

# Environmental Assessment Report

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Summary Initial Environmental Examination  
Project Number: 41936  
November 2007

## Republic of the Philippines: Acquisition and Rehabilitation of the Masinloc Coal-Fired Thermal Power Plant

Prepared by Masinloc Power Partners Company for the Asian Development Bank (ADB).

The summary initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

## CURRENCY EQUIVALENTS

(as of October 2007)

Currency Unit	–	Peso/s (P)
Pesos1.00	=	\$0.0222
\$1.00	=	P45.000

## ABBREVIATIONS

AES	–	AES Corporation
APESB	–	AES Philippines Energy Supply Business
ADB	–	Asian Development Bank
BOD	–	biological oxygen demand
CEMS	–	continuous emission monitoring system
DO	–	dissolved oxygen
EPIRA	–	Electric Power Industry Reform Act
ESP	–	electrostatic precipitators
EIA	–	environmental impact assessment
EMS	–	environmental management system
EMB-	–	Environmental Management Bureau-Department of
DENR	–	Environment and Natural Resources
EMD	–	Environmental Management Department
IFC	–	International Finance Corporation
MPPC	–	Masinloc Power Partners Company
NO <sub>x</sub>	–	nitrogen oxides
NPC	–	National Power Corporation
SO <sub>2</sub>	–	sulphur dioxide
SIEE	–	summary initial environmental examination
TRANSCO	–	National Transmission Company
TSS	–	total suspended solids

## WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
kV	–	kilovolt
bgl	–	below ground level
m	–	meter
mg/l	–	milligram per liter
mg/Nm <sup>3</sup>	–	milligram per normal cubic meter
MW	–	megawatt
pH	–	potential of hydrogen

## NOTES

- (i) The fiscal year FY ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends.
- (ii) In this report, "\$" refers to US dollars.

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## I. INTRODUCTION

1. The Masinloc coal-fired thermal power plant is a 600 megawatt (MW) base-load pulverized coal fired power plant. It is located in the municipality of Masinloc, Province of Zambales, about 250 kilometers (km) northwest of Manila. The plant consists of two 300 MW coal fired thermal power units, each with an identical drum type forced re-circulation boiler. The plant began operations in 1998. It covers an area of 137 hectares (ha).

2. This summary initial environmental examination (SIEE) presents an assessment of environmental issues relating to the Acquisition and Rehabilitation of the Masinloc Coal-Fired Thermal Power Plant Project. The SIEE was prepared in accordance with the *Environment Policy* (2002) and *Environmental Assessment Guidelines* (2003) of the Asian Development Bank (ADB). The design and construction of the Masinloc Plant was financed by two ADB public sector loans: Sixteenth Power (Masinloc Thermal Power) Project and Northern Luzon Transmission and Generation Project. The National Power Corporation (NPC) was the executing and implementing agency for both loans. The Sixteenth Power (Masinloc Thermal Power) Project funded the supply, installation, construction, testing and commissioning of a 300-MW coal-fired power plant including harbor facilities under a single turnkey contract, and the Northern Luzon Transmission and Generation Project funded, among other components, the installation of the second 300 MW generating set at the Masinloc power plant (stage II). In 1995, the project was classified as environmental category A.

3. The Masinloc plant is being privatized through international competitive bidding as part of a privatization program being carried out under a comprehensive sector reform law, the Electric Power Industry Reform Act (EPIRA). The Masinloc plant is expected to be run primarily as a merchant plant, selling electricity through the bid-based wholesale electricity spot market. ADB, together with the International Finance Corporation (IFC) and other lenders, is providing loans to Masinloc Power Partners Co. (MPPC) a subsidiary of AES Corporation, USA (AES), to cover part of the costs of privatization of the Masinloc plant. The rehabilitation works will be carried out over 2 years. The rehabilitation efforts will focus on returning the existing plant systems to the original equipment manufacturer's specifications. Major plant operating repairs will be carried out on the safety devices and systems, the ash collection and transport system, the boiler feed pumps, and the circulation pump. The proposed rehabilitation work aims to bring the plant's operating and environmental performance back to the original design standards and does not involve any expansion or additional facilities. The Project will not result in significant environmental impacts. Therefore, it is reclassified as environmental category B, requiring an initial environmental examination (IEE). The environmental performance audit and remedial action plan containing the corrective measures are regarded as the Project's IEE.

