INTER-AMERICAN DEVELOPMENT BANK

BRAZIL

Termobahia Co-Generation Plant Project
(BR-0354)

ENVIRONMENTAL AND SOCIAL IMPACT REPORT
(ESIR)

October 2001

Project Team: Adriana de Aguinaga (Team Leader, PRI), Roberto Vellutini (Head, Group II), Robert Montgomery (PRI), Elizabeth Brito (PRI), Ernesto Monter (PRI), URS Greiner Woodward Clyde (Environmental and Social Consultants)

TABLE OF CONTENTS

FIGURES

TABLES

LIST OF ABBREVIATIONS

ABB	Asea Brown Boveri
ABNT	Brazilian Association of Technical Standards
ADI	Area of Direct Influence
AII	Area of Indirect Influence
ANEEL	National Electricity Energy Agency
BED	Basic Environmental Design
CIPA	Internal Commission for Accident Prevention
CONAMA	National Environmental Council
DAA	Direct Affected Area
DNPM	National Department of Mineral Production
DNSST	Operational Health and Safety National Department
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EPC	Construction Agreement
EPI	Individual Protection Equipment
GCPS	Electric Systems Planning Group
IBAMA	Brazilian Institute for Environmental and Renewable Natural Resources
IPHAN	National Institute for Archeological and Historic Heritage
LP	Previous License
LI	Installation License
LL	Localization License
LO	Operation License
MME	Ministry of Mines and Energy
SRHSH	State of Bahia Secretariat for Water, Sanitation and Housing
EMBASAv	State of Bahia Water and Sewage Authority
CRA	Center of Environmental Resources of the State of Bahia
CEPRAM	State of Bahia Environmental Protection Council

I. INTRODUCTION

1.1 The proposed Project consists of the first phase of a two phase 485 megawatt (MW) cogeneration power plant. The first phase consists of the *Central de Cogeração Termobahia* that will generate approximately 190 MW of electricity and approximately 350 metric tons per hour of steam. The plant will be located beside the *Petrobrás Landulfo Alves* refinery ("RLAM" or "Refinery") in the District of Mataripe, State of Bahia, Brazil. The intent is to eliminate the operation of five old boilers firing fuel oil in the Refinery by implementation of the two phase 485 MW cogeneration power plant, which should reduce the overall air quality impact associated with the production of steam while promoting energy efficiency.

1.2 The Project was awarded to ABB Equity Ventures B.V. (formerly ABB Energy Ventures, Inc.) ("ABB-EV") by Petróleo Brasileiro S.A or Petrobrás (together referred to as "the Sponsors") in 1997 by means of an international bidding process. The Sponsors are developing the Project through Termobahia Ltda, a special purpose company owned 49 percent by ABB-EV, 49 percent by Petrobrás, and 2 percent by A&A Electricity Investment Ltd. Alstom Power will be the Engineering, Procurement, and Construction ("EPC Contractor") for the Termobahia project, who will provide EPC services in accordance with an EPC Agreement with the Sponsors. The operator of the Plant will be Petrobrás who will enter into an Operation and Maintenance Agreement with Termobahia Ltda.

1.3 Termobahia was included in the Priority Program of Thermal Power Plants of the Federal Government of Brazil responsible for increasing the power supply by constructing 49 thermal plants in 18 states by the year 2003. The priority program has been formulated to mitigate the increasing risk of electricity shortages and increase the participation of thermal power plants in the overall generation of electricity. This also reduces the exposure of the electric system to climatic risks, as well as the environmental and social impacts associated with the construction of hydroelectric plants.

1.4 Termobahia Ltda has approached the IADB for a loan to finance the Project via an A Loan of approximately US$ 68 million and a B Loan not exceeding US$122.5 million.

II. PROJECT DESCRIPTION

A. Site Location

2.1 The Termobahia power plant project is situated in the Municipality of São Francisco do Conde, state of Bahia, in the northeastern part of Brazil, specifically at km 4 of highway 523 BA, in Mataripe, Municipality of São Francisco do Conde (See Figure 1). The Project will be constructed on a brownfield site located beside the RLAM site. The Project site is a 48,100 square meter (m^2) area, located in the northern portion of the polygon that comprises RLAM, including the crest and slopes on the northern and western sides of the elevation separating the industrial zone from the Mataripe River estuary. Figure 2 shows an aerial view of the refinery with the Project area indicated by the arrow. The Project location is ideally suited given its intended purpose as a co-generation facility associated with the RLAM refinery and its purpose to provide supplemental electricity to the local power grid.

2.2 The site land surface features include some abandoned buildings and a warehouse, which are being removed to clear the area. In the past, this land contained a hotel, a storehouse and other support structures. The Project site is adjacent to a known contaminated area of RLAM, known as "Farofa". RLAM used the "Farofa" area for disposal of oil and other types of wastes. The "Farofa" is downgradient and is not likely to affect subsurface conditions on the Termobahia site. A detailed discussion of the "Farofa" site is presented in Section 4.

