5.2 Recommendations on Improvement Plan

5.2.1 Operation Management

1) Operation Manuals

a. Preparation of Complete Operation Manuals

NPC's standard Start-up/Shutdown Procedure Manual describes only the outlines in flowchart form. For operation of each equipment, instruction manuals from manufacturers are just gathered and used. Since the system and facilities of a thermal power plant are very complicated, such basic operation manuals are insufficient for the operators, who are required to have high technical knowledge.

The distribution of these operation manuals is limited to the Sr. Control Operators and superior staff. The operation manuals should be distributed or lent to all operators. Furthermore, the start-up and shutdown schedule, and the major operational instructions are given by the Operations Superintendents based on their experience and past records. Standard operation criteria have not been established yet.

For unification of operation methods and efficient operation, a comprehensive set of operation criteria like a Data Book should be prepared, so that even inexperienced operators can plan an operation schedule with ease.

b. Start of OMP Project

Recently, the Operations Management Program (OMP) Project has started and the operating procedure manuals have already been completed at the Bataan TPP and Mak-Ban Geothermal TPP. At the Malaya TPP as well, the OMP Project should be launched for preparation of the operating procedure manual as soon as possible.

2) Daily Patrol and Inspections, and Routine Work

a. Daily Patrol and Inspections by Operators

At power plants in Japan, data loggers, monitoring instruments and alarm devices enable a reduced number of operators, so field patrol and inspections are carried out about 2 times per shift. To ensure the proper covering patrol a large area, patrol routes are predetermined and patrol check sheets are used. Also, a cross-check system between the operator and maintenance staff is implemented.

At the Malaya TPP, for hourly patrol and inspections, an hourly shift patrol checklist is distributed to the Sr. Control Operators in charge of monitoring and operation in the central control room, and to the Plant Equipment Operators conducting operation, patrol and inspections at the site.

At the Malaya TPP, facilities are deteriorated and monitoring instruments and alarm devices are not sufficient, hourly patrol and inspections are essential for the early detection of trouble or abnormality. However, priority patrol for the selected patrol items is possible.

For the safe and proper patrol and inspections, the patrol passages and lighting equipment must be improved and gas or steam leaking sections must be repaired. Efforts should be made not to leave troubled sections unrepaired for an extended period.

b. Stand-by Equipment Change-over Test and Other Routine Operations

The present test intervals for turbine routine test and change-over test of stand-by auxiliary equipment would incur no problem.

Since no check sheets are provided for routine operations, operator has to carry out the routine operations based on his experience and past records. For prevention of operational errors and for record of change-over test, check sheets for routine operation with procedure and precautions should be provided.

In addition, for comprehensive management of routine work, a monthly routine list should be provided to ensure implementation of prescribed routine operations.

3) Operation Shift System

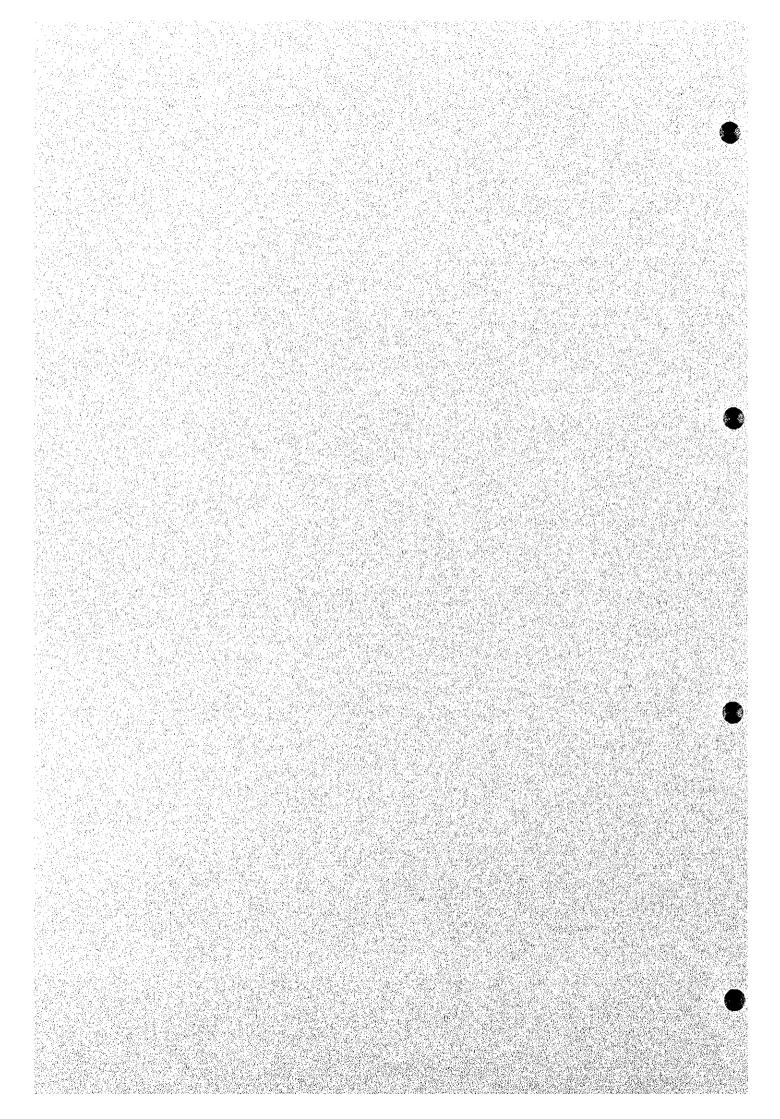
a. Operation Staff and Shift Operators

The Malaya TPP adopts a central control system, however, data logger is not equipped, and automation and labor-saving for power generating facilities have not been realized. In addition, control rooms for the gas turbine power plant and 230 kV substation are located separately with full-time operators. Eventually, a quite large number of operators is required.

The present staffing of shift operators would be no problem. However, it seems possible to reduce the number of staff by 3 persons (one person each from boiler, turbine and chemical) during normal operation, provided that the number of operators is increased at start-up and shutdown operations.

b. Circumstances of Duty Operation and Commuters' Bus Service

Most of the Malaya TPP employees live in the Metro Manila area and commute a long distance by shuttle bus. Furthermore, a midnight bus service is impossible because of safety conditions. Under these circumstances, the current shift schedule and bus schedule cannot be altered. Since traffic congestion in Metro Manila has become aggravated, a reduced commuting time cannot be expected. Therefore, it is necessary to lessen the commuting load by increasing bus operations and improving road conditions. As a fundamental measure, we also recommend that company housing quarters and dormitories be constructed in the vicinity of the Malaya TPP.



5.2.2 Maintenance Management

1) Maintenance Work Procedures

Both Administrative Procedures and Technical Procedures seem to have smaller numbers of items. Further improvement should be required.

2) Daily Maintenance

Simplified work can be achieved if the Preventive Maintenance Work Order (PMWO), used by the maintenance group of the power plant, is arranged in the form of a monthly routine list. Refer to Appendix 5-3.

PMWO items are insufficient and need to be improved.

3) Periodic Overhaul and Preventive Maintenance Plan

a. Observance of Periodic Overhaul Interval

Improved reliability cannot be expected if the periodic overhaul is constantly postponed due to the power supply situation, as has been the usual practice. It is important to establish set standards by overcoming various circumstances and to observe the periodic overhaul interval.

b. Periodic Overhaul Schedule and Manpower

Regarding the commencement of this periodic overhaul for the Malaya Unit No. 1, as the overhaul inspection for a power plant in the MMRC jurisdiction coincided, MSD manpower fell short and the MSD's arrival was delayed. Shutdown is meaningless if the periodic overhaul cannot be started even after the unit has been shutdown.

