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Natural Resources and Environmental Policy Project / International Resources Group
3 St. Kilda's Lane, Colombo - 3, Sri Lanka.

ADMINISTRATION OF POLLUTION LICENCING BY THE CENTRAL ENVIRONMENTAL AUTHORITY

Prepared by

Warren Riznychok and Peter Schmidt
Malcolm Pirnie Inc, New York, U.S.A.

For

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BOARD OF INVESTMENT OF SRI LANKA: Report on site visits to Katunayake and Koggala Free Trade Zones

EXECUTIVE SUMMARY

Malcolm Pirnie, Inc. has completed an initial review of the Central Environmental Authorities (CEA) Environmental Pollution Licensing Program for NAREPP/IRG. A detailed assessment of the issues affecting the licensing program is presented in the subsequent sections.

The problem presented to us and to CEA is encapsulated in our finding that the volume of complaints about industrial pollution and new industry license applications are each increasing, whereas the number of EPL's issued by CEA each month is decreasing. Other contributors to the problem concern CEA's basic standards and approaches to industrial pollution priorities. Our recommendations for solving this problem, and for easing the resource and staff constraints affecting the CEA are summarized below. Recommendations focus on the solutions that for the most part can be developed and implemented by the CEA. A summary of our recommendations are presented below.

Pollution standards and priorities

- Discharge limitations must be developed that relate to ambient water quality conditions and best available technology so industry can manage a phased compliance schedule for improving effluent water quality.

- The entire EPL program needs to focus on those industries which most seriously affect Sri Lanka's natural resources -- high polluting industries. Emphasis should also be on wastewater that pollutes the country's water supply with toxics.

- Precisely how an industry meets efficient standards should be left to that industry. EOs must resist writing license conditions which instruct industry on how to treat wastewater, design air abatement systems or recommend noise control measures. These are industry responsibilities, and industry should be instructed to contact professional help to meet effluent standards.

Staff organization and management

- CEA should place high priority on establishing clear, written priorities, roles and accountability requirements for the EPL staff.

- Organizational measurements must be implemented to develop performance indicators, provide planning tools, and communicate opportunities, issues and status.

- To allow EOs to focus on licensing of new and existing high polluting industries we recommend a separate group of EOs to respond to complaints only.

- More efficient use of limited staff and resources is essential. EOs planning field trips need to be prepared to collect samples, fill out EPL Applications with recalcitrant industries, and should always bring a site inspection checklist to be filled out.

- Every effort should be made to replace staff immediately when there is a vacancy. Staff turnover has in the past resulted in a staff deficit of 3 EOs, 1 SEO and a Deputy Director.

Information Management

- Information Management tools must be marginal to facilitate policy development, establishment of priorities, and improve efficiency. Designation of a single information and data coordinator is an important and necessary first step. Site inspection checklists or a copy should be given to the data coordinator for input into the information management system.

- To enhance efficiency, basic office support services must be improved; the number of telephones, filing cabinets, typewriters, word processors must be increased as soon as possible to meet minimum requirements for an efficient licensing program.

1. BACKGROUND

The Central Environmental Authoritiy's Environmental Protection Division (EPD) was formed in order to carry out the directives of the National Environmental Act (NEA) of 1980 as amended by Act 56 in 1988. Part IV A of the amended act directs that

> "...no person shall discharge, deposit, or emit waste into the environment which will cause pollution except:
>
> (a) under the authority of a license issued by the authority; and
>
> (b) in accordance with such standards and other criteria as may be prescribed under this Act."

Part IV A further describes the requirements for licensing, licensing fees, renewal period, and appeal processes. Subsequent to the NEA, water quality standards were promulgated, licensing procedures established, and a cadre of persons formed to manage the Environmental Protection Licensing (EPL) program within the EPD. These activities have occurred in a relatively short time frame with broad rather than specific priorities.

The Natural Resources and Environmental Policy Project (NAREPP) was invited to provide an assessment of the CEA's Environmental Pollution licensing program. The assessment was to have two main objectives:

1. Review and make recommendations for CEA's establishment of priorities, approaches and goals to support the pollution licensing program implementations.

2. Review and make recommendations for improving CEA's Licensing productivity, permit analysis, data management and use of technical and support resources.

Current EPL Status

The licensing program has been developed around a study executed by RDC, which established an industry inventory and pollution potential ranking system. The RDC study divided industry into major industrial classifications and established three levels of pollution potential - High, Medium, and Low. The RDC study identified over 4600 industries of an estimated 40,000 to 60,000 businesses as potentially requiring licensing.

Table I illustrates the current EPL program status and results, and Table II describes the licensing status of high-polluting industries.

TABLE I

EPL PROGRAM STATUS SUMMARY
(as of September 1992)

INDUSTRY CLASSIF-ICATION	TOTAL IND[1]	APPL R'VD	% OF TOTAL	EPL ISSUED IS	TB	NR	TOTAL	% OF TOTAL	NO. OF INSP	% OF TOTAL
HIGH	291	481	165%	210	38	7	255	53%[2]	398	83%[2]
MED	1900	938	49%	415	15	96	526	28%	707	37%
LOW	2415	809	33%	231	0	217	448	19%	546	23%
	4606	2213	48%	856	53	320	1229	27%	1651	36%

SOURCE : ENVIRONMENTAL PROTECTION MANAGEMENT INFORMATION SYSTEM - LICENCE DATA BASE

IS ISSUED PERMITS
TB - TIME BOUND PERMITS
NR - NOT REQUIRED

---

[1] FROM RDC REPORT

[2] TOTAL APPLICATION RECEIVED USED INSTEAD OF RDC NUMBER

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TABLE II - HIGH POLLUTING INDUSTRY LICENCE STATUS

INDUSTRY TYPE	CAT	NO. OF IND	IS	TB	NR	NI	% REMAINING
BASIC METALS	BM	13	7	1	0	5	38%
CHEMICALS IND.	CH	173	49	12	6	106	61%
	CM	1	1	0	0	0	0
FOOD	FD	35	8	7	0	20	57%
MACH. & EQUIP.	ME	2	1	1	0	0	100%
MINERAL PROD.	MP	3	1	1	0	1	33%
PULP & PAPER	PP	1	1	0	0	0	0
METAL QUARRY	QM	9	3	0	0	6	66%
TEXTILES & LEATHER	TL	84	23	14	1	46	55%
TIMBER & WOOD	TW	157	114	0	0	43	27%
URBAN SERVICES	US	4	2	0	0	2	50%
	TOTAL	482	210	36	7	229	48%

IS - ISSUED PERMIT
TB - TIME BOUND PERMIT
NR - PERMIT NOT REQUIRED
NI - NUMBER OF PERMITS RUNNING TO ISSUE

4 C - STATUS. TBL

TABLE II

As can be seen in these tables, to date only 27 percent of the identified industries have been licensed. Extrapolating the past two years progress indicates that 7.4 more years will be required to complete the task at the current rate. However, as subsequent parts of this section show, the licensing program will require 9 to 20 years to complete if the status quo remains unchanged.

EPL Performance

To begin to understand the challenges being faced by the EPL program we should review the EPD's licensing performance over the last 12 month period. Figure 1 (see following page) graphically portrays a key indicator of the performance of the EPD in issuing new licenses to both new and existing industries.

As can be noted in Figure 1, the current licensing trend is down from a high in October 1991 of 47 licenses issued to a low in September 1992 of 30 licenses issued. From the data used to construct Figure 1, the average permit issuance rate has been 32 per month or based on a 20 day month 1.5 per day.

Table III shows the EPLs issued for the last four months.

Table III

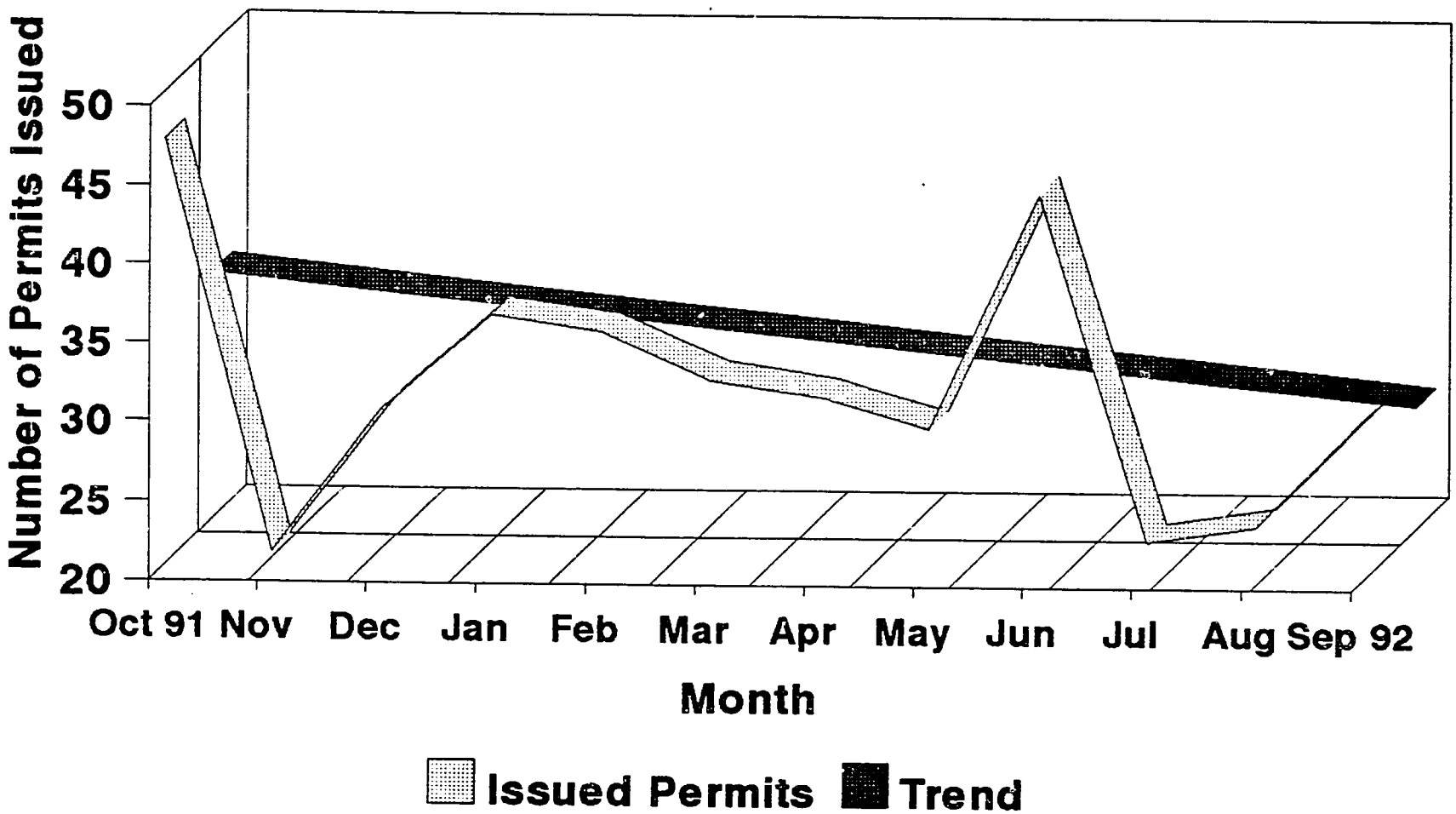
EPL Issues - Last Four Months	
MONTH	**Number Permits Issued**
June	44
July	22
August	23
Sept	30
Average	**30**

If June's permits are removed from the Table III data the permit issue rate average drops from 30 to 25 permits per month. These numbers imply that if permits continue to be issued at the 30 per month rate the 3400 remaining identified industries will be completed in 9 years. This time period does not include the impact of new industry licensing requirements.

