and evaluation plan (see chapter 9).

The EIS must enumerate and justify possible assumptions on which the KEMP is based. Moreover, the EIS must describe the assessment methods used to collect the information on which the KEMP is based and comment on their reliability.

Materials and construction standards for the construction works must be specified.

5.1.2 Si e sele ion

Site selection for the CETP has already taken place. In the EIS the choice of the location must be motivated. The EIS must indicate if and, if so, which environmental considerations have been taken into account in selecting the site. The legal status of the site must be highlighted in relation to possible claims in a later stage by other owners and in relation to the residential function attributed to the zone in which the site is located.

5.2 Development of alternatives

The KEMP is a programme with many components. For each of these components alternatives can be described. Combination of all alternatives of all components is not logical and would result an irrealistic number of alternatives.
The components 'in-house arrangements', 'solid waste collection, reuse and disposal', 'effluent collection and conveyance' and 'effluent treatment are interrelated. The development of alternatives can therefore follow a logical pathway. As the alternatives for in-house arrangements largely determine the form into which the other components will be shaped, the Commission proposes to adopt the following sequence in determining the alternatives:

- Define alternatives for the component 'in-house arrangements'.
  The following alternatives are to be described:
  - no action in house (zero emission reduction);
  - voluntary adoption of in-house arrangements following the proposed KEMP in-house arrangements introduction programme (voluntary basis for adoption of in-house measures and UASB as CETP);
  - adoption of in-house arrangements following individual industrial counselling finally aiming at ISO 9001/2 and ISO 14001 certification;
  - adoption of best available technology.

  For the three alternatives last mentioned, a ranking of priorities for in-house measures must be observed. An advice for this ranking has been given by the Commission in its advice on environmental, social and institutional aspects of the proposed tannery industrial areas, Punjab Tanneries (see appendix 4 for a summary on priority ranking).
- Define alternatives for the component 'Effluent treatment'.
  The following alternatives must be worked out:
  - no action;
  - UASB;
  - anaerobic lagoon followed by an aerated lagoon;
  - anaerobic filter followed by an aerated lagoon and sludge drying beds.

- Define alternatives for the component 'effluent collection and conveyance':
  - no action;
  - as needed for optimal functioning of UASB;
  - as needed for optimal functioning of anaerobic lagoon followed by aerated lagoon;
  - as needed for anaerobic filter followed by aerated lagoon and sludge drying beds.

Develop alternatives composing logical combinations of in-house arrangement alternatives and 'effluent treatment', including 'effluent collection and conveyance'. Motivate the combinations made and motivate non-observation of seemingly logical combinations.

- **!** Define alternatives for the component 'solid waste collection, reuse and disposal'.
  The following alternatives must be worked out:
  - no action;
  - as foreseen in the KEMP;
  - partial reuse and controlled disposal of residue;
  - maximum reuse and controlled disposal of residue.

Combine these alternatives to the alternatives defined in the previous step to logical combinations. The component 'occupational health and safety programme' has no alternative and must be described in its proposed form.

5.3 Technical aspects

After development and motivation of the alternatives these alternatives must be described in their technical details.

5.3.1 **In-house re u ion measures**

This section must start with an overview of the various in-house reduction measures[13]] (for an advice on priority ranking of technologies see appendix 4).

On the basis of the per tannery analysis and description mentioned under paragraph 3.2.1, the EIS must describe (in tabular form), per tannery and per alternative:

- **!** in-house modifications[14]] that will be probable (or needed) to reach the situation as described by the alternative;
- **!** in-house modifications needed for optimal functioning of the CETP and solid waste collection, including reuse (if any);
- **!** the rates of liquid, gaseous and solid waste emissions;
- **!** the extent to which O&M training is needed;
- **!** the O&M needs.

For every alternative the EIS must state how the targeted final situation can be achieved (sticks and carrots, means), describe what has been realized so far in this field and describe bottlenecks and problems encountered.

The EIS must quantify and qualify in tabular form the cumulated effluent and solid waste streams generated on the basis of full utilization of installed capacity for each of the alternatives. If segregated effluent streams are produced the qualification and quantification must address every individual stream.

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13 The word measure implies both the in-house technology needed and the required working routines/procedures for this technology.

14 In-house reduction modifications may be considered per group of tanneries.

5.3.2 **Cen ral e luen rea men**

Capacity choice
With the previously mentioned inventory of the derived waste water quality characteristics and flow data the influent to the proposed treatment plant is defined and herewith, in principle, its capacity. In time, however, process modifications may lead to reduced flows entering the CETP while the production capacity in tanneries may increase resulting in the opposite. Therefore, the EIS must present a clear justification of the design capacity of the CETP and subsequent unit processes.