According to the 1995 Periodic Overhaul Plan, 2 units or more are to be overhauled concurrently most of the time throughout the year, and 2 months out of the year have 4 units or more undergoing concurrent overhauls. This schedule is too tight.

Efforts to disperse MSD manpower can be fully understood. It is quite possible, though, that a slight deviation to this plan could aggravate the already demanding schedule. Once determined, the starting time for each power plant should be observed barring an exceptional reason. A complete periodic overhaul can be expected only

with carefully planned preparation. Irregular adherence to the starting schedule may lead to insufficient preparation. As Figure 5-8 indicates, MSD's manpower shortage is obvious, therefore, reinforcement of MSD manpower shall be studied in the future.

c. Filing of Periodic Overhaul Records

Records of periodic overhauls, general repairs, improvement work, etc. shall be filed in chronological order as Equipment Maintenance Records. This will enable us to assume the progressive degree of deterioration, whereby future repairs can be predicted.

d. Implementation of Remaining Life Diagnosis

For the Malaya TPP, the remaining life of the units needs to be diagnosed, as the total operation hours have exceeded 100,000.

4) Periodic Overhaul Procedures and Implementation System

The main purpose for an equipment overhaul inspection is to inspect the inside of the equipment in detail to prevent accidents. The followings are recommended for such important equipment as turbines and boilers regarding their inspection intervals and procedures.

a) Formation of Periodic Inspection Standards, etc.

NPC does not have standards for periodic inspection items (indicated as (1) in the figure). To make preventive maintenance a fundamental policy, and to maintain reliability of the power generating facilities, it is imperative to formulate standards covering periodic inspection items and inspection procedures.

We recommend that overhaul inspection procedures for major equipment such as boilers, turbines and generators, for which the MSD is taking responsibility, be of improved contents and be included in the MMP (Managed Maintenance Program) of the power plant.

b) Creating witness standards for major equipment overhaul inspections

- Who witness the inspection? (Manager, Superintendent, Principal Engineer)

- Who approves the inspection results?
- c) Shortages of required equipment and tools for work should be remedied, and management methods for them should be established.
- d) Lodging facilities, transportation, etc. should be sufficiently prepared for those assisting in the periodic overhaul including MSD, to improve their motivation to work.
- 5) Subcontracting Methods for Periodic Overhaul and Preventive Maintenance Work

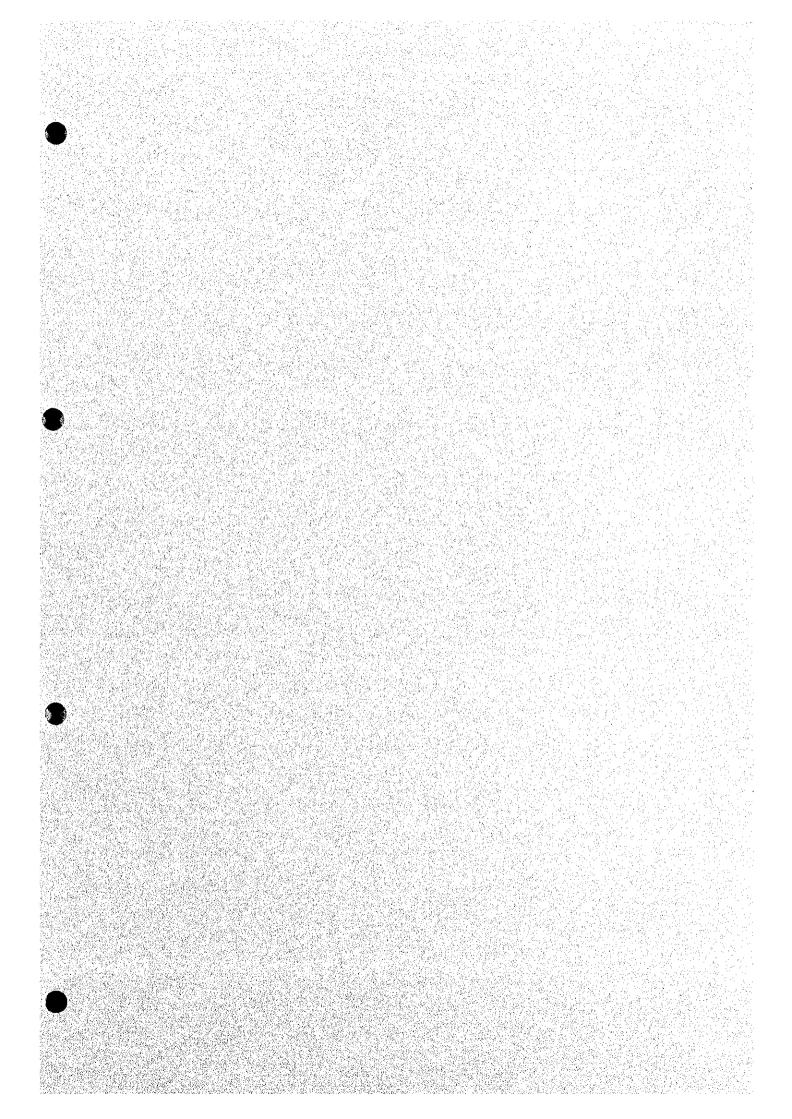
With regard to part repairs for major equipment such as turbines, boilers and generators, expansion of the subcontracting range, e.g. subcontracting to original manufacturers or hiring of instructors, is worth review from the aspect of a comprehensive guarantee.

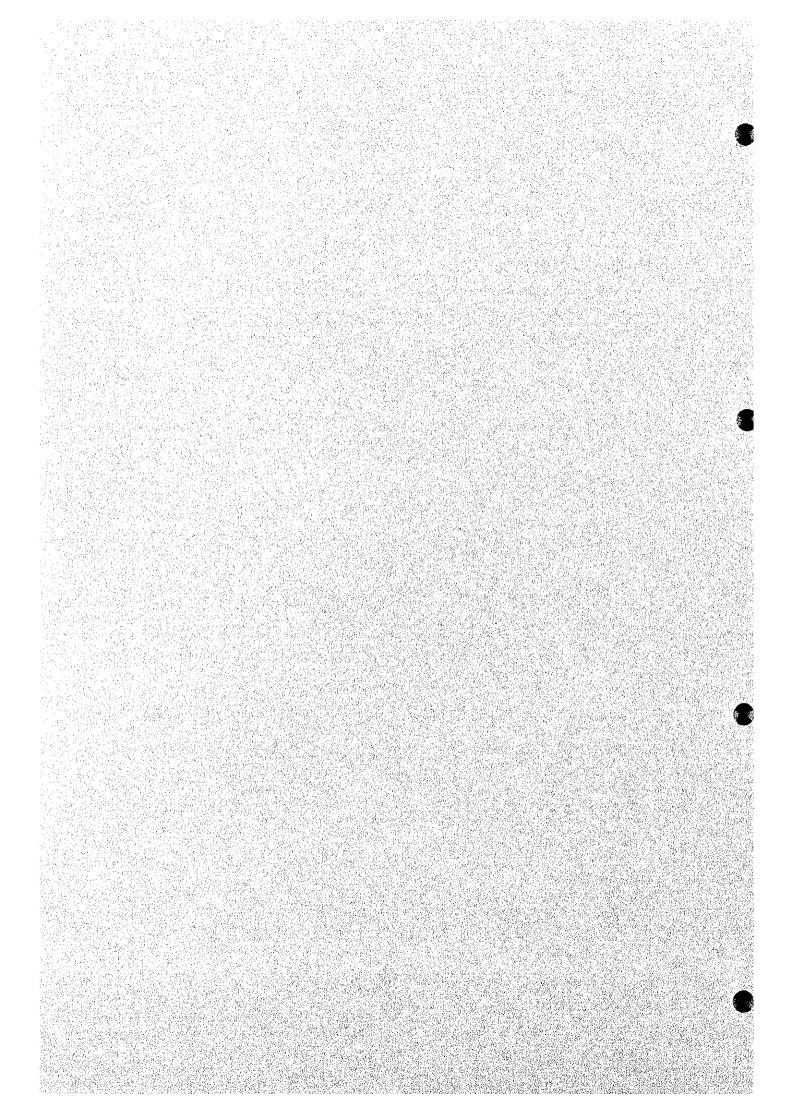
6) Management of Drawings and Data

As for drawings, a management system shall be established by setting drawing management standards for classification, modification, storing methods, etc. Ledgers shall be created based on these classification standards to facilitate search.