B. Project Components and Facilities

2.3 The Termobahia power plant will entail the development, design, construction, operation, and maintenance of a 485 MW natural gas-fired power plant operating in combined-cycle mode. The project will be developed in two phases. Phase I will generate 190 MW of electricity and approximately 350 metric tons per hour of steam for RLAM (the Project being considered for IDB financing). Phase 2 will generate an additional 295 MW and construction of Phase II may begin prior to Commercial Operation of Phase I.

2.4 In addition to the power plant, the Project includes a new approximately 13 km long 230 kV, nominal tension double-circuit transmission line to be constructed to interconnect Termobahia to the Jacaracanga substation of Companhia Hidro Elétrica do São Francisco (CHESF). The largest portion of the transmission line land belongs to Petrobras. In the rest of the area, there are some 20 medium to large size properties, which primarily consists of pasture and deforested areas. A new 900 meter long (m) independent access road was constructed in order to minimize traffic of heavy vehicles within the refinery.

2.5 The Termobahia combined cycle plant will be developed in a conventional Combined Cycle Gas Turbine (CCGT) configuration using two generation blocks, each of them comprising one Alstom gas turbine (GT 24) heavy duty type, one heat recovery boiler (HRSG) and one steam turbine. The exact Phase II design is not finalized. The first block, which will be constructed in Phase I, will generate net power of 190 MW, plus 350 tons of steam per hour, and the second block will generate 295 MW, for a total net generation of 485 MW. The gas turbines will be designed for continuous operation, 24 hours a day, 7 days a week. The Termobahia power plant was designed for operating at a base-load at 25°C, relative humidity of 80% at sea level. The minimum lifetime expected for the plant is 25 years.

2.6 The fuel gas system will accept three different quality gases, supplied from different sources: the refinery gas, normal gas, and rich gas. Currently, the plant is not expected to burn refinery gas in the gas turbine, but in the heat recovery boiler only. The gas turbines will burn natural gas (i.e. "poor gas") and "rich gas", and the supplemental firing will be capable of burning poor, rich, and refinery gases. The primary emissions from natural gas firing will be nitrogen oxides (NOx), carbon monoxide (CO) and particulate matter (PM). For operation with natural gas, no steam or water injection is anticipated to be required for emissions abatement purposes.

2.7 The Termobahia project will result in a reduced operation of RLAM's Unit 51 boilers. During Phase I, two of the five Unit 51 boilers (Units 51-4 and 51-5) will be removed from service, while the other three boilers (Units 51-1, 51-2, and 51-3) will operate at approximately one-half load. The continued operation of these three units is necessary for refinery reliability. Decommissioning of the five boilers of Unit 51 (Unit 51-1 through 51-5) is expected upon the implementation of Phase II. RLAM currently uses the Unit 51 boilers to supply approximately one-half of the refinery steam demand of approximately 700 tons per hour (about 350 tons per hour). The total steam

generation capacity of all refinery units is approximately 1050 tons per hour (TPH). When Phase I of Termobahia is on line, the turbine and HRSG will provide approximately 350 TPH, or the equivalent of the Unit 51 boilers. Once Phase II is online, RLAM intends to put the Unit 51 boilers in cold stand-by.

2.8 RLAM will supply clarified and filtered water to Termobahia, which it extracts from the Catu River, Sao Paulo Reservoir (Coreia) and the Pedra do Cavalo Reservoir. RLAM has a permit to withdraw 16,800 cubic meters per day (m^3/d) of water from the Catu River during a 24-hour period (Regulation 205/99-DE-SRH, Annex V) with a maximum pumping capacity of 21,000 m^3/day. The Sao Paulo Reservoir is a standby source of water approximately 5 km from the refinery with a pumping capacity of 28,000 m^3/day. The reservoir itself provides up to a 30 day buffer capacity for normal operations. Currently, the refinery receives supplementary water from the Pedra do Cavalo Reservoir through an interconnection with the Catu River near the city of Candeias. This connection has a capacity of 18,800 m3/day. The estimated maximum consumption of water by Termobahia is 8,400 to 13,200 m3/day, depending on the quantity of the condensate returned from the refinery. RLAM is concluding the construction of a water treatment plant to supply the demand of water for Termobahia. The raw water for Termobahia is treated by the water treatment plant of RLAM.

2.9 The power plant will utilize a closed cooling water system with one of the two closed cooling water pumps supplying the cooling water via the closed cooling water coolers to the generator –coolers and other auxiliary equipment requiring cooling. Losses in the system are made up of demineralized water from the demineralized water system. RLAM will provide the demineralized water required by Termobahia.