4. The environmental impact assessment (EIA) for the Masinloc plant was prepared by the Environmental Management Department (EMD) of the National Power Corporation (NPC) and was approved on December 18, 1992 after review by the Environmental Management Bureau of the Department of the Environment and Natural Resources (EMB-DENR) and the issuance of the environmental compliance certificate. No further environmental assessment requirement or clearance is needed for a take over of the physical assets, maintenance and operation of the plant.

5. The SIEE is based on the *Environmental Due Diligence Assessment Report*, October 2007, prepared by Environmental Resources Management (ERM) for MPPC and additional information from AES. The SIEE also covers a remedial action plan for significant environmental

issues that need to be addressed urgently. The plan will improve the operating efficiency, reduce environmental emissions and increase the health and safety standards of the plant.

## II. DESCRIPTION OF THE PROJECT

6. AES<sup>1</sup> is the project sponsor and fully owns MPPC which will implement the Project. MPPC will receive commercial, financial, and risk management support from AES Philippines Energy Supply Business (APESB), an energy marketing company established by AES.

7. The Project is situated at Barangay Bani in Masinloc, and occupies onshore and reclaimed lands, measuring 149 ha and foreshore lands measuring 6 ha. Site components include: (i) a powerhouse consisting of a turbine house, a heater bay and a control house; (ii) a boiler, pulverizer, draft system and stack; (iii) cooling water facilities; (iv) a coal handling system; (v) an ash handling facility; and (vi) dormitory and housing amenities.

8. The plant uses refined coal from Australia, the People's Republic of China and Indonesia. It occasionally uses locally mined coal. Coal is received at an offshore jetty, transported onshore via a 1 km conveyor system, and stored in four stockyards with a capacity of 270,000 tons. Crushed coal from the stockyards is transferred to coal silos, to pulverizers for final grinding, and then to the boilers. Fuel oil is used as start-up fuel and has increasingly been used as supplementary fuel at the plant. The power generated is delivered at the plant's 230 kilovolt (kV) switchyard connected to the transmission system of the National Transmission Company (Transco).

9. Seawater from Oyon Bay, which is north of the plant, is used for cooling. Fly ash is collected by electrostatic precipitators (ESP) and bottom ash is collected by the boiler's bottom hopper, before being transferred to an onsite ash disposal area. Fly ash has historically been sold to a third party broker for use in cement manufacturing and this is expected to continue under MPPC.

## III. DESCRIPTION OF THE ENVIRONMENT

10. The plant is located on flat alluvial surfaces extending into sandy beaches. The flat lowlands are overlaid with residual and alluvial deposits underlain by crudely bedded sandstone, mudstone and siltstone. The terrain is hilly, capped with weathered materials consisting of medium to fine sandy materials. The nearest surface water bodies include the Luis River about 1 km north of the plant, Oyon Bay, and the South China Sea. Groundwater is located 1 to 2.5 below ground level (bgl) and influenced by tidal movement, with general flow toward Oyon Bay and the South China Sea.

11. Before construction of the plant, the land was mainly agricultural, with mango trees and occupied by coastal communities. About 86 families were relocated to a resettlement village 1.5 km from the plant. About 11 hectares of the site were reclaimed using land-based soils from the area. Present land use includes agricultural and rural residential. The nearest school is located about 500 m southeast of the project site.

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<sup>1</sup> AES is a global corporation that is also engaged in exploring and promoting alternative energy businesses such as wind generation, supply of liquefied natural gas, greenhouse gas reduction activities, and the application of new energy technologies.

12. In the process of acquiring the plant, MPPC carried out an environmental performance audit to review existing plant operations and develop a remedial action plan. This audit comprised interviews with relevant site personnel, a review of available documentation, and a site tour. Environmental sampling and analysis of wastewater and groundwater from the site was carried out to identify potential presence of contaminants from the operation. The significant environmental issues that were identified were as follows.