A second key indicator or metric of the EPD performance is the internal time it takes to process an application once it has been submitted to the CEA for consideration. Since this is the first time this data has been summarized, the trends are indeterminate.

Monthly EPL Issues

Oct. 91 - Sept 92



Source: EPL Number Issue Log Book

FIGURE 1

Permit Issue Time

Time from Application to EPL Issue

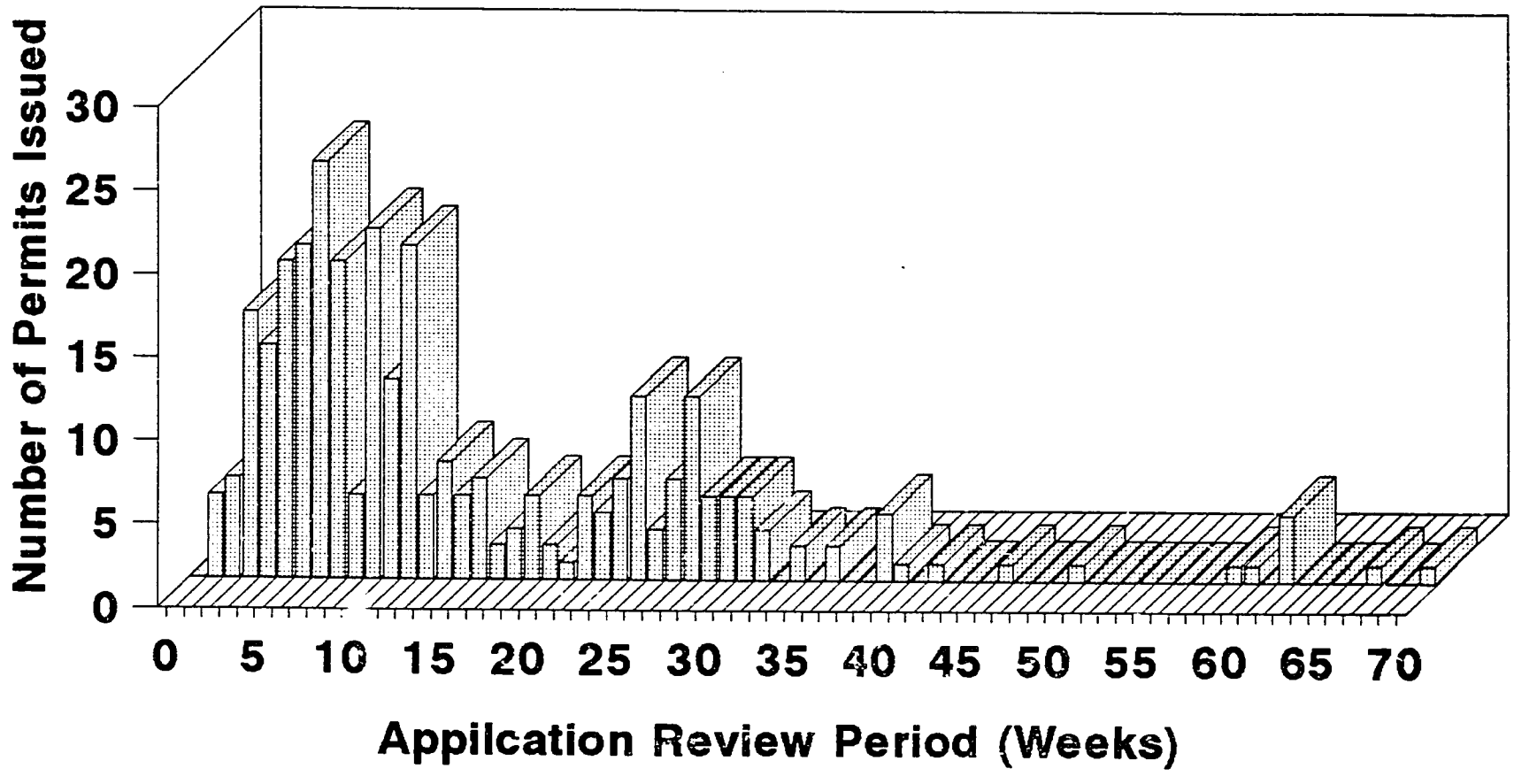


FIGURE 2

Source: Environmental Protection Management Information System - License Database

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Figure 2 graphically portrays the current distribution of the internal review time required to issue an EPL.

It is interesting to note that 80 percent of the licenses are currently issued in a 15 to 20 week time frame. The non normal distribution of the graph indicates that there are problems in efficiently issuing permits. To begin to understand the constraints and problems in the EPL program implementation the nature of the organizational demands must be explored.

There are two major set of demands that are impacting the EPL issuance process. These demands can be grouped into external and internal resource demands. Major external demands are exerted from several areas and consist of:

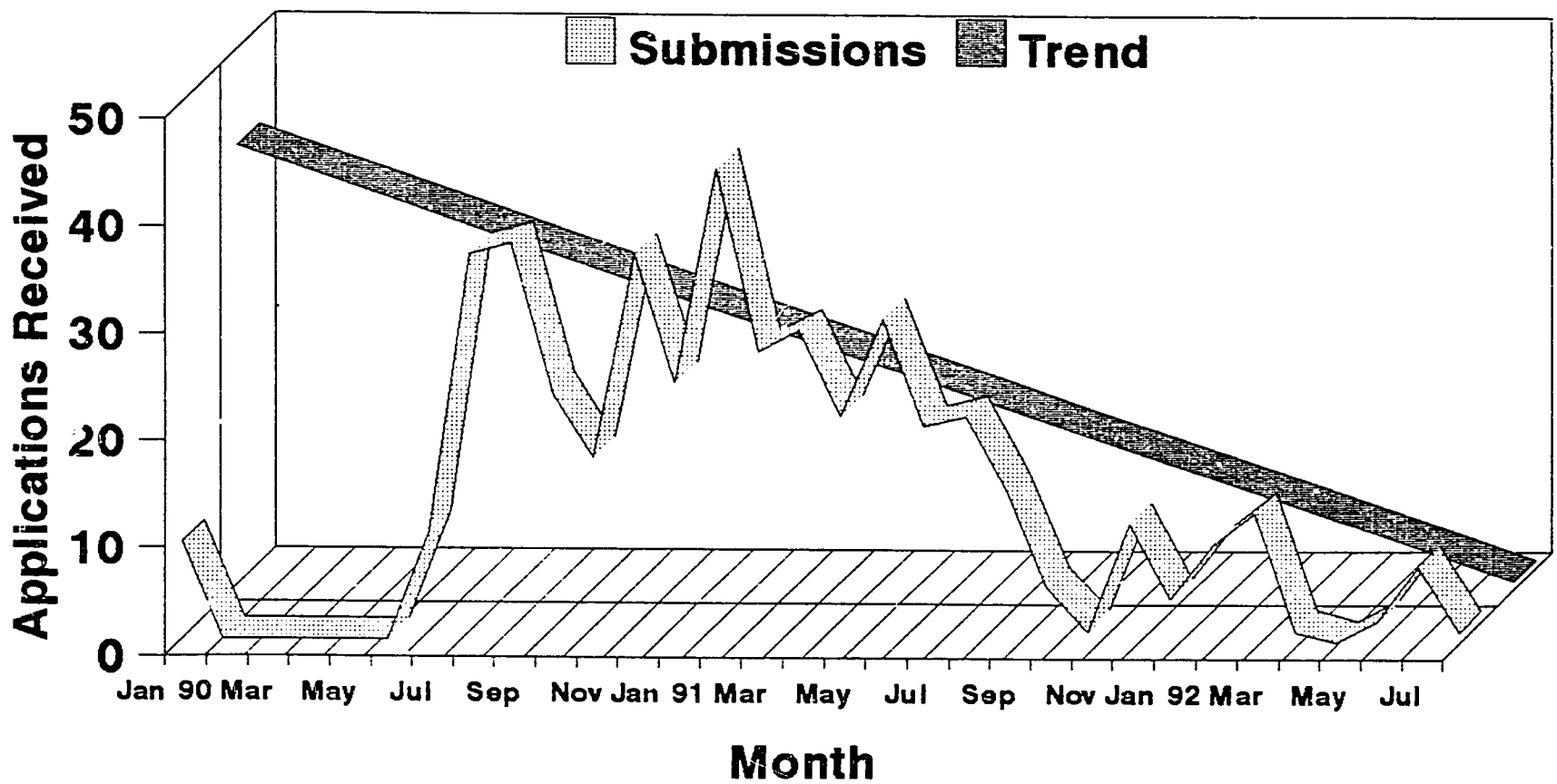
- Existing industries requiring licenses.
- New industries requesting licenses.
- Complaints resulting from existing industries.
- NEA and other legislative requirements.

External Factors Affecting Performance

A key factor is the number of industries requiring the EPD's attention. Illustrated in Table I are the 4606 industries that have been identified as requiring an industrial license and their current status. The NEA requires that all existing industries submit an application for the EPL by July 1, 1990. The NEA further requires that the EPD renew these licenses on an annual basis. Because of the magnitude of the initial licensing effort the EPD has made a consciences and wise decision not to expend effort in the renewal process. Figure 3 shows the monthly number of EPL applications received by the EPD since January of 1990.

EPL Application Submissions

Number Submitted per Month



Source: Environmental Protection Information Management System - License Database

FIGURE 3

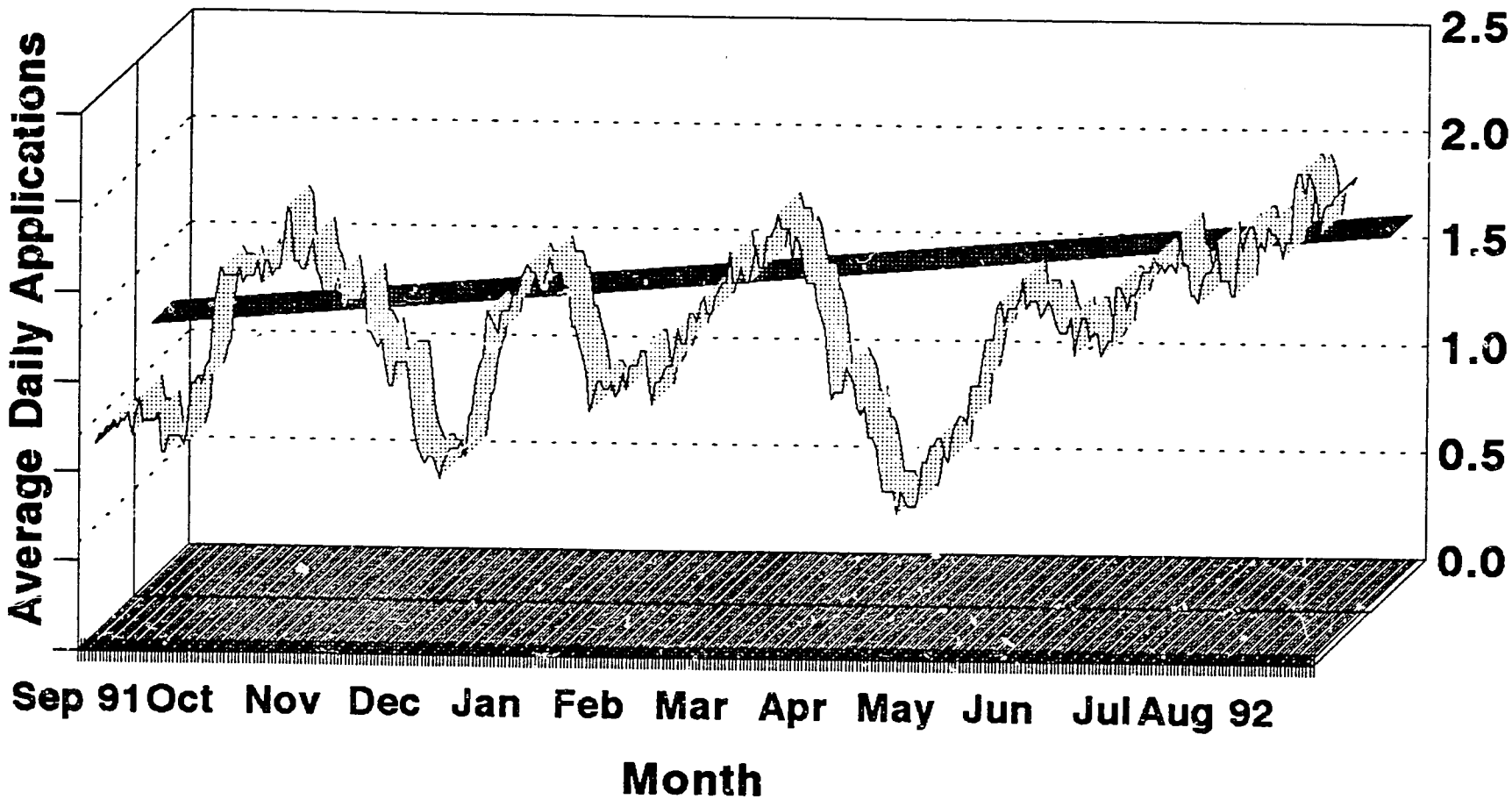
The data were extracted from the Environmental Protection Management Information System (EPMIS). Due to time constraints in entering the data, the number of EPL applications received per month is entered till July 1992. However even with these data deficiencies it is easy to see that there has been a sharp downward trend in the number of industries applying for the EPL. In conversation with industrialists, NGOs, and CEA staff, it was evident that industry is taking a wait and see attitude in complying with the requirements. The reasons for this non-compliance are summed up by several recurring comments:

- Unwillingness to spend money on control equipment when:
  - A competitor may not be doing it.
  - Other industries have not done it.
  - Common treatment facilities may become available at a later time with a lower cost when compared to individual treatment systems or,
  - The government may provide treatment cost assistance.
- Desire to wait until CEA requests them to comply with the regulation.
- Fear that the license will invite government interference in the company's business.

Figure 4 shows the average daily rate on new industry applications. While the trend of new applications is relatively flat, a review of the last 4 months shows a strong upward trend in the application rate for new industries.

New Industry Licences Application Trend

28 Day Rolling Average



Based on New Industry log book - September 1991 thru August 1992

FIGURE 4

Because of the drop in imputing data into the EPMIS licensing database a direct comparison between Figures 3 and 4 may possibly be misinterpreted, but an examination of the two trend lines in conjunction with the above comments, certainly suggest that the bulk of the current application submissions are resulting from the new industries.

Another major external factor is the volume of complaints that are sent to the CEA for action by the various government ministries, local authorities, and the general public. The EPD, while finding the complaints a major source of irritation and a significant portion of the complaints covering solid waste or neighbor disputes, attaches a high degree of priority to resolving the complaints, especially those that have been referred to them from other ministries. Figure 5 shows the increasing volume (workload) of these complaints for the last twelve months.

As can be seen in Figure 5 (following page) the complaints volume has a strong increasing trend. The volume of complaints is currently averaging five per day.

The last major external factor is the regulations. The CEA has been given a broad mandate that in the case of wastewater has established a set of standards that are unachievable by many industries over the near term, do not have a technical basis when applied in the context of the Sri Lankan environment, and are not supported by government policy with respect to municipal and domestic discharges. These regulations also establish several tiers of less stringent standards for certain classes of large industrial polluters.

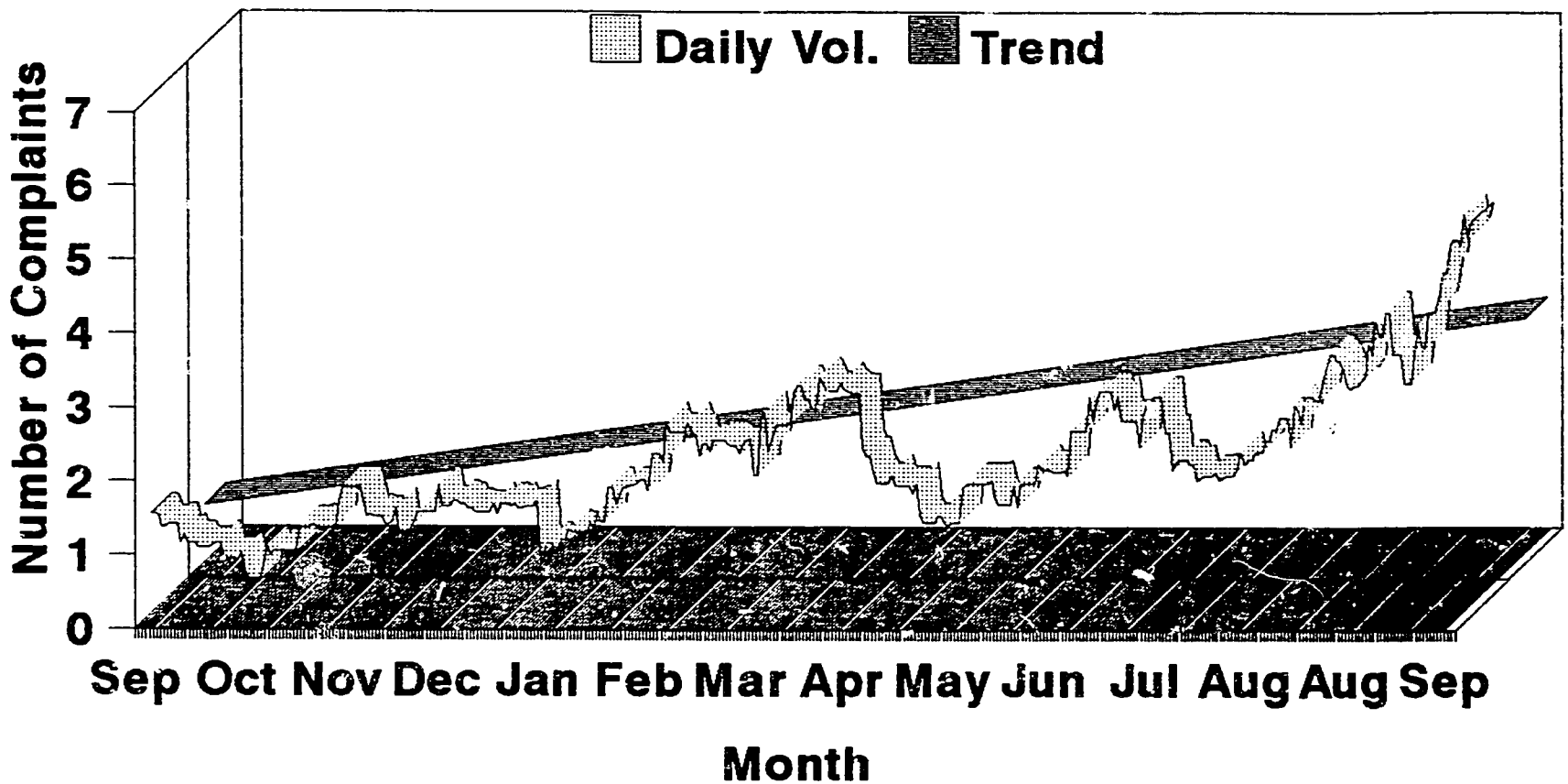
Internal Factors Affecting Performance

Internal demand factors are more numerous but can be influenced or controlled to a major degree by the CEA senior staff, directors and chairman. These factors have been grouped into six topics:

- EPL Mission and Priorities
- Organization & Metrics
- Resources
- Technical Constraints and Needs
- Information Management
- Regulatory Policies
- Laboratory
- Training Programs

Total Compliants - Daily Volume

28 Day Rolling Average



Source: General Complaints and Ministry Referred Compaints Log Books - September 1991 thru September 1992

FIGURE 5

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EPL Mission and Priorities

CEA's perception and clear delineation of its mission and priorities are probably the most important of the internal factors affecting the EPD's performance. The mandate given to the CEA is very broad and encompasses several highly significant issues. But while the act is broad and all-encompassing in its mandate the resources allocated to the CEA and specifically the EPD are very limited. In its planning process the CEA has developed a Corporate Plan (1992-1996). The purpose of this corporate plan is to set out the CEA's goals for the years 1992 to 1996. This document sets out some very ambitious goals for the CEA, specifically the EPD. Many of these projects are all encompassing and to be done thoroughly will require considerable resources. An example is the UNIDO mobile lab project. This project base is ambitious and serving to distract the EPL from its most immediate goal of licensing industry. It is very important that the EPD identify the licensing resources and dedicate them to the effort with minimal involvement in the other projects.

In our work with the EPD staff written policies and procedures were in limited evidence. Various study documents contained process steps or planned flow but for the most part policies and procedures were informal or, when written, not widely distributed (for example the corporate plan).

Organization

Only one organizational metric has been maintained -- the number of applications received and number of EPLs issued. There are no mechanisms to use EPMIS data to track efficiently:

- Time to issue permits
- Industry status
- Complaint load, type, and resolutions
- Information request to other agencies
- Manpower loading
- Resources Utilization

Resources

In general resources of all types were in short supply - from senior positions remaining unfilled to the availability of office equipment. CEA needs to fill positions as people leave or transfer.

Technical Understanding

The licensing staff receives a great deal of pressure to get involved in technical reviews of industrial plans to meet EPL requirements. There is also a great deal of temptation to specify methods in the permit conditions. The EPD needs to continue to fight this tendency and confine its comments and requirements to the measures needed to establish permit conditions.

Information Management

A comprehensive database (EPMIS) has been developed for maintaining information on industrial licensing status, waste streams, chemical use, and sampling results. In addition databases are available for complaints. Due to many factors, the EPMIS currently serves only to maintain company addresses and licensing status (i.e. issued, or not required). System support lacking include software and application user manuals, maintenance, and programming. Several of the EPMIS modules have bugs and are unable to provide the summary reports, or they hinder efficient data entry and retrieval.

Internal Constraints Summary

As problematical as these internal constraints are, they are for the most part under the control of the CEA. Most of the problems and constraints can be resolved with minimal expenditure of staff resources. Correction of these problems will yield measurable improvements in the performance of the EPD. In the following sections our findings, recommendations or action plans are presented to resolve these internal constraints. We also offer suggestions addressed to some of the external factors.

2. EPL MISSION AND PRIORITIES

The CEA's mission statement presented in the CEA Corporate plan states:

> " TO CONSERVE, PROTECT AND MANAGE THE ENVIRONMENT WHILE PROMOTING THE CAUSE OF SUSTAINABLE NATIONAL DEVELOPMENT, THROUGH POLICY, EDUCATIONAL, TECHNICAL, LEGAL AND INSTITUTIONAL MEASURES, FOR THE WELL BEING OF THE PRESENT AND FUTURE GENERATIONS OF SRI LANKA"

This statement should be used as the basis for developing policy, procedures, and priorities to guide the implementation of the EPL program. The development of policy and procedures from a corporate mission statement allows an organization to clearly define and guide the roles of the divisions, departments and staffing in the execution of the Mission Statement.

It was clear in our conversations with the EPL staff that roles and responsibilities were not well defined and often overlapped into other departments within the EPD and CEA. By developing the policy statements for each department and using them to assign work, responsibilities and roles, the CEA, and more specifically the EPD, can begin to function more efficiently.

Recommendations

1. Develop written policies and procedures for the EPD Protection Licensing Policy that clearly define the role of the EPL program in supporting the CEA Mission.

2. Develop detailed job descriptions to implement policies and procedures. Job descriptions should clearly, where possible quantitatively, state an individuals role, scope of authority, reporting requirements, and accountability measurements.