2.10 The power plant will generate effluents from various sources such as wash water and blowdown of the boilers. Industrial effluents, excluding cooling tower blowdown, have been estimated as approximately 500 m^3/day. In addition, 5 m^3/day of domestic effluents will be generated. The industrial wastewater will be collected and its treatment consists of an oily water equalization basin, two CPI feeding pumps to the separator, and an oil and sludge pit with a connection for a portable oil/sludge pump. The de-oiled water will be fed back to the wastewater network. The wastewater system will be sized to handle all wastewater from Phase I and Phase II. The HRSG blow down will be conditioned prior to being discharged into the wastewater network to meet the maximum 40°C wastewater temperature.

2.11 Originally, all of the Termobahia wastewater was to be discharged to the Mataripe River through a new outfall. The present design is such that all wastewater, excluding sanitary and stormwater, will be discharged into the sea. Process wastewater will pass through an oil/water separator and will be conditioned to comply with applicable guidelines. Termobahia Phase I wastewater will be combined with RLAM's effluent prior to its discharge to the sea. During Phase II, a new discharge point for the treated liquid effluents separate from RLAM's discharge will be developed and permitted. Currently there are no details available regarding the siting and regime of said ocean discharge outfall. Sanitary sewage will be treated in an on-site sanitary anaerobic wastewater treatment plant, and stormwater will be directed to the Mataripe River.

2.12 Stormwater runoff will be variable depending on the season. Termobahia will utilize the existing outfall to the Mataripe River for discharge of stormwater drainage from its site The Mataripe River at the discharge point is a Class 7 river (brackish water). During Phase II, an amount of 2,664 m^3/day of wastewater has been calculated as the blowdown of the cooling towers.

2.13 Termobahia will be required to properly handle the chemicals needed for the HRSG, water/steam cycle, and cooling water system dosing.

C. Project Workforce

2.14 The manpower estimated for the construction of Termobahia Phase I comprises approximately 250 workers, reaching an approximate number of 400 workers during the peak of construction. Approximately the same number of workers are estimated for Phase II. A permanent workforce of 40 persons will operate the facility, presumably working three shifts, 24 hours per day, seven days per week. That workforce would reside in the general region, commuting daily to the plant.

D. Project Schedule and Costs

2.15 Construction for the initial phase will take 25 months, for both civil and electromechanical activities. The total cost of the first phase of the Project is estimated at approximately US$259 million. The schedule for the second phase is expected to be about the same duration.

E. Project Alternative Analysis

2.16 The proposal for the Termobahia Project arose from Petrobras's energy self-sufficiency policy and from the economic and environmental need to replace RLAM's old boilers. In aligning its objectives with current energy sector guidelines, RLAM identified the opportunity to generate energy and steam for its units using the natural gas available in the region. An analysis of alternatives was presented in the EIA. This analysis considered technological alternatives (e.g. different types of fuels and generation techniques), location alternatives (e.g. inside vs. outside of the Petrobrás facility), as well as the no-action alternative.

2.17 The analysis for the location of the Project beside RLAM considered the following aspects:

- technical inability to transport the steam for long distances and the proximity to fuel sources;
- proximity to consumers;
- reduced environmental impact;
- lower costs;
- no need to construct new gas pipelines and new water intake and treatment facilities (though current design includes construction of a wastewater treatment facility); and
- existence of other mechanisms for environmental control at Petrobras.

2.18 The selection of the Project site within the RLAM area followed several studies, in particular geotechnical and soil contamination. Several locations were abandoned for further consideration for a number of reasons, including the proximity to the "Farofa" area, which has well documented petroleum residual contamination.

III. INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional

Power Sector

3.1 The National Electrical Energy Agency (ANEEL), was instituted and regulated by Federal Laws 8.897/95 and 9.427/96 and its regulations, as the regulatory body responsible for implementing the federal government policies and procedures related to the potential for hydroelectric exploration and energy production, as well as for issuing the appropriate concessions, permits and other forms of authorization. This includes approving the engineering aspects of the power plant, issuing the authorization for the owner to trade its energy production within the Brazilian market, and the public utility declaration (*Declaração de Utilidade Pública*) for the transmission line associated with the Project.

3.2 Two additional organizations are involved in the operation of the sector, GCPS and the National Electric System Operator (ONS), a private institution integrated by entities granted with concessions or authorizations as well as customers. Together they are responsible for the sector's operations planning and programming, and the activities of coordination and control of the generation and transmission system. Other entities involved are Coordinating Group for Interconnected Operation (GCOI) and National System's Operation Center (CNOS), regarding the sector's operations planning and programming, and the activities of coordination and control of the generation and transmission system.

3.3 The Coordinating Committee of the Environmental Operations of the Power Sector ("*Comite de Meio Ambiente do Setor Elétrico - COMASE")*, comprised of Eletrobrás and its regional concessionaires, established the environmental and social policies for the electric power sector based on the following guidelines: social and environmental feasibility of the project, environmental protection and socioeconomic development of the project area of influence, and public consultation and participation.