System choice
Preferred system
The 'Techno-economic study of combined effluent treatment plants for tannery clusters in Karachi' (PTA, January 1996) selects an UASB reactor in combination with a modified activated sludge process for the treatment of the tannery waste water.

The UASB technology and its operation must be described and its choice justified[15]] for the various in-house reduction levels. In addition, the following points need to be addressed:

- compliance of the CETP with NEQS;
- the advantages/disadvantages of this technology;
- operational intricacies including the process of starting up the reactor, risks of process failure due to compounds toxic to the anaerobic biology;
- the possible need for the addition of missing nutrients, their availability and the practical aspects thereof;
- remedial action plans for operational calamities;
- the tasks and responsibilities of the various levels of plant personnel and how each will be prepared to perform the required operation and maintenance duties;
- the anticipated process monitoring programme including parameters measured and measuring frequency.

Moreover, it must be described how the in-house reduction level, needed for adequate operation of the UASB, can be achieved i.e., can be enforced.
The meaning of the term 'modified' in 'modified activated sludge' must be explained.

The 'Techno-economic study of combined effluent treatment plants for tannery clusters in Karachi' (PTA, January 1996) also selects a filter press for the treatment of the excess sludge. In the EIS this technology must be described and its choice must be justified, specifically against the background of system qualifiers as 'very complex', 'highly skilled person required' and 'high maintenance requirements', as used in the referenced Techno-economic study.

The EIS must indicate the methods of removal of the sludge, its quantity, its quality, method of transportation and its final destination for each of the various levels of in-house modifications. Moreover, the environmental impact of the sludge at its final destination and site preparation requirements must be mentioned.

Alternatives
Next to the above proposed system, the use of the effluent and sludge treatment systems mentioned under paragraph 5.2 must be described for those in-house reduction level alternatives for which application may be relevant. Advantages and disadvantages of these systems in terms of O&M and environmental impact must be addressed.

15 UASB is considered to be proven technology for unsegregated tannery effluent on a basis of a dilution of one part of tannery effluent and 3 parts of city sewage.

5.3.3 Tanner e luen olle ion an on e an e s s ems

Upgrading of the effluent collection and conveyance system is foreseen in the KEMP. The present system of effluent collection must be described including its shortcomings and the underlying causes.

For alternatives in which upgrading is foreseen, the process of upgrading must be described. Specifically it must be described how the improvements will temporarily affect the functioning of the system and/or the conditions along the system.

The set up of the future collection system, including the conveyance system that must be constructed between zone 15 and the CETP-site, must be described. The description must include specifications for capacity, construction materials, profiles, linings, and the way leakage into the underground is prevented. If relevant, it must be described how the various effluent streams (sulphur containing effluent, other effluent) will be collected and conveyed separately.

In addition to effluent conveyance, the systems for evacuation of rain water and surface runoff, its anticipated quality and possible need for treatment must be addressed.

For those alternatives where a UASB reactor is foreseen, the EIS must describe how sewage of the Bulzan and/or Bilal colony will be conveyed to the CETP and who will be responsible for construction, funding and O&M of this conveyance structure.

Moreover, it should be indicated what measures are to be taken at the tannery level to keep the upgraded collection facilities in working order, what possible maintenance needs may arise, both translated in terms of manpower and equipment requirements and possible needs for training.

5.3.4 Tanner soli as e olle ion, rea men an isposal

This section must discuss how the methods underlying the 'best-available-technology' are evaluated for use by tanners in the Korangi area.
Moreover, the EIS must indicate how the solid waste streams, qualified and quantified for every in-house alternative under paragraph 5.3.1, will be collected, reused, treated and/or disposed. As specified under paragraph 5.2, four alternatives must be described.

5.4 Institutional aspects

A thorough description must be given of management aspects of the facilities and the components of the KEMP.

The EIS must describe the institutional and organisational infrastructure required to implement each alternative of the KEMP. It must describe the tasks and responsibilities that will be attributed to each institution and organisation that will contribute to execution of the activities. Moreover, the educational and training requirements should be specified, including their costs and financing sources.

It is understood that on the short term the PTA will take up the entire responsibility for management of the KEMP (and thus for cost-recovery) through the private enterprise Environmental Management Limited (EML). The EIS must describe the relation between the responsibilities taken up by the PTA and the responsibilities of government agencies for monitoring and pollution control (law enforcement). The EIS must present the legal instruments that enable the PTA to warrant cost-recovery of central facilities.

The EIS must present an assessment of risks of failure of the organisational structure as proposed for the various alternatives.