Regarding data, the data management standards shall be set for classification, sorting/disposal, storage years, circulation flow, etc. and at the end of each year, data shall be sorted and disposed of according to the respective stored years so that the data volume can be reduced.

1. Workers needed for Overhaul (xx MSD+power plant maintenance staff ---- Mech 138, Elec 51, Admin 25 MSD only (assumed (1) × 2/3) Ö ⊙ CM MC 1) Workers needed () is based on major overhaul in Japan 2) MSD Workers needed () is estimated at 2/3 of total wokers () based on overhaul at Malaya TPP. Nov. OW THE ಕ 3. Shortage of MSD workers NID O 2. Present MSD workers Figure 5-8 Number of Required Workers Based on the Overhaul Plan in 1995 4. Assumptions: Sep. Aug. Jul. Jun ğ May. Apr. . ₹ Mar. Interconnection Calacta 1 & 11 Feb. Jan. 38 350 100 300 200 200 300 8 150 150 75 30 909 500 4001 300 200 8 MAL₂ MAN 2 MAN BAT2 MAL BAT 1 BCF 1 SUC 1 Number Workers Required ੱਠ





5.2.3 Chemical Management

- 1) Water Quality during Operation
 - a. High silica content in the feed water of Malaya Unit No. 2.

Possible cause might be colloidal silica. Resumption of the coagulator is recommended.

- No data of copper contents
 Analysis of copper is recommended.
- c. High dissolved oxygen content

Although the current value is within the standard, a zero value would be desirable. Air leakage points around the condenser should be found out.

2) Analysis Frequency

Plant system water is frequently analyzed every 4 hours probably due to condenser tube leak. To reduce the frequency, the following countermeasures are necessary:

- a. To reduce condenser tube leak by thorough investigation and study, and
- b. To improve reliability of chemical instruments by training of maintenance staff and steady replenishment of spare parts

3) Deep Well (Raw Water)

Conductivity is high and water quantity is unstable. Demineralization of deep well water or Laguna Lake water by Reverse Osmosis method or by evaporation method should be studied. It will reduce the cost of chemicals needed for regeneration of resins.

4) Demineralizer

- a. SiO₂ meter must be repaired and put into operation as soon as possible.
- b. Outflow of colloidal silica should be watched.

5) Chemical Injection

A confirmation test should be performed to examine whether the sodium oxychloride (NaClO) injection into the condenser cooling water is effective at the current concentration and frequency. One testing method could be to change the injection concentration and frequency for a certain period and check the effects of chemical injection by inspection of condenser water box conditions.

6) Countermeasures for Condenser Leaks

- a. During periodic overhauls, remove the leaking tube to investigate the cause of the leak, and study countermeasures.
- b. Refer to literatures from other countries where water similar to Laguna Lake water has been used for condenser cooling water.
- c. Increase the water pressure at the rotary screen. After the pressure has been increased, conduct a test to confirm the effects of foreign matter removal. Removed foreign matters should be prevented from flowing into the condenser.
- 7) Record and save data concerning equipment preservation during shutdown.
- 8) Record and save water quality data for each step during start-up.
- 9) Inspections during Periodic Overhaul
 - a. Inspections of condenser hotwell, water box, deaerator, flash tank (M-1), drum (M-2) and turbine blade should be ensured.
 - b. Inspection results should be recorded and saved.

c. If any defective sections are found, investigate the cause and take appropriate measures.

10) Chemical Cleaning of the Boilers

Entrusting the work to a company which has experienced specialists is recommended.

11) Chemical Instruments and Sampling Rack

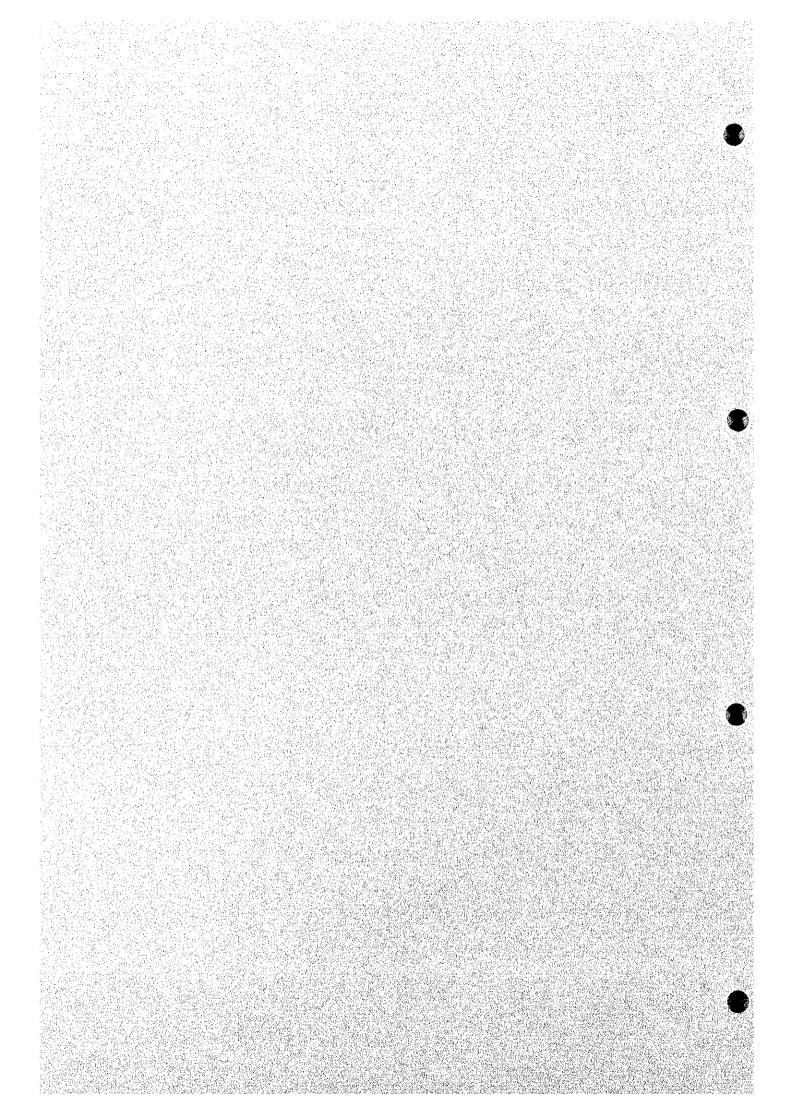
a. Improvement of the reliability of chemical instruments

We recommend training some personnel to take charge of instrument maintenance for all power plants. (It might be worthwhile to consider dispatching them to Japan for this training.)

- b. At the time of instrument procurement, sufficient quantities of parts, consumable, accessories, etc. should be delivered to allow for a quick response to any failures.
- c. At the time of instrument procurement, a manual with detailed troubleshooting instructions should be requested.
- d. Complete replacement is considered necessary for chemical instruments and sampling rack of Malaya Unit No. 2.