### **1. Air emissions**

13. Currently, the ESPs and continuous emission monitoring systems (CEMs) are not functioning as designed. Air emissions exceed standards for particulate matter established by EMB-DENR, which represents a health hazard both to workers and to residents in the surrounding areas. In addition, sources of fugitive air emissions are associated with failure to properly maintain coal conveyors, ash silo hoppers, dump trucks and coal sprinklers. This needs to be resolved by buying parts and spares for the ESPs and installing them by April 2008. For the CEMS, a dust density meter will be procured and the motherboard replaced by April 2008.

### **2. Wastewater**

14. The wastewater treatment plant used for process water is not currently operational due to a lack of maintenance. Thus, untreated wastewater is being discharged directly into Oyon Bay. The faulty pump and associated parts will be replaced.

### **3. Stormwater**

15. Storm water discharges exceed Philippine effluent discharge standards for oil and grease, and chemical oxygen demand. This is probably the result of a combination of factors including poor waste and chemical handling practices and storage arrangements at the plant including those associated with coal and ash as well as other fuels and chemicals. Stormwater drains are substantially damaged and blocked with ash.

### **4. Material Handling and Storage**

16. Chemical and intermediate oils and waste drums are stored in open areas and have not provided with secondary containment, labels or hazard warning signs. Drums are in a poor condition and staining has been observed at these storage areas. Current materials storage and handling procedures pose risks to employees' health and could result in soil and groundwater contamination as well as contamination of storm water and the marine environment.

### **5. Waste Management**

17. The resulting stockpiling from inadequate ash management has resulted in ash being deposited, dumped or blown in areas around the bottom and fly ash silos and along the routes to the ash disposal area. It has become a source of fugitive air emissions as well as discharges to the marine environment. Existing ash piles around the plant need to be cleared as they are also a source of fugitive air emissions.

18. According to the environmental compliance certificate update of December 2001, the disposal area was constructed with an impervious lining. However, drawings indicate that the installed lining system does not cover the entire ash disposal area. In addition, solid wastes are

dumped and waste-burning is reported in the ash disposal areas. Limited information is available on the nature of the waste and its location within the ash disposal area. Given the incomplete lining, the presence of hazardous wastes could represent a risk to human health and local ecology.

19. Other engineering controls such as access roads and surface water controls are inadequate, rendering areas of the ash disposal area waterlogged and inaccessible. The ash disposal area has not been managed appropriately, and ash materials have been dumped in a haphazard manner, e.g., along haul roads and around the ash disposal area. The areas have not been leveled.

20. Waste oils, resins and waste containers such as drums and carboys are stored around the plant in open areas. These wastes represent a potential source of soil and groundwater contamination.

## **6. Marine Impacts**

21. Coal and ash have found their way into the Masinloc and Oyon Bays through the storm drainage channels.

23. The inappropriate storage and handling of chemicals and wastes could have resulted in contaminated soil and groundwater. Depending on the nature and extent of such contamination, remedial action may be required to safeguard human health and ecologically sensitive receivers including Oyon Bay.

## **7. Contaminated Groundmass**

22. The inappropriate storage and handling of chemicals and wastes could have resulted in contaminated soil and groundwater. Depending on the nature and extent of such contamination, remedial action may be required to safeguard human health and ecologically sensitive receivers including Oyon Bay.

23. Potential sources of contamination include: (i) storage of solvents, resins and waste drums on paved and unpaved areas; (ii) storage of scrap metal and other wastes adjacent to the stormwater drain west of the plant; (iii) staining alongside west wall of the water treatment control house; (iv) ash dumped on unpaved and open ground close to fly ash areas; (v) spillage of lubricating oils on the access road at the northern boundary of the coal stockpile area; (vi) the unpaved and open ground around the transfer tower is stained black with oil and coal; (vii) seawater intake pumps with visible leakage of oil; (viii) there is inappropriate waste disposal, such as burning, in the ash disposal area; (ix) hazardous materials storage warehouse; (x) underground petroleum storage with underground piping, reportedly not in use for 2-3 years; and, (xi) leakages from the waste oil tank located on unpaved area between the road and the surface water drain.