3. Establish clear and measurable priorities (short and long term) to facilitate the allocation of staff and EPD support resources. Priorities should clearly state:

   - which industries will be given top priority for licensing (recommended as high polluting and new industries);
   - criteria for handling or referring complaints to other ministries or government agencies;
   - Time frame (goals) for accomplishing priorities;
   - Maximum review time for each type of compliant or application;
   - How support resources will be allocated (i.e. typists, computers, and vehicles).

Clear procedures and priorities will be especially important as CEA begins to delegate to the local authorities the power to license low polluting industries. Lack of procedures and guidelines could result in confusion and mistakes in the classification and licensing of low polluting industry.

3. ORGANIZATION

Figure 3-1 shows what staff levels should have been in place in September/October 1992 during our review of the EPL program. However, staff transfers and/or departures reduced staff needs to implement the EPL program. A Senior Environmental Officer (SEO), 3 environmental officers (EO) and one Deputy Director left the program. They were not replaced due to a government freeze on hiring. Retention and rapid replacement of staff is key to maintain a level of quality and responsiveness necessary for any organization. Figure 3-2 shows approved staff allocations and levels expected by year end 1992. CEA is currently interviewing candidates for the vacant positions.

Staff turnover needs to be considered when organizational structure is being developed so that it addresses times when the program may be short-handed. Accordingly, we have identified several alternative organizational structures which address turnover and factors important to the EPL program. These factors include;

- The need to give high priority to complaints and new industry site clearance/application requests.
- Increasing volume of complaints and new industry EPL applications, as discussed in section 1.0
- Need to focus on industries affecting Sri Lanka's natural resources, particularly surface and ground water.
- Volume of industries located in the Colombo District, approximately 60% of existing industries.

Given all of the above factors two alternatives for reorganization of current work load distribution have been identified. Both alternatives include a separate and distinct group of EO's and Lab technicians whose primary responsibility is to respond to complaints only. Both alternatives also need to focus on high polluting industries for new industrial applications and licensing of existing industries.

<u>Alternative 1</u> - Distribute new license applications for siting clearance to EO's assigned to specific districts. This is similar to the current arrangement but these EO's will not be responsible for responding to complaints. If the industry is not a high polluting industry a license should be issued with conditions. These conditions should immediately include:

FIGURE 3 - 1
ORGANIZATION CHART
ENVIRONMENTAL PROTECTION DIVISION
CURRENT STAFF LEVELS
SEPTEMBER 1992

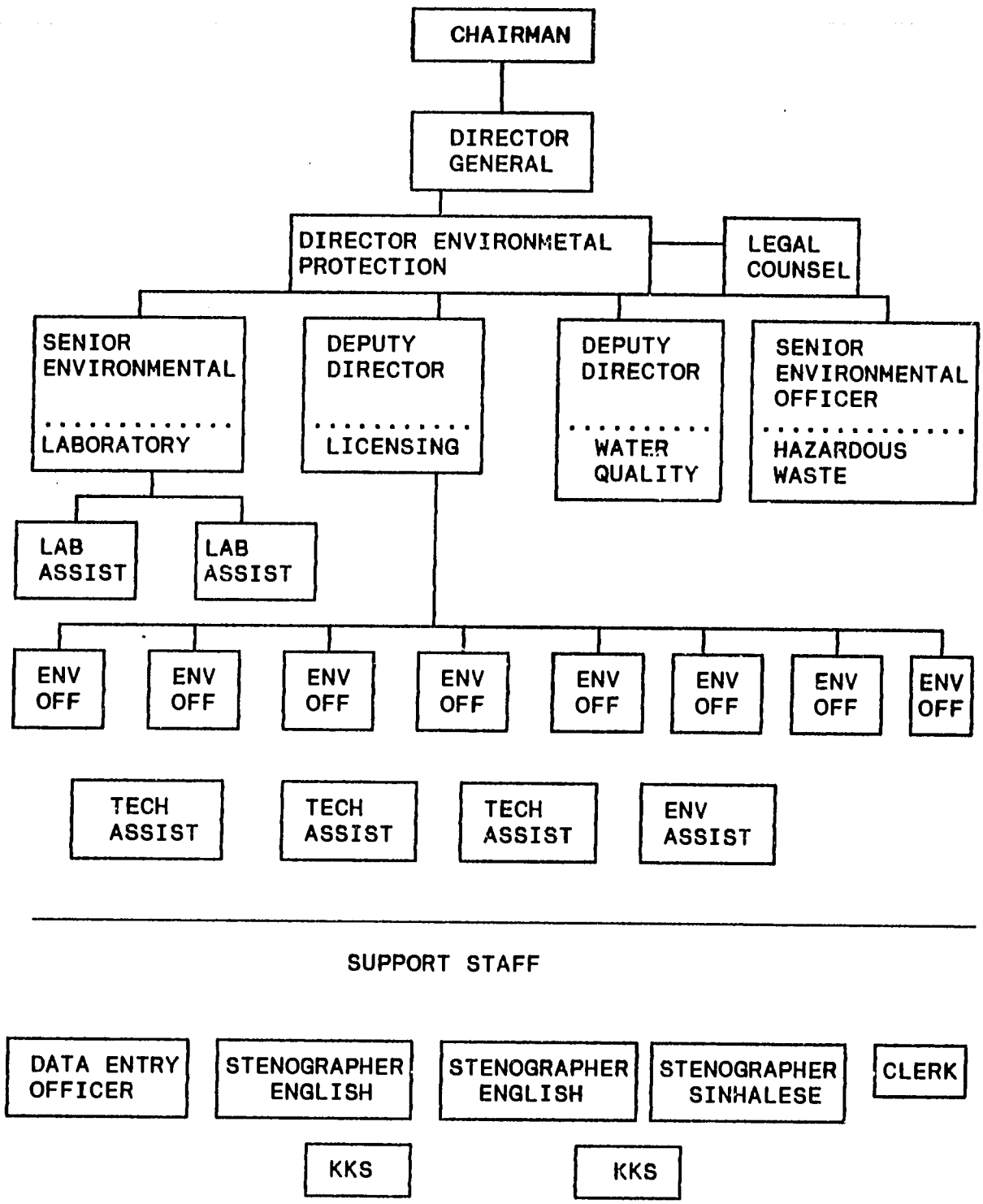
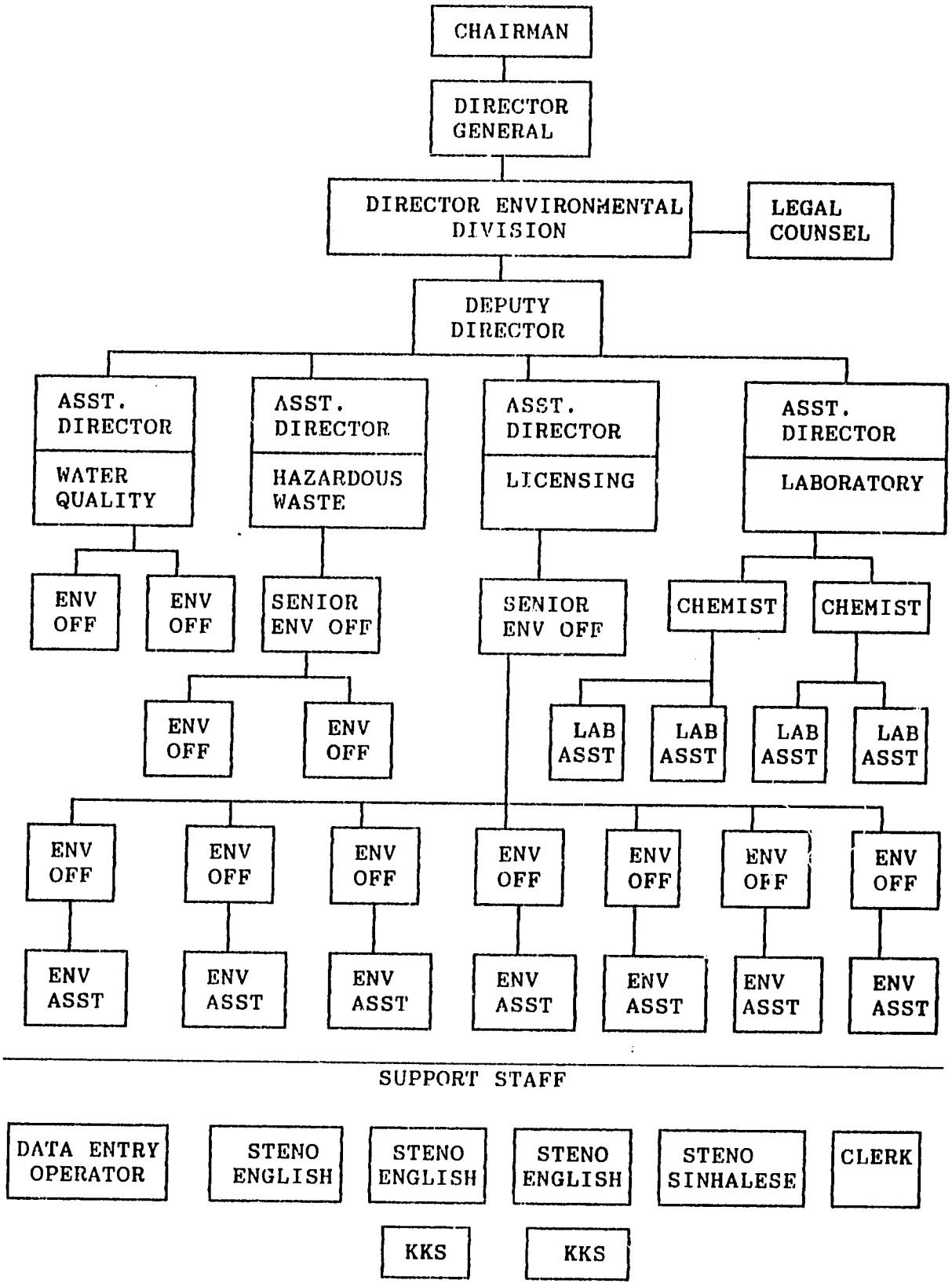


FIGURE 3 - 2
ORGANIZATION CHART
ENVIRONMENTAL PROJECTION DIVISION
PROJECTED STAFF LEVELS
YEAR END 1992



- Mandatory industry compliance with NEA discharge standards within a specified time frame (3 to 5 years)

- A provision for CEA review and amendment of the EPL if complaints are filed. These amendments could include additional actions or conditions to be taken/met by the industry.

- A required industrial audit of the facility conducted by an independent consultant/professional engineer.

Alternative 2 - This option is similar to the 1st option except that additional staff would be assigned to the Colombo District, where 60 percent of the industrial operations are located. The remaining EO staff not assigned to Colombo or to complaints could be a pool of EO's for the remaining areas of the country.

Alternative 2 offers a pool of EO staff in each key sector, complaints, Colombo and the remaining District so that if one staff member leaves other EO staff would be familiar with the project and are able to quickly fill lapses in full staff capacity until the vacated position is filled.

Organizational Metrics

A key to establishing priorities for effective program management is meaningful measurements. Without a score card it is difficult to identify organization opportunities and problems, and quantify accomplishments in a meaningful and defendable fashion. Currently the EPD maintains one measurement for the EPL program - the number of applications received and the number of permits issued. This measurement does not allow the EPD to identify trends in applications, complaints, and permit issues to establish or modify goals and priorities. Moreover the lack of measurements prevents the EPL from highlighting its accomplishments, justifying support needs or defending itself from unfounded criticism.

In the execution of our project review we developed a number of measurements which we used as a basis for our investigation into the EPL program. All of these measurements were developed from data that was available from within the organization. The analysis we conducted for this report provides a foundation for implementing organizational metrics to help CEA execute its mission.