12) M-2 Boiler Continuous Blow

M-2 boiler blow of approximately 14 tons/h is carried out almost continuously. The necessity and reasons for such a large amount of the blow down water must be investigated. Probable cause is boiler water contamination due to condenser tube leak and/or colloidal silica in the make-up water.



5.2.4 Organizations of Power Plant and Relevant Management Office

1) Organization of Malaya TPP

a Operations Division

The Efficiency Control Group acts as staff of plant manager at present. Accordingly, a certain length of time is required for acquisition of records of boiler performance test, boiler leak test, AH performance test, fuel consumption, vibration test, etc. It is anticipated that actions of performance management and operations management will become quick when the Efficiency Control Group belongs to the Operations Division.

The operation manager has duties of management such as revision of operation manual, study of operations method, preparation of training plans and materials and preparation of operation shift schedule. The operations superintendents and principal engineers of daytime duties are expected to assist the operation manager in those management duties. The technical subjects must be studied for improvement of the efficiency and reliability of the plant through cooperation with engineers of other divisions.

b Maintenance Division

The thermal power plant maintenance at NPC are performed by MSD and the Maintenance Division of the power plant. MSD is in charge of overhaul and repair of major equipment, and the Maintenance Division of the power plant is in charge of daily maintenance and overhaul of auxiliary equipment.

The maintenance works of NPC are mainly performed by its own staff. Majority of maintenance ability such as maintenance staff, maintenance tools, machine tools, etc. are centralized to MSD. Accordingly, the overhaul works depend on MSD conditions of overhaul schedule and available manpower. There are some cases where the maintenance works cannot be performed as scheduled, and delay occurs sometimes.

It is considered that the present organization of the Maintenance Division of the power plant is of no problem. But it is necessary to study the organization and capacity of MSD.

2) Relevant Management Offices for Power Plant Operation and Maintenance

a. The Responsibility at the Time of Overhaul

The responsibility of NPC at the time of periodic overhaul is divided into many departments as described below.

- MSD is responsible for planning and implementation of overhaul of major equipment (including recording and preparation of report).
- The maintenance group of the power plant is responsible for planning and implementation of overhaul of minor equipment.
- The power plant is responsible for scheduling of the entire periodic overhaul.
- MMRC has the authorities for placement of orders for goods and works necessary for periodic overhaul. (However, the power plant has the authorities for up to 100,000 pesos.)
- ERD of NPC head office is responsible for quality assurance.

The plant manager has overall responsibility for periodic overhaul, even for the works done by MSD. On the other hand, the vice president of MMRC is generally responsible for power plants management.

b. Capability of MSD

MSD has roughly 210 employees, including 138 for mechanical work, 51 for electrical work, and others in support services.

According to the recent staff structure of the overhaul of MMRC thermal power plant use of many temporary employees by MSD, most of whom are helpers is observed indicating insufficiency in MSD's permanent staff, particularly of skilled engineers.

From this, we would like to put forth the following proposals to the NPC.

c. Proposals for MSD and MEC

a) Reinforcement of MSD Manpower

The current MSD manpower has the capability to perform just one major overhaul and one minor overhaul at a time. The shortage of manpower at MSD is obvious.

With the conventional practice of filling the shortage through subcontractors or temporary workers, lowered engineering quality is unavoidable. The following shall be studied in the future:

- For work where expertise is required, such as in disassembly of a turbine main unit, MSD should be reinforced so that the necessary number of groups can be secured by using only full-time MSD staff.
- Fostering of subcontractors
 Subcontractors equipped with reliable expertise in particular areas shall be nurtured to enhance working relations and communications with MSD.
- Support of maintenance personnel from other power plants
 Maintenance personnel from other power plants are alternately dispatched to support periodic overhauls. Any shortage after that is filled by temporary employees.

b) Improvement of MSD Technical Skill

Preparation of disassembly inspection procedures
During a periodic overhaul, the MSD is in charge of major equipment such as turbine main units and generators. The disassembly inspection procedures are of a summarized version, or there are no procedures, in which case the staff's experience is depended on.

For all major equipment detailed procedures should be prepared.

- Maintenance and improvement of technical skill
 OJT (on-the-job training) and collective training set for respective special fields shall be conducted for the purpose of nurturing of skilled workers.
- Preparations of equipment, tools and vehicles
 Equipment, tools and vehicles needed by MSD shall be completely prepared and their thorough management shall be targeted.

c) Privatization of MSD

MSD does not have enough manpower to execute periodic overhauls for the power plants within its jurisdiction. Privatization is also an effective measure to increase manpower and improve technical skill.

On the other hand, viewed from the power plant side, once corporation MSD become a private contractor, the instruction and direction system will be simplified and the responsibility will be clarified.

d. Privatization of MEC

Merits of privatization will be attained successfully by the effort of firm through pursuit of profit and competition with other similar firms.

In the case of a manufacturing shop, the management will be stable when diversification of business is attempted so that idle of equipment and manpower are eliminated and ideal operation factor of facilities is attained. Because of these reasons, privatization of MEC has some merits.

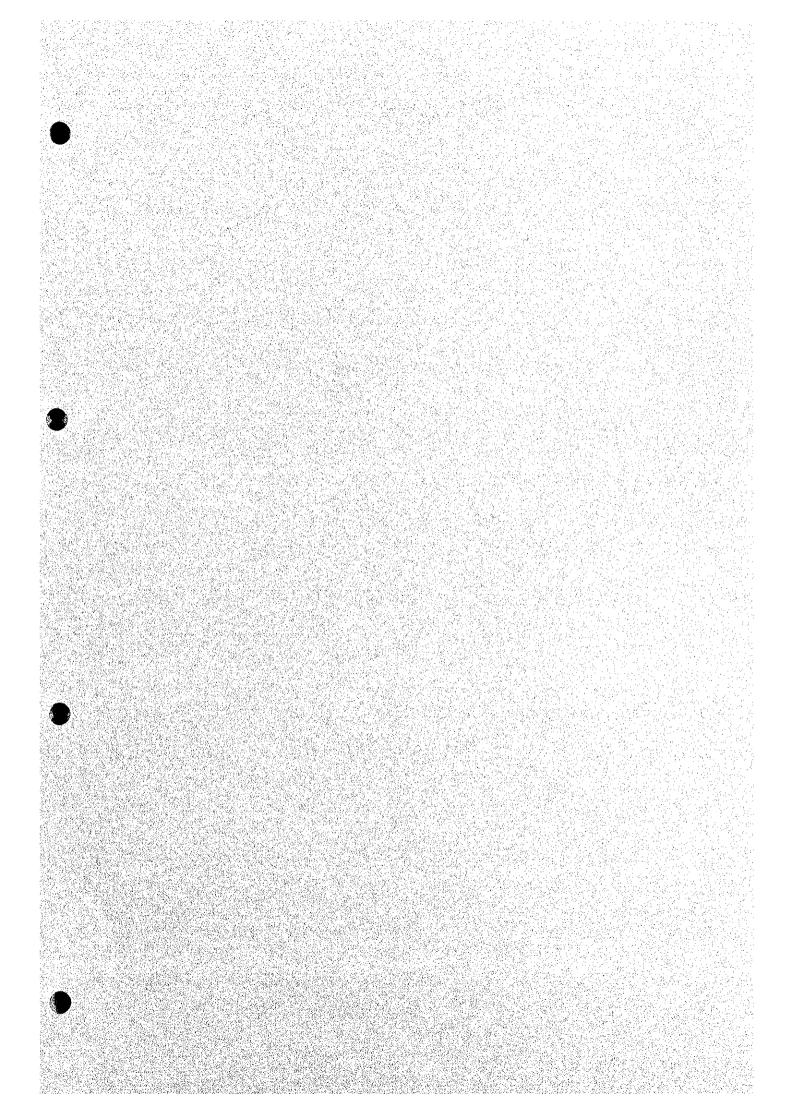
3) System of Responsibility and Authorities