A quantification must be given of approximate O&M costs of each alternative of the KEMP and a description must be given as to how these costs will be recovered, on what basis and who will be the responsible party. Alternative recovery systems may be described.

5.5 Economic Aspects and the MILIEV Programme

(Terms of Reference for the financial and economic study)
Requests for financial assistance from the Netherlands MILIEV programme are appraised – next to environmental effects, development relevancy, technical and institutional viability – on their commercial, financial and economic viability. This means that the EIS must provide sufficient relevant data – following the criteria as used by the MILIEV programme – in order for appraisers to properly advise the Netherlands Government whether or not the project qualifies for MILIEV funding, and under what conditions.

Although guidelines for the financial and economic analysis are integrated in this advice (appendix 5), it is proposed that the analyses themselves are presented in detail in a separate study. A summary of the results of the financial and economic analysis must be presented in the EIS with reference to the economic study. Summary results should at least show:

- the Commercial Internal Rate of Return (cIRR);
- the Financial Internal Rate of Return (fIRR);
- the Economic Internal Rate of Return (eIRR);
- the results of Sensitivity Analysis for the three different IRRs.

The PTA has applied for MILIEV funding to cover a part of the investment costs of the CETP. The MILIEV guidelines apply therefore for the CETP only. However, the in-house activities as proposed in the KEMP, will largely determine the capacity and system choice (and therefore the investment and O&M costs) of the CETP. In addition, the financial sustainability of the CETP will largely depend on payments received from users who are using the CETP to dispose of their effluent.

Considering the heterogeneous characteristics of the tanneries in the target area (different business scales, production methods, products, location, et cetera), an overall cost-benefit analysis has to be carried out to determine the ability of the different categories of tanneries to pay for the services provided by the CETP. Financial feasibility will be the main criterion of this cost-benefit analysis. As there are a large number of tanneries in the target area, representative samples of different categories of tanneries will suffice to carry out the overall analysis. According to category and alternatives, results of the analysis must show clearly:

- the effect of the proposed in-house measures on the financial performance of the business;
- the ability to pay for the services of the CETP;
- the effect on employment and consequently overall poverty within the target area.

Based on the results of the cost-benefit analysis, an assessment must be made which shows:

- the expected number of users of the CETP and the number according to category (small, medium, large);
- the maximum user's rates which can be charged for using the services of the CETP, including a possible rate differentiation according to volume and degree of contamination of user's effluent;
- the total expected revenue of the CETP during the entire economic lifetime of the plant;
- an identification of risks classified as high, medium and low.

5.6 Alternative most friendly to the environment

In the EIS the alternative most friendly to the environment (amfe) must be described. This alternative may be a combination of the environmentally most desirable alternatives of the distinct components of the KEMP, completed with additional mitigating measures. The amfe, therefore, will be a combination of maximized in-house measures followed by a treatment system maximally removing waste water components, minimally consuming energy, and requiring minimal infrastructural facilities.
The amfe must be fully worked out so that comparison with the other alternatives is possible.

5.7 No action alternative

The no action alternative is not implementing any activity. This alternative (a combination of the alternative first mentioned for every component of the KEMP under paragraph 5.2) is not realistic but must be described as a benchmark to compare systematically the impacts of the various alternatives.
Moreover, the no-action alternative will give a clear picture of what will happen to the environment if the KEMP (or a possible alternative programme) is not implemented.

. THE CURRENT SITUATION OF THE ENVIRONMENT AND ITS AUTONOMOUS DEVELOPMENT

6.1 General

The EIS must contain a description of the current situation of the environment and its development if no action will be undertaken (the autonomous development). As has been pointed out in paragraph 5.7 this description serves as basis for comparison of the environmental effects of the various alternatives. **The description must be limited to those aspects that may be influenced by, or may influence the proposed activities and alternatives and must cover the entire area.** This area may differ per aspect. The study areas must be indicated on maps. If on certain aspects adequate information is available in existing documents a synthesis of the information must be presented in the EIS and the document must be referenced.

6.2 Natural environment

A general description of the natural environment must be given to help understand the natural setting of the project especially identifying those features which may have direct or indirect interaction with the project.