Recommendations

Using figures 1-5 as a reference point, begin tracking (and graphing) the information outlined below. This information will provide starting points; as this effort continues the data collected, time periods and charting methods should be evaluated to assure that the metrics remain meaningful. Information to be tracked:

- Monthly EPL issues: This measurement should be a count of the number of permit applications completed with a permit issue or denial. As a backup to this, CEA should chart information on a 2 to 3 month rolling average to smooth out the monthly fluctuations. Detailed data similar to Table I should also be maintained.

- Permit Issue Time: This is a very important measurement. During the establishment of goals and priorities a permit issue time goal should be established. Initially this goal should be set at an achievable level and tightened over the next several months. The charting of this measurement should be modified slightly from figure 2. On a weekly basis for each permit issued, CEA should track the amount of time between receipt of the application and permit issuance. An average should be calculated and charted. Since this number could fluctuate wildly, due to the potentially small number of permits, a summary graph of the last 12 months experience should be maintained.

- EPL Application submissions: This measurement should be kept in the same manner as Monthly EPL Issues. New Industry and existing industry applications should be charted separately.

- Complaints Volume: This measurement should be kept in the same manner as Monthly EPL Issues. Additionally, CEA should establish categories for complaint types and each compliant place in that category. CEA should also maintain a summary chart showing complaints by type.

- Complaint Response Time: - This measurement will be similar to Permit Issue Time.

- Other measurements to consider are:
  - Sampling volume
  - Site inspection volume
  - Status of information requests to local authorities and other ministries

Initially these metrics should be tracked at the summary level. Over the next several months and after licensing priorities are established a weekly manual charting effort should be expanded to provide details by priority, sector, and possibly by EO.

4. TECHNICAL CONSTRAINTS AND NEEDS

The CEA EO staff has experience in a variety of industrial settings. However, there is limited experience in wastewater treatment, air emission abatement and noise control. Our field trips also showed a need for training programs in sampling, industrial environmental auditing and other technical transfer programs. Summarized below are key technical constraints and needs.

- Due to limited EO experience in wastewater treatment technology, EO's must resist inclusion of treatment solutions when writing permits. Permit conditions should put the burden on the industrialist for finding solutions.

- EOs should be trained in the use of field testing equipment (and additional field equipment purchased) to eliminate the need for laboratory staff to accompany EO's on site inspection.

- EOs should be trained in the use of industrial audits to supplement and enhance the site inspection process.

- The existing site inspection report checklist should be expanded to incorporate basic environment auditing principles and should accompany the EO's on every site inspection.

- EO's need to be trained in industrial operation of high polluting industries so they can better understand all the sources of pollution.

5. RESOURCES

There are several key areas to focus on to improve resource allocation that will improve CEA's credibility in the public and private sectors and streamline the permitting of high polluting industries. These key areas are:

- Office/Administrative needs
- Personnel
- Site Inspection

Our review of CEA's administrative support, and discussions with the public and private sector at seminars, helped us identify CEA's office communication within the EPD. Currently there is one intercom and telephone to support the eight EO's. There is one Sinhalese Typist and one typewriter to support the entire department. There is one fax machine and one computer. Table 5-1 is a list of basic office supply equipment absolutely necessary to support the licensing program and any government organization with CEA's mandate.

Personnel retention and replacement need high priority to assure the government that it has a sufficiently high level of trained staff to support the licensing program. Field trips with EOs revealed a need for field sampling kits to accompany EO's on site inspections. These are needed to give EOs the ability to sample an industry when necessary during a site inspection rather than to make a special trip later, with extra time and effort. The EO's and laboratory staff also need comprehensive water and wastewater sampling equipment and a program for training.

TABLE 5 - 1

OFFICE EQUIPMENT AND ADMINISTRATION NEEDS

ITEM	MINIMUM QUANTITY
Sinhalese Typewriter/Wordprocessor	2
Sinhalese Typist/Wordprocessor*	2
Phones**	5
Fax machine	1
Copy machine	1
Computers	2

* There is currently only one Sinhalese Typist and typewriter and the backlog of work is over 2 weeks.

** At a minimum there should be at least one phone for every 2 EOs.

6. INFORMATION MANAGEMENT

CEA has a significant opportunity to collect environmentally related information from Sri Lankan industry as part of the licensing procedure. This industrial information is essential to develop future environmental policy, establish licensing priorities, and track and estimate current and expected workloads. Industrial information is also necessary to communicate licensing, compliant, and monitoring status in response to government, industry, or citizen requests or to provide CEA with reliable statistics and metrics.

An initial step has been taken to support the collection and maintenance of data by the implementation of the Environmental Protection Management Information System (EPMIS). Like so many of the other good and well thought out tools and systems CEA has developed and implemented, EPMIS suffers from neglect, low utilization, and lack of maintenance support. In many cases, logbooks and staffs personal file management practice serve to manage industrial data.

EPMIS has been developed for use on a MS DOS based personal computer. The relational database has been developed using Dbase and consists of a number of tables containing data that are collected during the licensing and monitoring activities. The database is capable of capturing the majority of data provided in the license application, tracking complaints against industry, license status, and sampling data. However the system currently maintains a company's file code, addresses and license status; the remainder of the available information is not being captured consistently.

Major impediments to the use of this tool and to efficient data collection and information management include:

- Lack of adequate number of computers: Currently CEA has only one computer which supports word processing in addition to the database. Because the database is only available for short periods (due to the priority given to word processing) much of the available information is recorded into log books and company files. Consequently, EPMIS only maintains minimal information.

- Incomplete and inconsistent information from application and site inspection forms: The forms are poorly designed and do not facilitate the data gathering in a consistent format. Lack of a comprehensive guidance document and examples of a properly filled form for a variety of situations further contributes to this problem.

- Lack of feedback loops for identifying data to be entered into the database: Examples of this problem include inspection report results, sampling results, and complaint information.

- Lack of a documentation and programming support: Several of the EPMIS functions do not work; many of the reports take several hours to prepare, which further restricts the availability of equipment. No utility or maintenance programs are now used to index records, de-fragment the hard disk, or optimize the programs operations. In addition, program defects have not been fixed or table structures evaluated for more efficient maintenance and retrieval of data.

- Responsibility for data management is spread out among the EPD staff: Different assistants maintain log books giving the status for ministry and general complaints, new licenses, and EPL license numbers. Additionally much of the updating of these books must be done by the EO's, and it is done sporadically if at all.

- Lack of a convenient, organized file system: Company files are maintained by the EO's assigned to the district in which the company is located. Each EO has his own filing system. A lack of file storage cabinets further hampers the filing and retrieval of company information.

Recommendations to CEA

1. **Identify a single individual with personal computer knowledge and programming experience to become a data and information coordinator.** This individual should have the computer assigned to him or her on a full time priority basis. This person should:

    - Assure that information currently collected is entered into the database in an accurate, timely, and consistent manner.
    - Provide timely status reports (see Organization Section).
    - Implement the use of unused modules for compliant tracking, analysis results, site inspection and application information.
    - Act as the focal point for initial inquiries for license and complaint status.
    - Provide programming support for program enhancements/maintenance.

2. **Develop internal procedures for providing completed applications, site inspections, and compliant review information to the data and information coordinator.**

3. **Develop a detailed and comprehensive guidance document for the submission of an EPL application.** This guidance document should provide in great detail the EPL process, time requirements, and information required. Information requirements should detail how data is to be entered into the form, the acceptable units, and the degree of accuracy required. In addition to these instructions, at least one example of a completed document should be included for reference purposes. To facilitate submission of accurate information the EPL application form should be redesigned to include lines and boxes with appropriate headings indicating where the information and data should be recorded. Required and optional data should be clearly indicated. The data requested should mirror the data required for the EPMS.

7. REGULATORY POLICIES

Regulatory Treatment Standards

The NEA has set effluent standards for industrial wastewater discharged to inland surface waters; indirect groundwater discharges via land application; and industrial and domestic effluents discharged into marine coastal areas. Categorical standards have been set for the rubber, textile and tanning industries.

Discharge limits adopted under the NEA were based on effluent criteria from other countries including the United States and the United Kingdom. The standards were not based on ambient conditions in Sri Lanka, which vary significantly from the US and UK. For example, the mean average temperature in Sri Lanka is approximately 28° C, which suggests that receiving water bodies may have high absorptive capacity for pollutants due to naturally high biological activity in warmer climates. In contrast, in the northern United States inland receiving water temperatures are 6-8° C during winter months (December - March).

Discharge standards need to be based on ambient environmental conditions. When they do, the CEA and other government entities will then have a sound technical basis to develop industrialization strategies that effectively and efficiently protect Sri Lanka's natural resources.

A country-wide Water Quality Monitoring and Management Plan (WQMMP) would provide the CEA with a tool to protect environmentally sensitive areas and develop fair and equitable discharge criteria for industry. Specifically a WQMMP can:-

- Identify natural resources in the country that need to be protected from pollution sources;
- Determine environmentally sensitive areas where only clean, non-polluting industries are allowed to operate;
- Develop discharge standards consistent with ambient conditions and aimed at improving environmental quality over time;
- Develop a permitting system that allows for a phased approach to meet water quality objectives and defray treatment costs over time;
- Identify surface water bodies that supply drinking water under current conditions;
- Determine drinking water treatment needs for polluted water bodies;
- Provide baseline characteristics of country-wide water quality to track future pollution trends;
- Identify pollution contributions from industrial versus municipal sanitary waste sources.

The WQMMP program should be developed so highly industrial urban areas are evaluated first. The Greater Colombo area should receive highest priority, with a continued outward migration of data collection.

We recommend that this type of program be carried out by an independent organization able to provide the long-term technical and analytical resources necessary to meet the objectives of a comprehensive WQMMP.

This program should not be managed by CEA. The CEA lacks analytical capacity and technical expertise in this area. However, if CEA's staff were assigned to support the program, on a temporary rotating basis, they could receive highly valuable practical training in sampling, testing and modeling techniques used to evaluate water quality.

License Renewal Time

The NEA requires an annual license renewal. Given the low average number of licenses issued over the past two years, as discussed in sections 1 and 2, annual renewal is now not manageable if EOs need to make site inspections and rewrite licenses.

Recommendations:

- We recommend that conditions be written into the initial license that provide for automatic annual renewal unless complaints are levied against the industry. Time-bound licenses for compliance with discharge standards will allow CEA to carry out continued oversight of industrial progress toward improved environmental operations.

Enforcement Issues

Industries have been required by Ministerial Order to submit license applications to CEA by July 1, 1990. To move this program along more quickly we offer two recommendations.

Recommendations:

- CEA legal counsel should send a letter to industries, particularly high-polluting industries, to urge compliance with license requirements. The letter should set a time limit for responding. Counsel should take followup action upon any failure to respond.

- EOs going into the field should always bring with them blank copies of license applications, and they should at that time begin work with industries who have failed to complete applications. This step would eliminate unnecessary correspondence to obtain additional information not included, or likely to be included, in mailed applications.

8. LABORATORY SERVICES

The EPD has a laboratory which can provide basic analytical support to the EPL program in the areas of air, noise and water pollution. The current and projected staff levels for laboratory support can be seen in the organization charts, Figures 3.1 and 3.2.

The responsibilities of laboratory staff for year-end 1992 projections are summarized below.

- ASSISTANT DIRECTOR (1) - Provides overall management of laboratory services including sample analysis for air, noise and water pollution, laboratory accreditation, coordination of laboratory support from the private sector and water quality and air quality monitoring programs.

- CHEMISTS (2) - Laboratory chemists provide support for water quality monitoring, water pollution control, microbiology, air quality monitoring, vehicle exhaust emissions, green house gas analysis and support for the UNIDO mobile laboratory project.