## **IV. INSTITUTIONAL REQUIREMENTS**

24. Upon taking ownership of the facility, MPPC will be responsible for rectifying the environmental issues identified during the environmental performance audit through implementation of a remedial action plan. All remedial actions will be completed within 2 years. This will be done with support from the existing environmental team at the plant, consultants as well as technical and managerial support from the AES Group. MPPC will liaise with the DENR to ensure the work meets the environmental requirements of the ECC and government. The

work will be structured under a comprehensive environmental management action plan (EMAP), which includes corrective as well as mitigating measures for significant environmental impacts due to plant rehabilitation and continued operations. MPPC will develop and carry out formal documented systems for managing their environment-related activities. It will also update the EMAP as necessary and develop more detailed management plans especially for waste management and air emissions to be submitted for ADB review. The EMAP is summarized in Appendix 1 and an ash management action plan containing proposed remedial actions for ash emissions is summarized in Appendix 2.

25. Environmental monitoring is being conducted by the Environmental Monitoring and Services Division (EMSD) of NPC. A multipartite monitoring team has been formed in coordination with EMB-DENR and is tasked to monitor the environmental conditions of the plant and the compliance of the Project with the conditions of the ECC. The team is composed of representatives from the NPC, local government units, local communities, nongovernment organizations (NGOs), and EMB-DENR. The environmental monitoring program (EMP) covers environmental, ecological and other monitoring activities to determine the plant's compliance with the regulatory requirements of the DENR, the Department of Health, and the Department of Labor and Employment on environmental and occupational health standards and guidelines. Environmental quality monitoring involves quarterly sampling and analyzing air and water including groundwater wells. Ecological monitoring includes but is not limited to corals, seagrass, fish and other marine resources, mangrove inspection and replanting. These are conducted twice a year. Other monitoring activities include light fuel oil analysis, marine and river sediment monitoring, solid waste monitoring, soil quality monitoring, and social monitoring. The required environmental monitoring reports including the self-monitoring reports are submitted through the Multipartite Monitoring Team (MMT). The EMP will be adequate to cover the Project and will continue under MPPC.

26. In general, MPPC commits to improve the environmental, health, and safety aspects of the plant so they meet AES's rigorous global standards. A summary of key environmental standards that will be applied to the plant is shown in Tables 1 and 2. MPPC will also implement the AES safety management system and comply with AES safety standards. MPPC will carry out a safety audit within 12 months of the takeover and once every 3 years subsequently as part of the AES safety audit program.

**Table 1: Air Emissions**  
(maximum stack emissions level in mg/Nm<sup>3</sup>)

Pollutants	World Bank <sup>a</sup>	Philippines <sup>b</sup>	AES
SO <sub>2</sub>	2,000	1,500	1,500
NO <sub>x</sub>	750	1,000	750
Particulate matter	100 <sup>c</sup>	200	150 <sup>d</sup>

AES = AES Corporation; mg = milligram; NO<sub>x</sub> = oxides of nitrogen; Nm<sup>3</sup> = normal cubic meter; PM = particulate matter; SO<sub>2</sub> = sulfur dioxide

Notes: <sup>a</sup> Based upon the World Bank guidelines for rehabilitation of existing thermal power plants (*Pollution Prevention and Abatement Handbook, 1998*)

<sup>b</sup> Based upon the Clean Air Act

<sup>c</sup> Up to 150 mg/Nm<sup>3</sup> may be permitted in exceptional cases

<sup>d</sup> Technological options will be reviewed to establish a cost effective solution that will enable the plant to comply with World Bank guidelines

Source: AES Corporation.

**Table 2: Wastewater Discharges**  
(mg/l except for pH and temperature)

Parameters	World Bank <sup>a</sup>	Philippines <sup>b</sup>	AES
pH	6 – 9	6 – 9	6 – 9
TSS	50	150	50
Oil and grease	10	10	10
Temperature increase	≤3 <sup>o</sup> C	≤3 <sup>o</sup> C	≤3 <sup>o</sup> C
COD	250	200	200
BOD5	50	100	50

BOD5 = biological oxygen demand; COD = chemical oxygen demand; pH = potential of hydrogen; TSS = total suspended solids

Notes: <sup>a</sup> Based on the World Bank standards for new thermal power plants (*Pollution Prevention and Abatement Handbook*, 1998)

<sup>b</sup> Based on DENR Administrative Order 1990-35

Source: AES Corporation.