- climate:
  - compass rose in relation to location of residential areas;
  - temperatures, humidity and rate of evaporation;
  - rainfall, especially also the increased precipitation observed in the last ten years, including absolute daily maxima;
- hydrology and hydraulic regime in the Gizri Creek in relation to flushing of the tanneries effluent;
- hydrogeology, the hydraulic conductivity of the soil in Korangi Industrial Area;
- immissions (background values):
  - air quality (dust, pathogens, odour, chemical pollutants);
  - degree and extent of pollution of aquifers and soil;
  - existing noise level;
- the degree and extent of pollution of the Gizri Creek must be described[16]: quantity and quality of the sludge in the tidal creek (heavy metals and micro-organic compounds);
- fish resources and the pathways through which fish might be contaminated with pollutants;
- agricultural production as affected by the tannery zone in Korangi;
- location of residential areas, ecosystems (rare) and protected areas in relation to pollution threats by the tannery zone in Korangi.

6.3 Socioeconomic and economic environment

In this paragraph information must be provided with regard to the socioeconomic conditions prevailing in the tannery sector in Korangi. The following aspects must be quantitatively and qualitatively addressed in the economic study:

16 Information on pollution of the Karachi coastal area is available from Wallingford Hydraulic Research LTD, Wallingford, Oxfordshire OX10 8BA. U.K.

- macro-economic importance of leather sector:
  - future economic development of the tannery sector;
  - critical development bottlenecks (lack of raw material, import restrictions, foreign competition et cetera);
- employment;
- social and economic situation of workers and their families;
- level of education and skill of workers and extent of awareness of labour regulations;
- perception of workers with regard to current working conditions and possibilities to change conditions;
- degree of organisation of the tannery workers and bottlenecks for organisation;
- economic situation of affected groups (farmers, fishermen, neighbouring communities) and possible causal relations between tannery pollution and this situation;
- social and economic situation of vulnerable groups (women, children)
- perception within these groups of their position and possibilities to change this position;
- viability of small tannery enterprises in the long term (deterioration of small business environment).

6.4 Health and safety aspects

The following aspects must be qualitatively and, if data are available, quantitatively addressed:

- health situation of communities affected as compared to communities not affected (the health situation of vulnerable groups, children and women, should be addressed separately);
- existing preventive and curative in-tannery measures for occupational health and safety;
- the resulting occupational health situation (the health situation of vulnerable groups, children and women, should be addressed separately);

6.5 Institutional environment

The EIS must assess the functioning of the existing institutional infrastructure providing management services, law enforcement services and public services like water, electricity, sewerage removal and treatment and solid waste collection and disposal for the industrial estate of Korangi. An assessment must be presented of their actual performance and their capacity to assume the responsibilities and perform the tasks attributed to them.
Special emphasize must be laid on an assessment with regard to the capability to enforce relevant laws and regulations and the manner in which this is done and may be done under the KEMP.

6.6 Environmental performance of tanneries

In this paragraph an overview must be given of the existing situation of the environmental performance of tanneries. The information is available from the analysis in the individual tanneries (see paragraph 3.2.1).

- water consumption, estimation on the basis of running hours and capacity of conduits;
- material reused;
- adoption of in-house arrangements, processing and general internal environmental measures;
- emissions (remaining, quantified);
- waste streams (remaining, quantified);
- emergency plans;
- possible incentives for improvement of environmental performance.

. IMPACTS

7.1 General

Both positive and negative impacts must be described. The impacts must be assessed and described for every specified alternative and for the construction stage and during regular operation. The research methods applied to assess the impacts must be discussed and their trustworthiness quantified.

7.2 Environmental impacts

The following impacts must be assessed. Impacts on:

- marine pollution;
- changes in the Gizri Creek due to reduction in organic matter input from tannery effluents;
- the feasibility of cleaning the Gizri Creek by:
  - flushing of tannery sludge accumulated in the creek bottom. The impact of flushing on the ecosystem must be described;
  - dredging the tanneries' sludge by suction from the creek bottom, disposal of contaminated sludge. The impact of suction dredging and sludge disposal on marine pollution must be described;
- expected recovery time of the tidal environment in the Gizri Creek with and without interventions in the creek;
- ambient air quality (e.g. the impacts of airborne particles released from the aeration system of the UASB);
- soil and ground water (aquifer) quality;
- drainage and road conditions;
- agricultural production.

7.3 Socioeconomic and economic impacts

In the economic study the following impacts must be assessed. Impacts on:

- overall employment and poverty within the area of influence of the tanneries;
- overall working conditions within the tannery sector;
- medium and long term economic development of the tannery sector;
- medium and long term effect on the country's economy as a whole (tax revenues, foreign exchange earnings and savings, et cetera);
- income distribution;
- position of vulnerable groups, especially women and children;
- level of education, skill and awareness of labourers and effects thereof;
- economic position of affected groups (farmers, fishermen, et cetera).

Description of the impacts per alternative is only needed for those points where a difference between the alternatives is found.