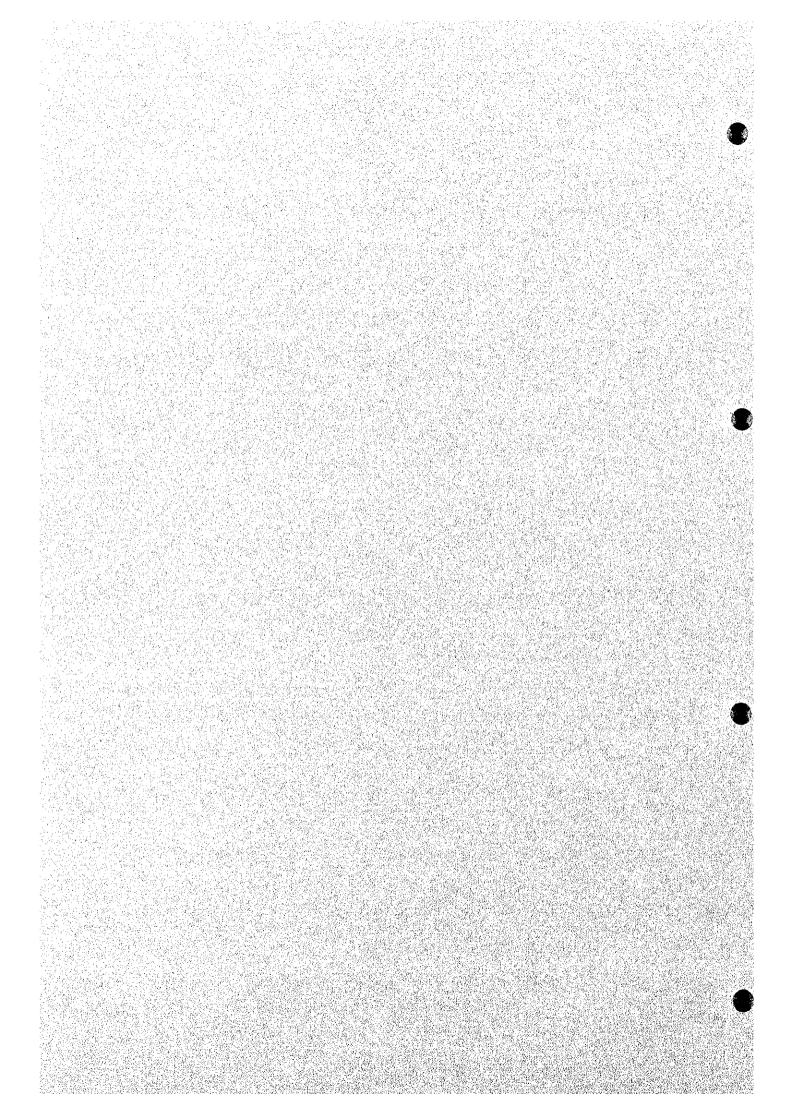
a. Increase of Authority of Plant Manager

Increase of authorized purchase amount of the plant manager should be studied.

The plant manager should be able to implement routine daily maintenance works or alike at his own responsibility.

Purchasing related to the above, including work order placement and in the case of emergency, should be quickened.





5.2.5 Equipment and Material Procurement and Management

1) Equipment and Material Procurement

a. Major Problems

The following are problems which have been indicated concerning purchase of equipment, parts and materials:

- a) Long time purchasing procedures
- b) Some parts for major equipment procured from a manufacturer other than the original manufacturer caused major problems later.
- c) Because prices are often a major determining factor in evaluation of the bid proposals, some purchased items are not of the required specifications or are inferior.
- d) Unsatisfactory items sometimes have been delivered due to incomplete or inappropriate specifications attached to the P.R. (Purchase Requisite).

b. Countermeasures

The NPC has made considerable efforts to rectify the above problems, yet some remain unsolved. Including efforts already initiated by the NPC, measures for future improvement are provided below:

a) Expansion of MMRC's authorized purchase amount

Formerly, for all purchases of 2 million peso or more, the Regional Center had to submit the application to the Material Management Dept. in the Head Office for their scrutiny and approval. Now that this has been amended so that the Regional Center will submit the application for approval directly to the Office of the President any amount in excess of authority of the vice-president of MMRC, and now that the Regional Center's authorized amount of purchase has been expanded to 5 million peso for sealed bidding and 10 million peso for public bidding, the required processing time for purchases is expected to be greatly reduced.

b) Speed-up of purchasing procedure

In view of the nature of public corporations, though, a reasonable amount of time may be required in the NPC for the internal approval procedure. Hence, it will be necessary to establish a system which, under given conditions, minimizes the processing time for purchase of parts and materials, and ensures punctual delivery. As the specific measures, we recommend the following:

- The parts and material purchasing plan included in the periodic overhaul plan currently being prepared by the Planning & Scheduling Section of the Power Plant should be made as accurate as possible, and the P. R. should be issued early enough to allow sufficient lead time for delivery. In order to facilitate this, the annual periodic overhaul must be completely and precisely executed, and the major work items to be executed in the overhauls during the next and 3 or so years should be clarified along with the necessary parts and materials.
- The Planning & Scheduling Section of the Power Plant must draw up the above-mentioned periodic overhaul plans and purchase plans in cooperation with the Maintenance Group of the power plant and MSD (Maintenance Services Dept.). In addition, the department must follow up on the progress of the purchase, and after an order has been placed, control the delivery through close communication and coordination with the Material Management Division of the MMRC.

c) Procurement from the original manufacturer

In order to avoid the problem of ordering parts for major equipment from manufacturers other than the original manufacturer, regulations designed to this effect are stipulated in Circular No. 88-34. It will be necessary to prevent any such problems through effective application of these regulations.

d) Improving P.R. and technical specification

The following countermeasures are recommended to prevent the problems of purchasing parts and materials not conforming to the specifications:

- In conjunction with the preparation of the Purchase Requisites and the attached technical specifications to be made in accordance with the purchase plans of parts necessary for overhauls, the Power Plant organization should be reviewed so that these important documents will be prepared by engineers who are thoroughly versed in the actual overhaul work at site as well as in the engineering design work, or thoroughly examined by similarly qualified engineers.
- In order to ensure the availability of such qualified engineers, OJT should be conducted, and job rotation with the Engineering Dept. of the NPC Head Office and MMRC should be implemented.