27. MPPC will implement and maintain an environmental management system (EMS) that is consistent with ISO 14001. The goals of the EMS are to achieve greater management focus on important environmental risks; more efficient environmental work processes that are fully integrated into broader business planning and decision making; better line management ownership for environmental performance; and improved environmental results.

## V. REMEDIAL ACTION PLAN

28. Initially, MPPC will implement a remedial action plan that contains corrective measures to address the key issues and actions identified during the environmental performance audit. The elements of the plan are described as follows.

### A. Permitting

29. A permit register will be established to record all obtained permits by December 2007. MPPC will ensure that environment-related permits are obtained and renewed on schedule.

### B. Air Emissions

30. The plant complies with sulfur dioxide stack emission requirements by limiting coal sulfur content to 1%. Nitrogen oxide emission limits are met by controlling boiler combustion. Although ESPs and fly ash conveying system are not functioning because of the poor condition of the equipment, once the parts are replaced, it is expected that emissions standards for particulate matter of 150 mg/Nm<sup>3</sup> can be achieved. The ESP parts will be purchased and installed by April 2008.

31. MPPC evaluated the technical feasibility and cost-effectiveness of meeting the World Bank guidelines for new plants of 50 mg/Nm<sup>3</sup> for particulate matter. However, they concluded that full compliance could not be achieved because of the prohibitive cost. Detailed studies are ongoing to determine the particulate emissions level that can be achieved, with the expectation that levels of 150 mg/Nm<sup>3</sup> can be met as provided for in the World Bank guidelines for rehabilitation of existing thermal power plants,. However, MPPC will target 100 mg/Nm<sup>3</sup>.

32. As the CEMS are also not functioning as designed, the equipment will be repaired by April 2008 to ensure accurate and consistent measurements of stack emissions. Fugitive emission sources, such as coal conveyors, ash silo hoppers, and coal stockpile sprinklers require repair and ongoing maintenance. This will be completed by May 2008.

### **C. Wastewater and Storm Water Discharge**

33. The waste water treatment plant requires replacement of equipment and other maintenance to be properly operational. A full condition survey will be undertaken and relevant parts will be purchased and installed by April 2008. Storm water discharges from the site exceed Philippine effluent discharge standards for oil and grease and chemical oxygen demand. These are probably the result of waste handling practices at the plant and blockage of storm water drains by ash. Storm-water drains will be fully operational and protected from contamination sources by May 2008.

### **D. Material Handling and Storage**

34. Materials and waste storage will be improved with dedicated, labeled, covered and contained storage areas provided. Storage areas will be constructed by April 2008.

### **E. Waste Management**

35. The process of onsite movement of ash and the collection and offsite use of fly ash is hampered by contractor capacity and outdated procedures, resulting in ash stockpiling, contamination of runoff, and fugitive dust. A contractor will be identified by January 2008 who will provide the necessary services. Existing ash piles around the plant will be cleared by October 2008. Review of the ash disposal area engineering, access routes and drainage will be carried out under a re-engineering plan that will be completed and implemented by end of December 2008. The engineering plan will include dividing the area into sections, covering the already filled parts with topsoil and revegetating these parts with appropriate plant species. Domestic solid waste is currently being dumped in the ash disposal areas. A solid waste management program, including associated segregation, recycling and disposal arrangements will be completed and implemented by February 2008.

### **F. Marine Impact**

36. Releases of coal and ash have entered Masinloc and Oyon Bays through the storm drainage system. A marine ecological assessment study is being planned to assess any environmental damage that has occurred as a result of the operation of the plant and recommend remedial measures. This study will be completed by December 2007. The plant's Oil Spill Contingency Plan will be updated by May 2008 and spill clean up equipment will be procured in areas such as the coal handling jetty.

### **G. Contaminated Groundmass**

37. Inappropriate storage and handling of chemicals and wastes at the plant could have resulted in contamination of soil and groundwater as well as of ecologically-sensitive receiving areas, including Oyon Bay. An investigation of soil and groundwater contamination will be conducted to identify the nature and extent of contamination as well as the need for any remedial action. A remedial plan, if required, will be available in June 2008.