7.4 Health and safety aspects

The following impacts must be assessed:

- ! the health impacts on previously affected communities (if relevant the health situation of vulnerable groups, children and women, should be addressed separately);
- ! preventive and curative in-tannery measures for occupational health and safety;
- ! the resulting occupational health situation as compared with national and international standards (if relevant the health situation of vulnerable groups, children and women, should be addressed separately).

7.5 Impact of institutional and organisational functioning

The overall environmental impact if the PTA assumes the governmental responsibilities must be compared to the environmental impact if responsibility stays with the government.

7.6 Impacts under irregular circumstances

Impacts from inadequate operation and calamities (e.g. intoxication of the UASB reactor, extreme rainfall) must be described under this heading.

. COMPARISON OF ALTERNATIVES

In the comparison of alternatives the situation that develops if KEMP is not further implemented (autonomous development) must be compared with the alternatives described (implementation of KEMP as foreseen, alternatives for KEMP including the amfe).
The comparison must be done in a matrix format on a set of criteria. These criteria are quantitative as much as possible. The following criteria must be included:

Development of the tannery sector:

- ! compliance with national targets;
- ! compliance with international import requirements (ISO standard, Eco-label).

Environmental performance:

- ! percentage of (re)use of (raw) materials:
  - chemicals (indicate reuse percentage per chemical);
  - raw material;
  - waste;
- ! remaining emissions (quantified):
  - to the air (stench, dust);
  - to the soil and ground water per contaminant;
  - solid waste per stream;
- ! compliance with standards and regulations:
  - solid waste disposal;
  - CETP (NEQS, international [European Union]);
- ! environmental impacts of:
  - calamities (worst case);
  - disfunction of institutional structures (worst case).

Health aspects:

- relation environmental performance and occupational health;
- resulting health environment/health hazard:
  - in house;
  - external;
- compliance with standards on labour health and safety and sanitary conditions:
  - ILO, WHO, National Factory Act, Social Security measures.

Technological aspects

- risks of malfunctioning of the installations;
- level of skilled labour required and training needs;
- the extent to which the chosen technology can be incorporated in the existing system (in view of frequent power cuts, choking of outfall lines, effluent and runoff drainage systems).

Economic aspects:

tanneries:

- investments required;
- effect on O&M costs;
- effect on revenues;
- incremental costs and benefits;
- financial viability;

central facilities

- investments required and financial plan;
- commercial viability;
- financial sustainability;
- economic analysis;
- risks of non-recovery of O&M costs and investment costs.

Institutional and organisational feasibility

- complexity and cost of the required modifications of the institutional infrastructure;
- complexity/manageability of collective technical and in-house technical infrastructure;
- complexity/manageability of the organisational infrastructure;
- complexity/manageability of in-house operational organisation;
- risk of institutional mal- and disfunction. Adequate/inadequate powers; inefficient freedom of operation on commercial lines; inadequate cooperation with other organisations involved;
- risk of non-compliance with (national) legal requirements and standards;
- risk of non-compliance with international requirements for leather production;
- risk of occurrence of cost run offs and of financial deficits on account of O&M in particular.

The weight that is given to the criteria by the general public or interest groups may be derived from public participation activities. Other sets of weights may be given by other stakeholder groups. These may be presented in the EIS and a sensitivity analysis may be applied upon these sets.

9. APS IN NO LED E, MONITORIN AND EVALUATION

In the EIS gaps in knowledge and information must be identified. The importance of this information for decision-making must be evaluated.

In the EIS an environmental monitoring plan must be presented. This plan must include monitoring of:

- emissions of tanneries and CETP;
- recovery of O&M costs;
- management and functioning of CETPs;
- cost-effectiveness of introduced technologies;
- efficiency of facilities after implementation of the chosen strategy.

The monitoring plan must indicate the agencies responsible for its implementation and the way implementation is funded, as well as time schedules and deadlines for reporting.

An evaluation plan for KEMP-implementation must be presented in the EIS. This plan must foresee evaluation on the following points:

- development of legislation;
- institutional buildup, staffing and training;
- progress in adoption of in-house technology and working routine change;
- effectiveness of removal of pollutants by the UASB.

The EIS must indicate the agencies responsible for this evaluation plan.

10. SUMMARY, FORMAT AND PRESENTATION OF THE EIS

A non-technical summary must be included in the EIS. This summary must address the major subjects of the EIS, using comprehensive maps, tables and diagrams, and be written in such diction that it provides non-technicians and decision-makers with a clear insight in the issues treated. The summary must be translated into Sindhi and Urdu.

It is suggested that the EIS is written in the same format as this advice for Terms of Reference. The use of maps, tables and diagrams is recommended as it may considerably increase readability.