2) Equipment and Material Management

a. Major Problems

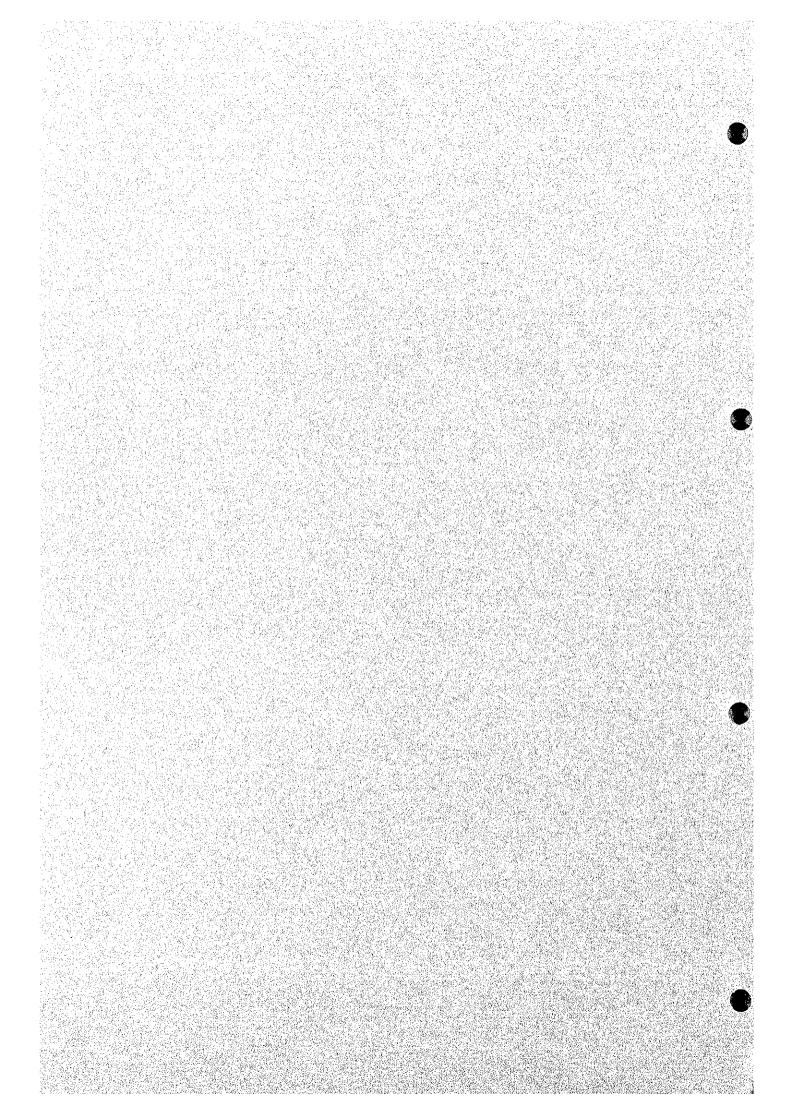
The following are the major problems we found with material management:

- All parts for overhaul recommended by major equipment manufacturer have been purchased and stored.
- Inventory seems excessive.
- Some large parts have been left outdoors and exposed to the elements.

b. Countermeasures

Below are the recommended countermeasures to the above problems:

- In order to avoid purchase of unnecessary parts and materials, review the items and quantities in the parts list recommended by the manufacturer. If any items are deemed to be unnecessary or excessive, or can be replaced with a ready-made or existing item, they can be deleted or decreased.
- In conjunction with the above, comprehensive rationalization of the inventory items and quantities should be studied.
- For purchase of large parts and materials, such as super heater panels and condenser tubes, delivery time should be adjusted to come immediately before the time the parts are needed. Outdoor storage should be avoided if at all possible.



5.2.6 Hiring, Education and Training of Personnel

1) Hiring of Personnel

a. Recruitment Guideline

It is recommended to adopt a new guideline of recruitment which allows periodic employment of once, or twice if difficult, a year in lieu of the current policy for employment on vacancy basis.

The current complements of all power plants under MMRC are to be reviewed. The number of personnel of the individual groups and sections are to be examined considering the following points.

- Difference in the power plant type: Coal-fired, heavy oil-fired, etc.
- Difference in the range and level of automation and remote control at the power plant
- Adjustment of complements to meet work load of power plant and other departments

After the number of personnel is reviewed, recruitment of personnel will be made with sufficiency ratio 100% to the new each complement. Those who were periodically employed will be educated and trained during the apprenticeship period, and they will not be counted as a part of the complement in this period.

b. Long-term Manpower Outlook

On the basis of the long-term manpower outlook, recruitment plan and education and training plans will be developed.

c. Casual Workers

Employment of casuals for periodic overhaul will be discontinued, and instead of that, subcontractors will be used for a part of the periodic overhaul work as permanent measures.

d. Method for Hiring

Currently there are few personnel rotation among power plants, and relevant offices such as Engineering Department of Head Office, MMRC, etc.

As a result, the number of personnel having actual experience of operation and maintenance at power plants is extremely few at the Engineering Department, etc. at the Head Office. On the other hand, there are few personnel who have experience in the engineering and design work for thermal power plants in MMRC and existing power plants accordingly. In other words, NPC organizations have weak points respectively.

As solution to this, we would make recommendation on the mutual rotation of personnel among relevant departments and on the revision of the recruitment system.

It is also recommendable that employment of college graduates for the thermal power groups jointly be made at Head Office for both MMRC and Head Office, subject to the following conditions:

- Consent of relevant vice presidents of MMRC and Head Office is needed for selection of new employee.
- All new employee of thermal power group will be divided and assigned for training to the power plants for a certain period of time.

2) Education and Training

a. Freshman Training (collective training)

Freshman training will be conducted in conjunction with the new recruitment system previously recommended.

A committee will be established for development of this guideline.

 Since NPC extends nation-wide, individual implementation, on Regional Center basis, of this new training system for newly hired personnel is recommendable for the ease of actual conduct. - The Head Office seems better to be combined with MMRC due to the geographical relation as far as new hiring of employees is concerned.

A plan for implementation of freshman collective training by each unit stated above will be developed. Whole company wide coordination and authorization are required.

Privatization of NPC is a current issue subject to the detailed deliberation.

b. Freshman Training at Power Plant

"Freshman collective training" will also be conducted once a year at each power plant at the time of recruitment. Decision on this policy solely depends on the Vice President of MMRC.

If the collective training on the Regional Center basis stated hereinbefore will be conducted, the training at the power plant can be the one for the purpose of orientation only.

In this case for example, the training will only include admonitory lectures by plant manager, briefing by principal engineers of each section on the operation system of the power plant, working regulations, outline of the power plant facility, functions and services of each section, flow of clerical services, etc. and observation tour of the power plant.

2. Position Training of Operators

Position training has to be regularly conducted according to the operators training program irrespective of the shifting of the personnel. It is therefore, to be built in the regular training system of NPC and is not to be designed as mere provisional training of the operator for filling the vacancy due to retirement or shifting.

The training implementation program will be developed for the purpose of training particularly young operators. A sample draft outline for such a program is given below.

a) Purpose

- Fast bring-up of freshmen to the capable level
- Learning multiple position

b) Trainee

Operators of second year to fourth year after entry to the company. All operators will be the trainee as a rule.

c) Positions to be Learned

- The target is to learn three positions, i.e., boiler, turbine and electrical control positions.
- Positions on both Units No. 1 and No. 2 should be learned.
- The already acquired positions are excluded.

d) Period

Two years or less as the target.

e) Implementation Plan

The superintendent will develop, in deliberation with the principal engineers, a training implementation program for the trainees selected among their subordinates (shift operators.) It is necessary to determine the basic concept of the implementation of the training program as the common policy prior to the start of the implementation to avoid inconsistency among the trainee groups.

f) Evaluation

Evaluation of training results will be made in coordination with the training program being developed by the Human Resources Department of NPC Head Office.

d. Installation of Simulator for Operation Training

A simulator will be installed at Batangas TPP as a part of the construction project of Unit No. 2. The simulator at Batangas TPP is recommended to be equipped with a training center and lodging facilities for collective training, if there is not any plan to equip a simulator with the existing NPC training center.

e. Job Rotation

Job rotation of operators will be implemented regardless of shifting for fill-up of vacancy. It will help morale enhancement of the young people. Job rotation will become feasible when the position training mentioned earlier is regularly conducted.

CHAPTER 6

SURVEY ON ENVIRONMENTAL ASPECTS

CHAPTER 6. SURVEY ON ENVIRONMENTAL ASPECTS

6.1 Environmental Policy of the Philippines

6.1.1 Administrative Organization of Environmental Protection

The Department of Environment and Natural Resources (DENR), the Laguna Lake Development Authority (LLDA) and the National Power Corporation (NPC) have the major roles in the environmental protection mandate as far as the operation of the Malaya Thermal Power Plant (Malaya TPP) is concerned. The following discussion gives a brief description of the various functions of these environmental offices.