- LABORATORY ASSISTANTS (4) - The lab assistants perform analytical testing for air, noise and water analysis. Two of the above lab assistants have also been assigned to the UNIDO mobile laboratory project.

Based on the proposed staff levels, projects and responsibilities, only 1 chemist and 2 lab assistants will be available on a part-time basis to support the licensing program.

Current laboratory throughput for basic water quality testing (BOD, COD, SOLIDS) is limited to approximately 20 samples per day. This is a manageable volume of work for the 3 lab staff available to support the licensing program. However, the current or projected year-end laboratory staff levels cannot handle the more advanced/technical analytical testing requiring state-of-the-art equipment (gas chromatography, mass spectrometry).

The plan for CEA laboratory support of the licensing program includes:

- At least one lab staff assigned to an EO during field sampling events to assure good field practices for use of analytical equipment.
- Basic laboratory support for gross contaminant measurements.
- Selection of analytical parameters to be tested.
- Spot checks of industrial compliance with current discharge limitations.

CEA's approval to laboratory and lab staff requirements needs re-evaluation. Given the laboratory support for the licensing program, the number of EPL applications received, the EPL's issued, potential number of industries requiring an EPL, and 200 annual work days, several comments can be made regarding laboratory support of the EPL program:

- Currently 2200 industries have applied for EPLs. If CEA's laboratory program is to provide annual spot checks this means that nearly 11 industries should be sampled per day.

- Should industries needing EPLs reach estimates of 4,600 then some 23 industries would need to be sampled per day for annual spot checks.

- Present requirements for Laboratory staff in the field, now necessary to support the above activities, also limits the actual analytical time they have available in the laboratory.

The above statistics show that the CEA's laboratory and staffing restricts any comprehensive program to provide even spot checks on industrial compliance with discharge limitations.

Recommendations:

Accordingly, we offer several recommendations regarding CEA's role in an industrial monitoring program and support of the licensing program:

- Industrial monitoring should focus on only high polluting industries where Sri Lanka's natural resources are being affected or where complaints have been filed against high polluting industries;

- Laboratory staff assigned to the licensing program should not be used to support other donor programs or CEA initiatives.

- A technical approach and plan needs to be developed to identify analytical parameters required for testing from each industry;

- Industry needs to be largely self monitoring;

- Sub-contracts with private laboratories may be needed to support CEA's monitoring program.

In addition to the above specified comments several other general comments can be made regarding CEA's laboratory services. These comments are based on interviews with laboratory staff and a review of laboratory operations. CEA needs to:

- Maintain record keeping of equipment calibration and maintenance.

- Document laboratory procedures and quality assurance/quality control (QA/QC) practices;

- Develop analytical procedures specific to CEA's testing equipment.

In general, as with many new laboratories, better data tracking and documentation of laboratory operations needs to be developed if CEA's credibility is to stand up in court.

Table 8-1 is a summary of CEA's laboratory equipment, which shows that there is little or no duplication of equipment. This lack of redundancy further hinders the lab's ability to support the licensing program during field inspections. With 8 environmental officers performing site inspections only one on any given day will have analytical field support.

TABLE 8-1

LABORATORY EQUIPMENT

WATER QUALITY TESTING	QUANTITY
UV/VIS Spectrophotometer	1
Oil and grease analyzer	1
Manometric BOD analyzer	1
Multimeter for field testing of pH, conductivity, Turbidity, Dissolved Oxygen, Temperature, Salinity	1
Surface water flow monitoring equipment	1
COD reflux analyzer	1
Total and fecal coliform test equipment	1
Incubators	1
Biological	2
BOD	1
Steam bath	1
Refrigerators with freezer	2
Solvent recycle recovery system	1
AIR QUALITY TESTING	
H Nu-organic vapor analyzer	1
Ambient air analyzer	1
Wind direction and velocity analyzer with data logger	1
High volume analyzer	1
NOx analyzer	1
So2 analyzer (range 0-15 ppm)	1
Portable ozone analyzer	1
Ozone generator	1
So2 analyzer (Range 0.1, 0.2, 0.5, & 1.0 ppm)	1
NOISE TESTING	
Sound level indicator with internal and external sound calibrator	3

9. TRAINING PROGRAMS

Based on our initial review of the EPL program, interviews with EPA staff, field trip observations and records review, we have identified several training programs for EPL staff. These training programs are summarized below:

- Field sampling techniques
- Communication skills
- Water and wastewater analytical testing
- Industrial auditing
- Wastewater treatment technologies
- Project management
- D Base and spreadsheet training for Database coordination

REPORT ON WASTE DISPOSAL ISSUES AT SRI LANKAN COASTAL RESORTS

By Warren Riznychok and Peter Schmidt: Malcolm Pirnie Inc
for NAREPP/IRG - October 1992

Several resort areas along Sri Lanka's southwestern coast were visited to review waste disposal issues at tourist locations. The areas visited were:

* Bentota - Ceylon Tourist Board
* Ahungalla
* Beruwela
* Hikkaduwa

At each location, we investigated water supply, solid waste disposal and wastewater treatment. Water supply and solid waste disposal were similar at each resort area.

Groundwater was generally the source of water for sanitary uses and cooking. Most areas had some form of treatment, usually filtration and disinfection. The Triton Hotel at Ahungalle also had water softening units. CEA staff who have also reviewed groundwater data in resort areas indicated that groundwater treatment has to include disinfection because of elevated levels of fecal bacteria and the concern over water borne diseases. Fecal contamination of the groundwater is most likely the result of waste water disposal practices with soaker pits and septic system both at the hotels and surrounding villages and homes.

The majority of solid waste generated, at each resort area, is from food scraps and packaging of disposable materials i.e., cardboard boxes and plastic wrappers. This solid waste is carted away and dumped in an uncontrolled manner according to the hotel operators at Bentota. This practice, however, is a countrywide problem.

The majority of the resorts visited disposed of food scraps to carters who transported the waste to pig farms. Food waste and fat removed from grease pits was either buried or included in the solid waste stream. This is an universal practice for disposing of food wastes where there is no infrastructure to deal with solid waste collection and disposal.

Below is a summary of general comments regarding water supply and solid waste disposal at the resort areas visited.

* Groundwater used for water supply needs is contaminated with fecal bacteria, and the source is likely to be soaker pits for wastewater treatment from the hotel and surrounding homes.

* The cost for groundwater treatment may increase over time if wastewater

treatment and disposal practices are not improved (see site specific wastewater treatment needs).

* Disposal of food waste through pig farms is one alternative for solid waste disposal but may not be a long term solution.

* Resorts not utilizing the pig farms, might consider a joint venture to compost food waste. It may be possible to find an investor to design and build a compost facility to service the resort industry. The investor would benefit from the sale of composed material as natural non chemical fertilizer. This approach might minimize future solid waste disposal cost for resorts should a countrywide solid waste program be implemented. The compost could also be used for the hotel gardens.

* Disposal of non recyclable/useable solid waste really needs to be addressed on a municipal and countrywide level. However, the hoteliers of Sri Lanka can set an example by cooperatively identifying and purchasing a suitable extent of land for land filling of these other products. Solid wastes and sludge from waste treatment could also be disposed here in a controlled environment.

WASTEWATER TREATMENT

Wastewater treatment practices at each site and future treatment plans and needs vary from one resort area to the next. For this reason, each resort area is discussed separately below and wastewater treatment needs are addressed on a site specific basis. At the time of our visit all hotels were using tanks or soaker pits for wastewater collection and treatment, except for Coral Gardens Hotel at Hikkaduwa. This trend needs to be changed if groundwater as a source of water supply is to be protected.

Bentota

There are 6 hotels in the Bentota resort area with approximately 800 rooms. In addition a 200 room hotel is being planned. The site utilities and infrastructure are managed by the Ceylon Tourist Board. Waste water is currently collected in tanks or soaker pits. Solids that accumulate in these collection vessels are periodically pumped and carted away. A new secondary wastewater treatment system was designed by a local engineer and was constructed 4 years ago. The system has not been used because an Environmental Pollution License (EPL)could not be issued by CEA due to the system design plans. CEA recommended changes to the system. The cost of the original system and the changes are Rs.1.6 Million and Rs.1.5 Million respectively. Based on our review of the system several modifications to the existing system could provide consistent quality effluent without odors. The current system design and

our proposed modifications are illustrated in Figure 1, and can also be found in Annex I (Bentota Solutions).

The proposed treatment system modifications include:

* Enclosure of the current system into concrete or plastic tanks to create a trickling filter design where the effluent can be captured and recycled for low discharge periods.
* Secondary setting
* Disinfection
* Utilization of the existing sludge drying beds for sludge dewatering.

AHUNGALLA-TRITON HOTEL

The Triton Hotel is planning to a 130 room five star hotel in addition to their 160 room hotel. The management at the Triton would like to provide a common wastewater treatment system to service both hotels. Currently, wastewater is discharged to a series of cess pools and soaker pits with the sludges periodically being pumped out and carted away. One alternative treatment process for the Triton is to design and construct a secondary treatment facility with disinfection. The suggested unit processed are listed below:

* Primary settling
* Secondary treatment with a trickling filter
* Secondary settling
* Disinfection

A second alternative is to import a package activated sludge plant. A sketch of both threatened alternatives are shown in Figure 2.

The effluent can be used for irrigation, or water scaping, and disposed via an ocean outfall or through a series of soaking pits. The ocean outfall is an expensive alternative unless, the outfall is sited close to the shore away from the beaches of the hotel, without affecting the coast and shore.

Beruwela

Three hotels at this location are owned and operated by a single owner. Wastewater is currently captured in tanks and pumped to a series of trenches near the front of the hotel. As infiltration from these trenches diminishes, new trenches are cut. This system, because it is not enclosed, can be very prone to production of odors. One owner of the hotels visited is negotiating with 6 other hotels in the area to develop plans for a common wastewater treatment facility to service all resorts in the area.

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

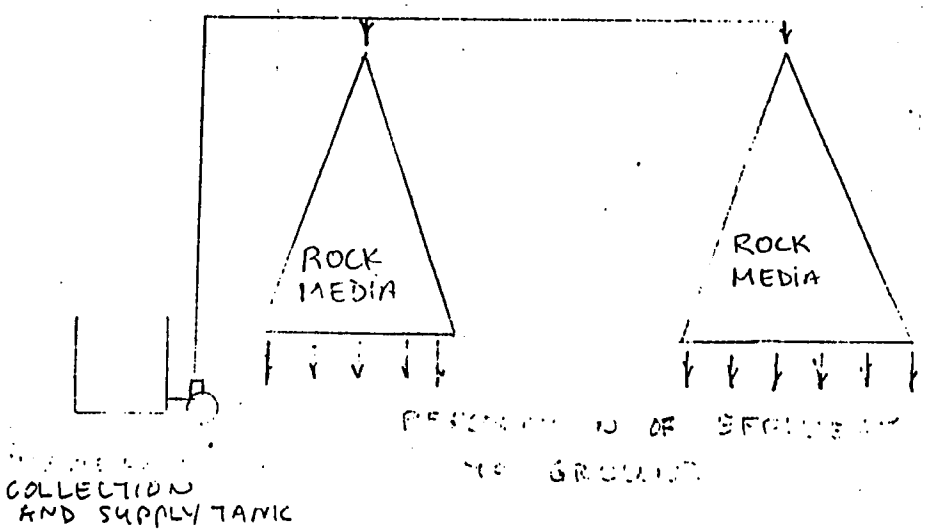
BY ..... DATE ..... SHEET NO. ..... OF .....

CHKD. BY ..... DATE ..... JOB NO. .....