38. The audit identified areas where existing management procedures and capabilities could be improved to minimize the risk of noncompliance as well as studies required in identifying impacts on the surrounding environment and human health. An EMS would provide the framework for ensuring compliance with applicable regulations. The EMS will be developed and implemented by February 2008. Monitoring the plant's impacts is a government requirement and will continue.

## **VI. FINDINGS AND RECOMMENDATIONS**

39. Due diligence findings indicate that proposed rehabilitation measures reflected extensive maintenance needs, ranging from replacement of much needed spares to an overhaul of plant grounds and equipment. Such maintenance would address the environmental issues that require attention and include air emissions, wastewater, storm water, material handling and storage, waste management, marine impacts and contaminated groundmass. Aspects that need to be addressed urgently include ESPs to reduce the particulate matter emissions, wastewater and storm water collection and treatment and ash management system. All these issues will be addressed by corrective measures under the comprehensive EMP.

## **VII. CONCLUSIONS**

40. All environmental issues and impacts, corrective and mitigating measures have been identified for the Project. The environmental performance audit and remedial action plan deemed as the Project's IEE are sufficient for the Project.

## ENVIRONMENTAL MANAGEMENT ACTION PLAN

Issues and Actions	Schedule
<p>(1) Permits</p> <ul style="list-style-type: none"> <li>a. Develop permit register</li> <li>b. Maintain permits by obtaining and renewing permits as required by issuing authorities</li> </ul>	<p>(1) a to be completed by December 2007  (1) b to be carried out during the project operational phase</p>
<p>(2) Air Emissions</p> <ul style="list-style-type: none"> <li>a. Repair ESPs and fly ash conveying system by replacing nonoperating parts (e.g., basal valves, filters)</li> <li>b. Confirm compliance with applicable standards with continuous emission monitoring systems (CEMS)</li> <li>c. Repair the CEMS by replacing the dust meter and faulty motherboard and ensure the CEMS are operable</li> <li>d. Check and/or calibrate CEMS performance/reliability</li> <li>e. Repair equipment to control sources of fugitive emissions (e.g., coal conveyors, ash silo hoppers, dump trucks, coal sprinklers)</li> <li>f. Establish maintenance schedules for equipment</li> </ul>	<p>(2) a to be completed by April 2008  (2) b to be discussed and agreed between ADB and MPPC  (2) c and d to be completed by March 2008  (2) e and f to be completed by June 2008</p>
<p>(3) Wastewater Discharge</p> <ul style="list-style-type: none"> <li>a. Repair waste water treatment plant (WTTP) by replacing nonoperational parts (e.g.s pumps)</li> <li>b. Conduct regular maintenance of WTTP</li> <li>c. Inspect, unblock, and repair damaged areas of the storm water drainage systems</li> <li>d. Maintain storm water drains by proper waste handling, protecting from contamination sources and preventing ash blockage</li> </ul>	<p>(3) a to be completed by April 2008  (3) b to be carried out during project implementation phase  (3) c to be completed by May 2008  (3) d to be carried out during project implementation phase</p>
<p>(4) Material Handling and Storage</p> <ul style="list-style-type: none"> <li>a. Construct appropriate chemical and waste storage by providing secondary containment, labels and hazard warning signs</li> </ul>	<p>(4) a to be completed by April 2008</p>