1) The Department of Environment and Natural Resources (DENR)

The DENR is the lead governmental authority which administers and implements the various laws and regulations related to environment and the management of natural resources. A number of agencies and bureaus are attached to the DENR.

The Regional Office (one for each of the twelve administrative regions in the Philippines plus the National Capital Region of Metro Manila and the Cordillera Area Region, the mountainous indigenous tribal area of north central Luzon), the Environmental Management Bureau (EMB) and the Pollution Adjudication Board are the DENR offices which have key roles in the environmental function of the DENR.

a. The Environmental Management Bureau (EMB)

The main functions of the EMB which has its offices in Metro Manila is to give advice to the DENR Secretary on matters relating to environmental management, conservation and pollution control. EMB is also the reviewing agency of the DENR for submitted Environmental Impact Assessment/Statement studies from project proponents of Environmentally Critical Projects or for projects proposed to be located in Environmentally Critical Areas as defined by the DENR. (Note: Electrical power development projects of more than 10 MW are considered by the DENR as environmentally critical.) Establishment, formulation and/or revision of environmental quality standards and criteria are also major functions of the EMB.

b. DENR Regional Office

Each Regional Office is headed by a Regional Executive Director (RED) assisted by five (5) Regional Technical Directors (RTD) for each of the five sectors: Environment and Protected Areas, Mines and Geosciences, Land Research. The Malaya TPP which is located in the Municipality of Pililia, Province of Rizal is within the jurisdiction of the DENR-Region IV which holds an office in Manila.

The Environment and Protected Areas Sector (EMPAS) is mandated to enforce the air quality and water quality standards required by the DENR. The Environmental Quality Division under EMPAS is directly involved in environmental compliance and pollution control monitoring.

c. The Pollution Adjudication Board (PAB)

In 1987, the PAB was created under the Office of the DENR Secretary. The PAB is composed of the DENR Secretary as Chairman, two DENR Undersecretaries as may be designated by the DENR Secretary, the EMB Director, and three others to be designated by the DENR Secretary as members.

PAB's main function is to adjudicate the pollution cases as provided for by law. The EMB serves as the Secretariat of the PAB. The powers and functions of the PAB may be delegated to the DENR Regional Office in accordance with the rules and regulations that may be promulgated by the PAB.

2) The Laguna Lake and Development Authority (LLDA)

To achieve an optimum use of Laguna Lake (considered the largest lake in Southeast Asia having a surface area of 900 km²) and related land resources, the LLDA was created in 1968. Over the years LLDA's mandate was broadened. LLDA's functions also include powers pertaining the management of air quality, noise, etc. since 1982 with E. O. 927. Recently, however, LLDA's focus is on lake water quality management with the other concerns monitored by the DENR-Region IV Office.

The water quality monitoring and surveillance function of the LLDA necessitated the creation in 1979 of an Environmental Protection Division (EPD) in the Authority. The LLDA is a quasi-judicial authority and is mandated by law to perform its function as a basin-wide authority. However, LLDA does not have control over all projects and activities affecting the lake and its region due to overlapping areas of jurisdiction with other government agencies.

3) The National Power Corporation (NPC)

As operator of most of the electrical power plants in the country, NPC's policy is to ensure that its power plants operate in an environmentally sound manner. The Environmental Management Department (EMD) of NPC provides information and advice to NPC's top management on environment-related matters affecting their power plants and projects. The department also provides environmental technical support to the Operations group down to the plant level.

The EMD Manager at present reports to the Manager of the Development and Technical Services Group who reports to the Engineering Vice President.

EMD at present is staffed with seventy-nine (79) people. The Environmental Impact Assessment Division (EIAD) is responsible for the preparation of EIA reports and studies and applications for Authority to Construct and Permit to Operate pollution control systems with the DENR. The Environmental Monitoring Services Division (EMSD) is responsible for the monitoring of project implementation of Environmental Compliance Certificate requirements/ conditions for DENR-approved major power development projects. Monitoring and sampling at operating power plants which used to be a key function of EMSD has been devolved to the plant facility level beginning last year. At the plant level, DENR has also directed the designation of Pollution Control Officers (PCO) to handle the various environmental/pollution control functions. At the Malaya TPP, the Chemical Superintendent acts concurrently as the Pollution Control Officer.

6.1.2 Philippine Environmental Regulations and Standards

For the continued operation of the Malaya TPP located in the Municipality of Pililia, Province of Rizal, the following Philippine environmental regulations and standards are relevant:

1) Flue Gas Emission Control

a. DENR Administrative Order No. 14

DENR Administrative Order No. 14 or DAO 14 which took effect on April 24, 1993 promulgated both maximum emission limits/standards and ambient air quality standards for source specific air pollutants from stationary and industrial sources/operations. For the Malaya TPP, the air pollutant parameters of concern are sulfur dioxide(SO₂), nitrogen oxides as NO₂, carbon monoxide(CO) particulate matter and smoke.

Generally, the new emission standards are relatively more stringent compared to those promulgated in 1978 by the former Philippine National Pollution Control Commission.

b. DENR Memorandum Circular No. 29

The DENR Memorandum Circular No. 29 dated May 31, 1994, which was communicated to the NPC in early August 1994 practically exempts existing thermal (and geothermal) power plants located in non-urban areas from complying with the DAO 14-prescribed emission standards. Instead, compliance to the National Ambient Air Quality Standards (NAAQS) will now only be required by the DENR subject to certain conditions.

The new NAAQS for source specific air pollutants from industrial sources/operations are given in Table 6-1.

Table 6-1 National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial Sources/Operations

*Pollutants (a)	Concentration ug/Ncm	(c) ppm	Averaging time (min.)	Method of Analysis/ Measurement (b)
1. Ammonia	200	0.28	30	Nesslerization/ Indo Phenol
2. Carbon Disulfide	30	0.01	30	Tischer Method
3. Chlorine & Chlorine compounds expressed as C1 ₂	100	0.30	5	Methyl Orange
4. Formaldehyde	50	0.04	30	Chromotropic acid method or MBTH- Colorimetric method
5. Hydrogen Chloride	200	0.13	30	Volhard Titration with Iodine solution
6. Hydrogen Sulfide	100	0.07	30	Methylene Blue
7. Lead	20	e de la companya de l	30	AAS ^b
8. Nitrogen Dioxide	375 260	0.20 0.14	30 60	Griess-Saltzman
9. Phenol	100	0.03	30	4-Aminoantipyrine
10. Sulfur Dioxide	470	0.18	30	Colorimetric- Pararosaline
	340	0.13	60	
11.Suspended Particulate Matter - TSP PM - 10	300 200	- -	60 60	Gravimetric Gravimetric

Notes: (a) Pertinent ambient standards for Antimony, Arsenic, Cadmium, Asbestos, Nitric Acid and Sulfuric Acid Mists in the 1978 NPCC Rules and Regulations may be considered as guides in determining compliance.

⁽b) Other equivalent methods approved by the Department may be used.

⁽c) Ninety-eight percentile (98%) values of 30-min. sampling measured at 25°C and one atmosphere pressure.

c. National Ambient Air Quality Guidelines (NAAQG) and Standards

For the purpose of protecting the public health and welfare and reducing damage to property as well as providing an air quality management control strategy for emission limitation from mobile and stationary sources, location of commercial, industrial and residential facilities, and to assist in the promotion and use of an improved transportation system, the hereunder National Ambient Air Quality Guidelines in Table 6-2 are hereby established.