SUBJECT FIGURE 1

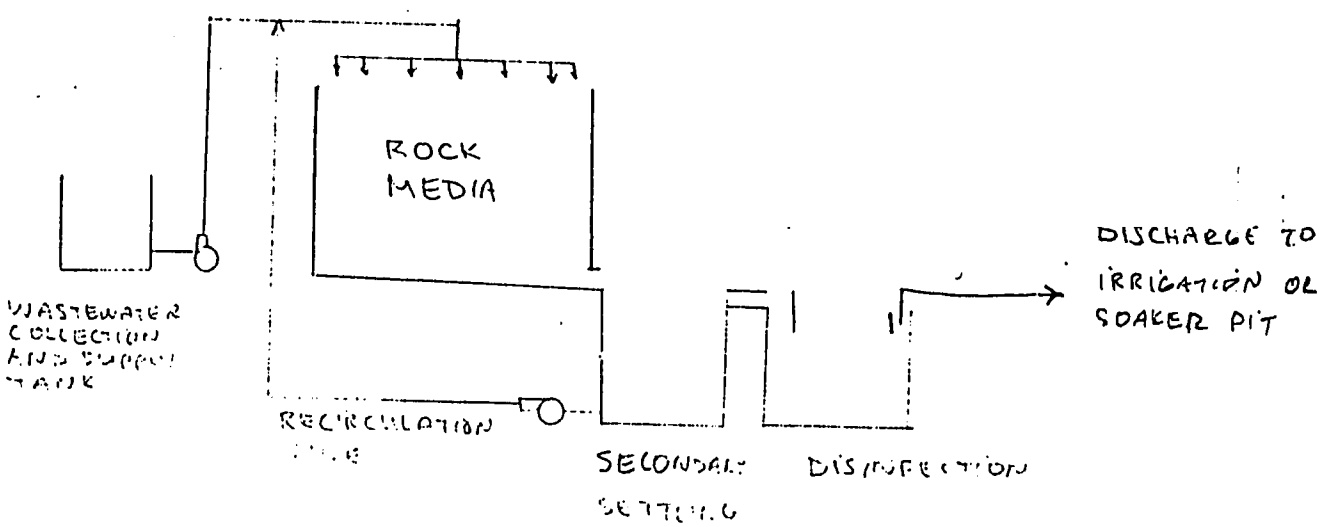
BENTOTA TREATMENT

CURRENT SITUATION



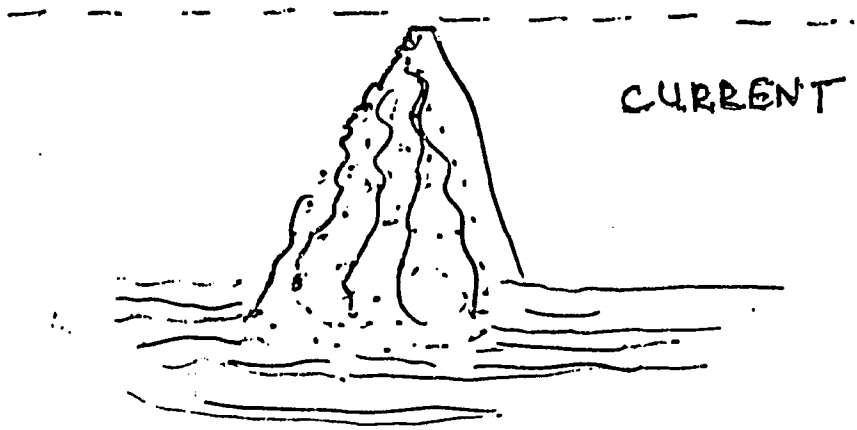
ROCK PILE / TRICKLING FILTER ARRANGEMENT

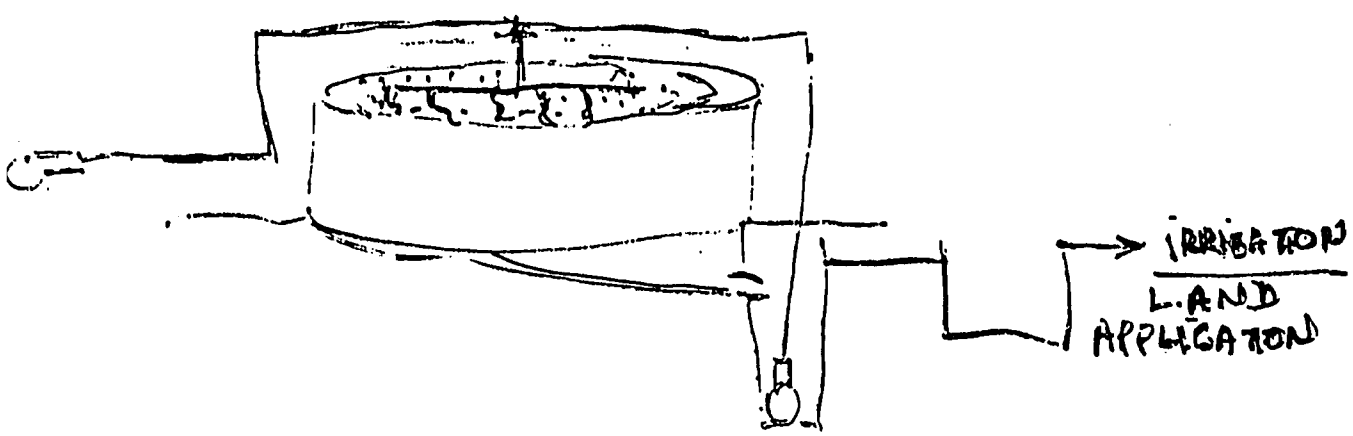
PROPOSED MODIFICATIONS



BENTOTA SOLUTIONS

- FLOW RESTRICTORS
- ENHANCE WASTEWATER TREATMENT DESIGN





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BY ..... DATE ..... SHEET NO. ..... OF .....

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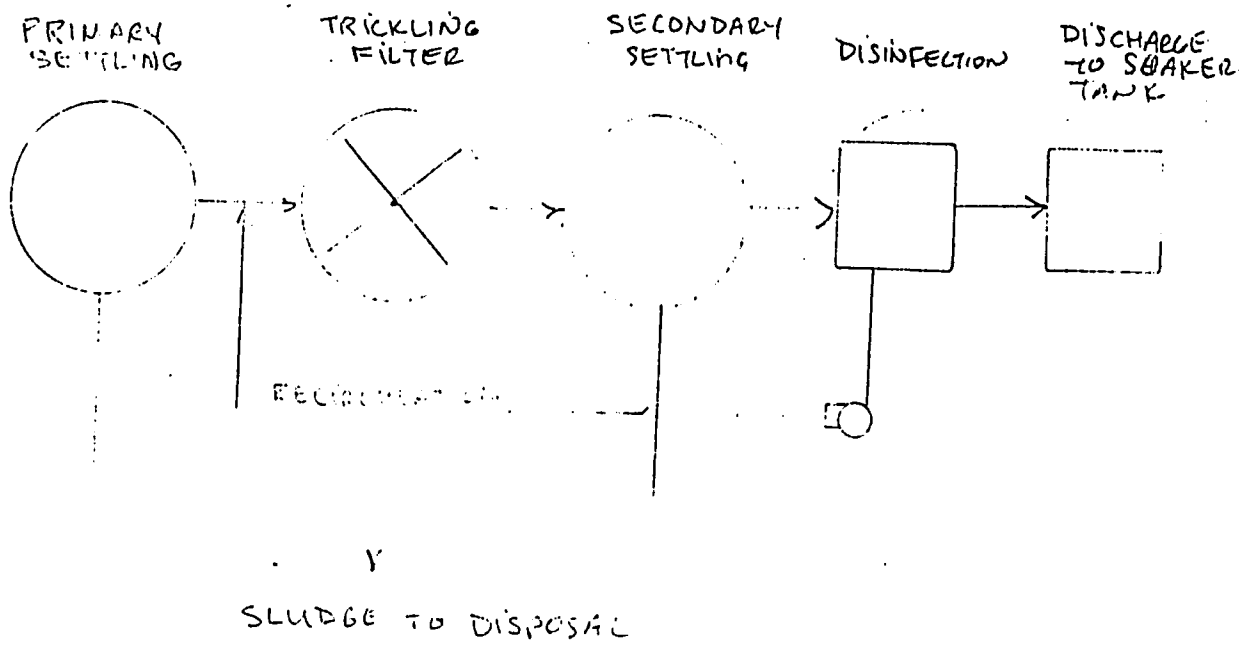
SUBJECT FIGURE 2

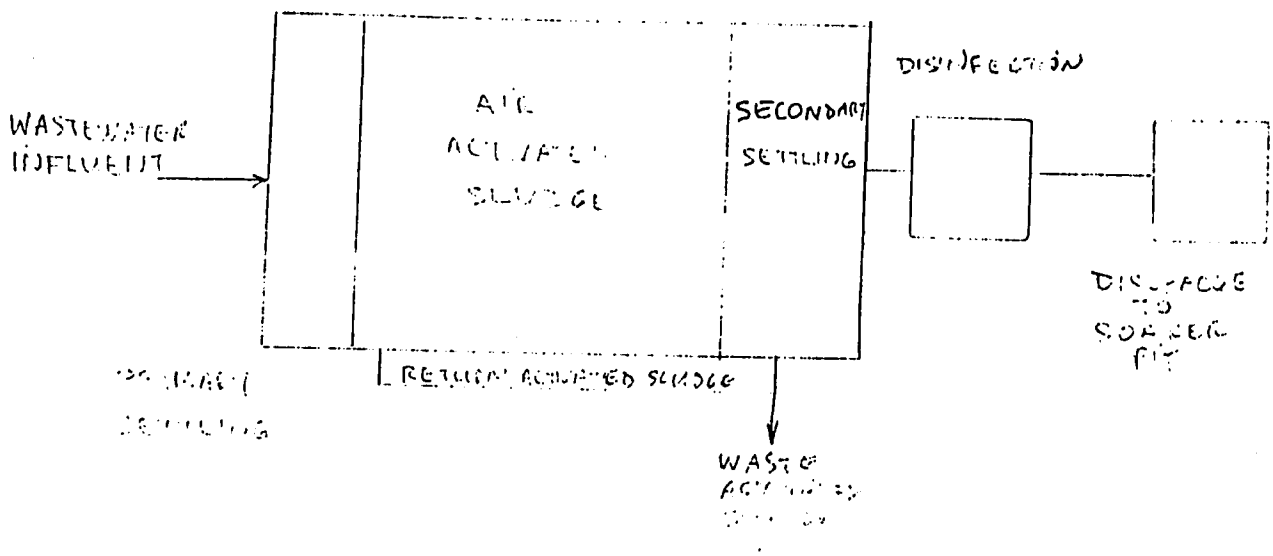
PROPOSED TREATMENT OPTIONS

ALTERNATIVE ONE



ALTERNATIVE TWO

PACKAGE PLANT



Hikkaduwa

There are several sources of direct (Point Source) and distributed (Non-Point Source) discharges of wastes to the coastal waters in the Hikkaduwa Resort Area. Specifically these include;

- A treated direct discharge from the Coral Gardens Hotel.
- Indirect discharges from smaller 30-60 room hotels.
- Direct discharges from two brackish water outlets to the coastal waters.
- Indirect discharges from fishing boats centrally in the area. While each boat represents a direct discharge we would refer to their waste as being distributed because of the volume of boats.

Each of the above discharges is a potential source of pollution. No data was available to identify the magnitude of the pollution contributed by each source. However, based on our experience regarding the types of discharges, we observed several impacts on the coastal waters at Hikkaduwa which are given below.

1 Coral Gardens Hotel Wastewater Discharge

The Coral Gardens Hotel is discharges treated wastewater directly to the coastal waters via a discharge pipe located at the immediate shoreline. The treatment system includes primary settling to remove settleable solids and an aerobic biological system to treat soluble organic waste components. The biological aerobic system operates on a timer and is aerated for 30 minutes every 4 hours.