<b>Issues and Actions</b>	<b>Schedule</b>
<p>(5) Waste Management</p> <ul style="list-style-type: none"> <li>a. Identify alternative contractor for collection and offsite use of fly ash</li> <li>b. Removal of ash piles around the plant (e.g., around the ash silos, haul roads)</li> <li>c. Ash disposal area to be engineered for future disposal activities</li> <li>d. Develop and implement a solid waste management program including the associated segregation, recycling and disposal arrangements</li> <li>e. Identify alternative disposal route for solid waste</li> <li>f. Clear all waste drums and chemical containers</li> </ul>	<p>(5) a to be completed January 2008  (5) a to be completed by October 2008  (5) c to be implemented during project operational phase  (5) d to be completed by Feb 2008  (5) e contract arrangements to be in place by Feb 2008  (5) f to be completed by April 2008</p>
<p>(6) Marine Impacts</p> <ul style="list-style-type: none"> <li>a. Conduct marine ecological assessment to assess environmental damage as a result of the operation of the plant and recommend remedial measures</li> <li>b. Update oil spill contingency plan and provide spill clean-up equipment in areas where it might be needed (e.g., the coal-handling jetty)</li> </ul>	<p>(6) a to be completed by Feb 2008  (6) b to be completed by May 2008</p>
<p>(7) Contaminated Groundmass</p> <ul style="list-style-type: none"> <li>a. Undertake an intrusive soil and groundwater site investigation to identify the nature and extent of contamination and determine the need for any remedial action</li> <li>b. Prepare a soil and groundwater site investigation report</li> <li>c. Carry out soil and groundwater site investigation delineation (phase III)</li> <li>d. Prepare a remedial plan if required</li> <li>e. Decontaminate contaminated areas</li> </ul>	<p>(7) a to be completed by Jan 2008  (7) b to be completed by Feb 2008  (7) c to be completed by May 2008  (7) d to be completed by June 2008  (7) e to be in accordance with schedule to be identified in the remediation plan</p>
<p>(8) Environmental Management</p> <ul style="list-style-type: none"> <li>a. Develop and document an environmental management system (EMS)</li> <li>b. Implement EMS</li> <li>c. Implement safety management system and comply with AES safety standards</li> </ul>	<p>(8) a to be completed by Feb 2008  (8) b, c, d, e, f and g to be carried out during project implementation phase</p>

<b>Issues and Actions</b>	<b>Schedule</b>
d. Carry out safety audit e. Continue providing assistance to community development activities (e.g., electrification, livelihood, solid waste management, reforestation, watershed management, health) f. Continue environmental monitoring g. Update the EMAP by reviewing measures as necessary	

Source: Masinloc Coal-Fired Thermal Power Environmental Due Diligence Report, October 2007, MPPC.

### ASH MANAGEMENT ACTION PLAN

Action	Schedule
<p>(1) Restoration of the ash disposal area</p> <ul style="list-style-type: none"> <li>a. Conduct soil and groundwater investigation to determine contamination and risk to human health or local ecology from historical ash and solid waste disposal</li> <li>b. Carry out further study to delineate extent of contamination, identify clean-up options and development of Remediation Action Plan</li> <li>c. Cap the ash disposal area with overlay soil and re-vegetation with suitable plants</li> </ul> <p>(2) Rehabilitation of access roads</p>	<p>(1) a to be completed by January 2008  (1) b to be completed by June 2008  (1) c to be implemented by Dec 2009  (2) to be completed by June 2008</p>
<p>(2) Engineering for ash disposal area</p> <ul style="list-style-type: none"> <li>a. Conduct topographical survey to determine remaining space for ash disposal</li> <li>b. Construct embankment and install and maintain surface water controls (e.g., drainage, water channels and sedimentation ponds)</li> <li>c. Line embankment with impervious material to minimize leaching and install groundwater monitoring wells as necessary</li> <li>d. Manage and maintain the ash disposal area as a contained landfill and re-vegetate with suitable plants</li> </ul>	<p>(2) a to be completed May 2008  (2) b and c to be implemented for future disposal activities; schedule to be confirmed  (2) d to be implemented during project operational phase</p>
<p>(3) Transport facilities available for on-site ash disposal</p>	<p>(3) contract arrangements to be in place by Jan 2008 and to be renewed periodically during project operational phase</p>
<p>(4) Develop a solid waste management plan, end disposal of solid waste at the ash disposal area and identify alternative site for solid waste disposal</p>	<p>(4) development and implementation of plan by Feb 2008; contract arrangements in place by February 2008</p>
<p>(5) Continue sale of fly ash and bottom ash to commercial contractor for off-site use and seek increased opportunities for commercial use</p>	<p>(5) contract arrangements to be in place by Jan 2008 and to be renewed periodically during project operational phase</p>

Source: Masinloc Coal Fired Thermal Power Environmental Due Diligence Report, October 2007, MPPC.