Table 6-2 National Ambient Air Quality Guideline for Criteria Pollutants

Pollutant	Short Term (a)			Long Term (b)		
	μg/Ncm	ppm	Averaging time	μg/Ncm	ppm	Averaging time
Suspended Particulate Matter (e) - TSP PM-10	230 (f) 150 (g)		24 hours 24 hours	90 60	•	1 yr. (c) 1 yr. (c)
Sulfur Dioxide (e)	180	0.07	24 hours	80	0.03	1 yr.
Nitrogen Dioxide	150	0.08	24 hours			
Photochemical Oxidants as Ozone	140 60	0.07 0.03	1 hour 8 hours	-		-
Carbon Monoxide	35 mg/Ncm 10 mg/Ncm	30 9	1 hour 8 hours		-	
Lead (d)	1.5	-	3 months (d)	1.0		l yr.

Notes: (a) Maximum limits represented by ninety eight percentile (98%) values not to be exceeded more than once a year.

- (b) Arithmetic mean
- (c) Annual Geometric Mean
- (d) Evaluation of this guideline is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.
- (e) SO₂ and Suspended Particulates are sampled once every six days when using the manual methods. A minimum number of twelve sampling days per quarter or forty eight sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.
- (f) Limits for Total Suspended Particulates with mass median diameter less than 25 50 µm.
- (g) Provisional limits for Suspended Particulates with mass median diameter less than 10 microns and below until sufficient monitoring data are gathered to base a proper guideline.

2) Effluent Control

In March 1990, DENR Administrative Order No. 34 (DAO 34) and DENR Administrative Order No. 35 (DAO 35) were promulgated by the DENR for the revised water usage and classification, water quality criteria and effluent regulations.

For the Malaya TPP, the water quality and effluent parameters of major concern are the physical parameters: pH, temperature, oil and grease, BOD, DO, COD, salinity and conductivity. Heavy metals such as chromium, copper, mercury, arsenic, other trace elements and other potentially toxic substances associated with fuel oil used at the plant and waste water treatment also impact on the main receiving water body, the Laguna Lake, particularly at points within the immediate vicinity of the Malaya TPP.

The Laguna Lake is a multi-purpose resource. Its uses are for aquaculture (fishpens), irrigation, cooling water for industries and for transport of fuel, raw materials and finished products. The lake also serves as a sink for various types of wastes generated by industrial, community and agricultural activities within the watershed.

The present water quality of Laguna Lake generally meets Class C standards (A.C.S. Borja, 1991). Thus, the effluent from the Malaya TPP will have to comply with the Classification C effluent standards prescribed in DAO 35. As provided for in DAO 34 (March 1990) Class C beneficial uses are for Fishery Water (for the propagation and growth of fish and other aquatic resources), Recreational Water Class II (boating, etc.) and for Industrial Water Supply Class I (for manufacturing processes after treatment).

Tables 6-3, and 6-4 indicate the effluent standards for select toxic/other deleterious substances and for conventional and other pollutants in Inland Waters Class C, respectively. Standards indicated in the tables are specified for both Old or Existing Industry (OEI) and for New/Proposed Industry or waste water treatment plants to be constructed (NPI).

Table 6-3 Effluent Standards: Toxic and Other Deleterious Substance
(Maximum Limits for the Protection of Public Health)

Parameter	Unit	Inland Waters, Class C		
		OEI	NPI	
		and the state of the state of		
Arsenic	mg/L	0.5	0.2	
Cadmium	mg/L	0,1	0.05	
Chromium (hexavalent)	mg/L	0.2	0.1	
Cyanide	mg/L	0.3	0.2	
Lead	mg/L	0.5	0.3	
Mercury (total)	mg/L	0.005	0.005	
PCB	mg/L	0.003	0.003	
Formaldehyde	mg/L	2.0	1.0	

Notes: (a) Except as otherwise indicated, all limiting values in this Table and as provided for in Section 4 of DAO 35 are maximum and therefore shall not be exceeded.

- (b) OEI means old or Existing Industry
- (c) NPI means New/Proposed Industry or waste water treatment Plants to be constructed.

Table 6-4 Effluent Standards: Conventional and Other Pollutants in Inland Waters Class C

Parameter	Unit	Inland Waters, Class C		
		OEI	NPI	
Color	PCU	200	150	
Temperature oC				
rise (max. rise in degree				
Celsius in RBW)		3	3	
pH (range)		6.0-9.0	6.5-9.0	
COD	mg/L	150	100	
Settleable Solids (1-hour)	mg/L	0.5	0.5	
5-Day 20°C BOD		80	50	
Total Suspended Solids	mg/L	90	70	
Oil/Grease (Petroleum				
Ether Extract)	mg/L	10.0	5.0	
Phenolic Substances	mg/L	0.5	0.1	
Total Coliforms	MPN/100 ml	15,000	10,000	

- Notes: (a) For color, discharge shall not cause abnormal discoloration in the receiving waters outside of the mixing zone.
 - (b) The COD limit generally applies to domestic waste water treatment plant effluent. For industrial discharges, the effluent standards for COD should be an a case to case basis considering the COD-BOD ratio after treatment. In the interim period that this ratio is not yet established by each discharges, the BOD requirement shall be enforced.

3) Noise Control

Section 78 of the 1978 Rules and Regulations of the National Pollution Control Commission prescribes ambient noise quality standards for classified general areas.

Table 6-5 indicate the maximum allowable noise levels in identified general areas. For the occupationally-exposed personnel at the Malaya TPP, excessive noise levels emanating from the turbine facilities/area could pose health hazards. Pumps, motors, air heaters and steam generating facilities are also expected to generate potentially excessive noise levels to workers continuously and directly exposed to such levels. Philippine occupational safety and health regulations provide that noise protective equipment be worn by the occupationally exposed workers.

Table 6-5 Environmental Quality Standards for Noise in General Areas

Category of Area	Daytime	Morning & Evening	Night Time	
AA	50 dB	45 dB	40 dB	
A	55 dB	50 dB	45 dB	
В	65 dB	60 d B	55 dB	
С	70 dB	65 dB	60 dB	
D	75 dB	70 dB	65 dB	

Notes: (a) Classification of General Areas

Class AA - Section or contiguous area which requires quietness, such as within 100 meters from school sites, nursery schools, hospitals, and special homes for the aged.

Class A - A section or contiguous area which is primarily used for residential purpose

Class B - A section or contiguous area which is primarily a commercial area.

Class C - A section primarily reserved as a light industrial area.

Class D - A section which is reserved as a heavy industrial area.

- (b) The standards are applied to the arithmetic median of at least seven readings at the point of maximum noise level
- (c) 24-Hour Period Division

Morning - 5:00 A.M. to 9:00 A.M.

Daytime - 8:00 A.M. to 10:00 P.M.

Evening - 6:00 A.M. to 10:00 P.M.

Nighttime - 10:00 P.M. to 5:00 P.M.

(d) For point or fixed sources of pollution, the noise level shall be measured at the boundary line of the factory site or establishment, or at least 30 meters from the boundary of a construction site.

4) Waste Disposal

The Malaya TPP generates waste treatment waste waters, oily wastes, fly ash, soot, and other chemical-laden wastes which when discharged into Laguna Lake, the receiving water body, could include potentially dangerous substances such as metals like chromium and copper. In one of its chemical forms, chromium (hexavalent) is very toxic to fish, animals and people.

DENR Administrative Order No. 29 (DAO 29) which provides the implementing rules and regulations of Republic Act 6969, otherwise known as the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990, stipulates that the waste generator shall have to notify the DENR on the type and quantity of wastes generated with the same information provided to the DENR on a quarterly basis. The required obligations and responsibilities of waste generators are detailed in Section 26 of DAO 29 shown in Attachment-2.

5) Environmental Standards of NPC and LLDA

As a rule, NPC follows /complies with the environmental regulations and standards of the DENR, the Philippines' highest environmental authority. Likewise, the LLDA which has water quality management jurisdiction of Laguna Lake requires compliance with the DENR standards and regulations specifically DAO 34, DAO 35 and DAO 29.