Because of the warm climate of Sri Lanka operating system can result in anaerobic/septic conditions which inhibit the treatment capacity and resulting in foul odors.

Mixing of this septic effluent in the shallow (1-2 inch) and turbulent conditions at the point of discharge may increase odors though via volatilization.

There are two possible alternatives for reducing odors. One is to move the discharge outward to a deeper water location (approximately 30 feet) where the effluent can mix more readily in the vertical water column and minimize odor production. We cannot predict at this time what the impact of this alternative might be on the outlying reef.

The second alternative is to aerate the biological system continuously. This will improve the treatment of soluble organics and result in a lower effluent BOD without a septic odor due to elevated dissolved oxygen levels. Operation of the system in this way, may however, result in an increase in discharge of suspended biological solids.

We recommend sampling the effluent of the current system operation versus the system operating under continuous aerated conditions. The trade-off may be a decrease in odors and the discharge of organic pollutants to the coastal waters versus a more visible suspended solids discharge. If the suspended solids increase with a significant reduction in BOD, secondary settling can be added to the system and provide a visibly pleasing and odor free effluent.

2 Indirect Discharges from Smaller 30-60 Room Hotels

These hotels are using either a soaker/cesspool arrangement to capture wastewater or an in-ground tank to collect wastewater. Reportably, it is not uncommon for these hotels to pump out their tanks directly into the ocean when polluted. The soaker/cesspool method captures solids while allowing the aqueous phase to percolate into the surrounding soils and ultimately into either the groundwater or to the coastal waters via groundwater flow or tidal action. Capturing water in the tank and pumping or cleaning out the tank when full minimizes any discharge to groundwater or coastal waters. The major impacts of these treatment alternatives are: a) odors produced when the tanks or cesspool solids need to be pumped out and b) potential ground water contamination. We would not expect these systems to have any significant impact on the coastal waters at Hikkaduwa given their current design and operation, providing the solids are not pumped into the water during peak occupancy times.

3 Direct Discharges from Brackish Water Outlets

These discharges may represent the largest single resource and volume discharge of pollution to the Hikkaduwa coastal waters. However, these surface waters need to be characterized by pollutants including BOD, COD, metals and toxic pollutants, and flows need to be monitored so mass quantities of pollutants can be determined. Should these waters be found to contain large quantities of pollutants compared to the other sources a first step in pollution prevention would be to identify the sources of pollution upstream of the coastal discharge. Upstream pollution sources may include domestic and industrial wastes.

4 Discharges from Fishing Boats

Discharges from fishing boats include fish not suitable for market or scraps from cleaning and oil from the maintenance of engines. These discharges can be controlled by collecting the oil and fuel product for on shore disposal or heating fuel. The fish could be used as animal feed. The current practice can result in odors from decaying fish, an unsightly shoreline due to fish and oil washing up, and oils that may coat the surface of the coral reef resulting in loss of marine life on the reef. The magnitude of coral reef destruction from fishing boat oils could not be quantified based on our interviews and on shore inspection.

One solution for the pollution problems arising from fishing boats is to move them from their current location to an area North of the Hikkaduwa Resorts, assuming additional room could be found.

Finally, destruction of the Coral Reefs at Hikkaduwa appears to result from tourist activities practiced by glass bottom boat operators through physical smashing and breaking of the Reef by the boats, anchors, and boat operators. To stem further reef destruction - harmful to the interests of the hotels and boat operators, a public awareness campaign and education for the boat operators is appropriate and necessary.

SUMMARY

The coastal areas are becoming increasingly stressed as tourism expands in these areas. Limited ground water and surface water monitoring reveals high levels of contamination and limited adsorptive capacity. The hotels, ministries and municipalities need to work together to establish integrated resource planning tools and treatment capacity to ensure an adequate water supply and to preserve the coastal resources from being spoiled because of improper soil and wastewater discharges.

Key action items:

* Water supply and quality investigation monitoring.

* Establishment of common wastewater treatment systems for both the hotels and surrounding Municipalities.

* Establishment of a solid waste management plan and protected implementation appproaches.

BOARD OF INVESTMENT OF SRI LANKA
SITE VISITS TO KATUNAYAKE AND KOGGALA
By Warren Riznychok and Peter Schmidt: Malcolm Pirnia Inc
for NAREPP/Irg - October 1992

BACKGROUND

The Board of Investment of Sri Lanka (BOI) manages several industrial estates throughout Sri Lanka. Each industrial estate either has or is planning to have about 80 industries. BOI provides and maintains the site's utilities, access roads and in general the sites infrastructure including water supply, wastewater treatment and solid waste disposal.

BOI requirements for industries on the estates are that each industry must employ 500 people and export more than 70 percent of their products. Industries on BOI estates also have financial incentives on imports of equipment and accordingly they are called "FREE TRADE ZONES". Malcolm Pirnie staff made brief visits to BOI sites at Katunayake and Koggala. The purpose of the visits was to gain an understanding of the INDUSTRIAL ZONE concept, review waste management practices, and comment on the observations. Katunayake is operating at near full capacity with 78 industries in operation. Koggala is a relatively new site with only 7 of approximately 76 planned industrial operations.

KATUNAYAKE SITE

The Katunayake site employs approximately 50,000 people in 78 factories. Fifty percent of the industries are garment factories.

Water Supply - Originally groundwater was to be the source of water for manufacturing and sanitary purposes; 700,000 gallons per day (gpd) of groundwater was being consumed for these needs in 1984. After 1984, stress on the aquifer and mechanical pumping operations limited the availability of groundwater to 400,000 gpd. However, BOI found an alternate water supply from the Negombo Municipal water supply system. Water from this source has been used to supplement BOI's current 400,000 gpd groundwater supply.

It was not clear if pumping operations and mechanical problems with the wells or groundwater availability restrict the volume of supply for the site. It does appear that the Katunayake industrial estate will continue to use the Negombo supply as a supplement and may rely on Negombo as its major water supply in the future. This may eventually affect the ambient surface water conditions of the Mahaweli River as BOI increases its dependence on Negombo. No BOI personnel were aware of any hydrologic studies for the site and its water supply.

Wastewater Treatment - All industries at the site discharge to a common wastewater treatment system. The common wastewater treatment process consists of grit removal, biological treatment via surface aerated lagoons, secondary sedimentation and sludge treatment in drying beds. The system was designed to accept and treat the site's sanitary wastewater and pre-treated industrial wastewater.

Industries generating wastewaters which may be toxic to the biological treatment process of the common system are required to pretreat their wastewater to limits set by BOI. These pretreatment processes will typically include neutralization and other physical chemical processes to remove metals and other toxic contaminants.

Some observations were made during the site inspection of the central wastewater treatment system at the Katunayake site:

- One of the surface aerators in two of the three treatment trains was inoperable and in need of repair.

- Dissolved Oxygen (DO) level of the effluent was 0.2 mg/l. Since this is very low, measurements should be taken along the length of the aerated lagoon to determine the effective aeration/tank capacity utilized for biological treatment.

- Dewatered sludge from the drying beds was placed on the grounds surrounding the beds. This practice provides an ultimate sludge disposal alternative but with limited capacity.

Based on these observations and interviews with plant operations staff, several recommendations can be made regarding wastewater treatment and sludge disposal. These include developments and implementation of:

- A preventative maintenance program to minimize down time of equipment and to assure long term reliability of the capital investment.

- A plant monitoring program aimed at improving process performance rather than just measuring effluent quality.

- A sludge management program that can incorporate the use of dried/treated sludge as fertilizer for grounds maintenance.

<u>Solid Waste Disposal</u> - Solid waste is collected and taken to a central location for burning. Two burn units are operated by BOI. Some segregation of waste occurs at the burn units as metals or non combustible materials are removed by the burn unit operators and dump scavengers. Our observations of the solid waste situation at Katunayake:

- The solid waste generated by the site exceeds the capacity of the two burn units. This is evidenced by open burning of solid waste beyond the capacity of the burn units. Open burning occurs on approximately two acres of land near the burn units.

- The burn units are not operated efficiently as can be seen by the black smoke being emitted from the stacks. Insufficient air supply and overloading of the units are the most likely causes of these units' poor efficiency.

- The smoke from the burn units and open burning creates undesirable air emissions which affect the neighboring community and the airport.

- There is no mechanism for ash disposal, and ash is discharged to the grounds surrounding the burn units. This condition, along with the open burning, has resulted in nearly 2 acres of land which are continuously smoldering or on fire.

Opportunities for improving the solid waste condition at Katunayake are:

- Provisions for operator training and supervision to reduce the volume of materials initially loaded into the burn units, to improve the way air is supplied to the units, and to increase the amount of air supplied through equipment maintenance. As air supply is improved the volume of solid waste introduced to the burn units may increase, but it should not exceed the recommended capacity of the system.

- BOI may want to identify independently a landfill site for non-toxic, non-combustible wastes as part of a 10 year plan for solid waste management. A land fill would eliminate open burning. Additionally, ash from current operations could be used for supporting infrastructure needs at Katunayaka, i.e. roads, neighboring industries or other BOI sites.

- Long term planning for Katunayake should include efficient incineration and a focus on recycle/reuse programs.

KOGGALA SITE

The Koggala estate currently employs about 3500 people in the 7 industries operating on site. Other industries planned for the site include garment industries and, in general, industries which do not use or produce toxic waste.

The Koggala Free Trade Zone represents a unique opportunity to learn from Katunayake and develop efficient and cost effective ways of managing water supply, wastewater treatment and solid waste disposal. Each of these environmental areas is discussed below.

Water Supply - Water for production and sanitary uses will come from 3 tube wells located at the northwestern boundary of the site adjacent to the Sri Lanka Air Force runway. The tube wells are screened at a depth between 10-15 meters, and are to supply 300,000 gallons per day for site water supply needs. It is not clear how it was determined that ground water is available at this site or if saltwater infiltration could be a long term problem. It is also unclear what connection exists between the groundwater supply and Koggala Lagoon.

It may be important for BOI to identify alternate water supply sources at this time to assure future water supply as more industries start up. One alternative could be to recycle effluent from a tertiary wastewater treatment system (see next Section) to the factories for manufacturing/production needs.

Wastewater Treatment - The current plan for the Koggala site includes a supplemental water supply, secondary wastewater treatment and ocean discharge. The combined cost

of the system is estimated to be Rs.600 million approximately $ 13.5 million. It appears that the ocean discharge was the only discharge alternative considered. Other opportunities to integrate tertiary treatment with water reuse for manufacturing or irrigation have not been explored.

The tertiary treatment alternative could eliminate a costly piping system for an ocean discharge and could reduce overall treatment costs. The savings gained from tertiary treatment and recycle/reuse, irrigation or discharge to Koggala Lagoon could be funnelled into an efficient solid waste incinerator which would minimize air and solid waste problems similar to those now experienced at Katunayake.

Solid Waste - Given the current plans for solid waste disposal at Koggala we would not expect to see any improvement in solid waste management from what is on-going at Katunayake. This is an alarming prospect because of the proximity of the planned solid waste disposal area to Koggala Lagoon.

RECOMMENDATIONS FOR KOGGALA

The Koggala FTZ could offer: research and development opportunities for identifying cost effective treatment options; demonstration programs for integrated source reduction and waste minimization programs; and integration of municipal private, and industrial water supply, solid waste, and waste water management requirements. Additionally, the FTZ also offers the potential for University and other technical institutions to cooperate in the operation and research activities that can expand the technical experience base of Sri Lankan engineers. Specific recommendations include:

- Evaluation of other wastewater treatment opportunities which do not include an ocean outfall. This can be done as part of the EIA process or as an independent feasibility study.

- Development of a site wide environmental management plan which addresses solid waste disposal needs and encourages wastewater, recycle/reuse to minimize impacts on available water supply.