Environment

3.4 At the federal level, the Ministry of the Environment, Water Resources and the Amazon Region (MMA) is responsible for the coordination of the National Environmental Policy ("*Política Nacional de Meio Ambiente"*). The National Environment Council (CONAMA) is a consulting and deliberating body responsible for defining general environmental regulations and basic criteria and guidelines to implement the Policy, such as environmental and emission standards for ambient quality and pollutants, respectively, and also the general requirements for environmental licensing and for the environmental impact assessment process. The Brazilian Institute for Environment and Renewable Resources (IBAMA) is the federal agency responsible for executing and enforcing the environmental regulations and standards, at the federal jurisdiction, and to issue the environmental permit in the cases defined by law.

3.5 In terms of the Project, the environmental responsibility for the enforcement of environmental legislation, including the principal licenses, is primarily with the State of Bahia environmental agency: the Center of Environmental Resources *(CRA-Centro de Recursos Ambientais)*. The National Institute for Historic Heritage (*IPHAN - Instituto do Patrimônio Histórico e Artístico Nacional*), also participates in the permitting process, mainly through consultation originating from the State Environmental Agency. Additionally, the Ministry of Mines and Energy (MME) also participates through its National Department of Mineral Production (*DNPM- Departamento Nacional de Produção Mineral*), with the responsibility for blocking mining activities in the Project's administrative right of way, after the owner of the Project fills an official request for such action.

3.6 At the state level, the State of Bahia Environmental Agency, CRA is the main agency responsible for the environmental licensing of the Termobahia Project and for the Termobahia/Jacaracanga transmission line. Within the State of Bahia, there is also the state council for the environment, CEPRAM, dedicated to environmental policy making within the state. CEPRAM consists of five government representatives, five from the civil society and five from non-governmental environmental organizations. CRA is in charge of coordinating and enforcing the environmental policy dictated by CEPRAM, including issuance of environmental permits.

3.7 At the local level, the the municipal administration of São Francisco do Conde is responsible for verifying the Project's compliance with applicable industrial, land use, and occupational health & safety regulations, as well as with other related requirements.

Health and Safety

3.8 At the Federal level, the responsibility for developing and enforcing the health and safety regulations is assigned to the Ministry of Labor (MT) and its Regional State-based Offices (DRTs), whereas the Ministry of Health has legislative jurisdiction over health-related issues. At the local level, health matters are coordinated by the corresponding State Secretariats (in the State of Bahia, the State Secretariat of Health is a member of CEPRAM). Occupational safety issues are dealt with by the Secretariat of Labor and Social Action, which operates in cooperation with the Regional Labor Offices (Ministry of Labor).

B. Legal

Power Sector

3.9 At the Federal level, the most relevant piece of legislation that regulates the Project is Federal Decree 2.003/96, which regulates the electric energy production by independent power producers. Also relevant are Federal Law 8.987/95, which establishes the regime of concession and permit for public services, as established by article 175 of the Federal Constitution; Federal Decree 1.717/95, which establishes procedures for concessions of public services related to electric energy, and Law 9.648, which included amendments to all the above legislation, as part of the government's reform to introduce greater competition and transparency in the generation of electricity.

3.10 The expropriation process is regulated by the Federal Decree-Law 3.365/41 and Federal Law 2.786/56. This legislation constitutes the legal basis for the acquisition of private properties for public good/use. Article 5 (item XXIV) of the Federal Constitution defines the concept of fair payment. The expropriation process is to occur in two stages. In the declaration stage, ANEEL publishes a resolution determining that the area to be expropriated is of public utility. In the expropriation stage, the concessionaire is allowed to acquire and compensate the affected properties in the areas to be expropriated.

3.11 At the regulatory level, ANEEL Resolutions are the main legal documents governing the Project operations. Of particular importance are: (i) The resolution which empowers the owner to become an independent power producer (IPP), and (ii) The one which allows ANEEL to issue a declaration confirming that the Project's right of way becomes a restricted area (Area de Interesse Público).

Environment

3.12 As granted by the 1988 Federal Constitution, environmental legislation and regulations in Brazil are enacted at the federal, state and municipal levels. The federal agency establishes general requirements of broad applicability, while specific standards of enforcement are left to the state agency, either by regulation or by administrative orders. The states and municipalities may also issue standards of equal or more stringent requirements than the federal ones. In addition, the Brazilian Technical Standards Association (ABNT) issues technical norms and standards dealing with specific environmental matters. The content of these standards is in general considered as best management practice; however, they can also be considered legal requirements when recommended by any piece of legislation. Those norms and procedures are known as NBRs and/or NBS (*Normas Brasileiras*).

3.13 Federal Law 6.938/81 created the National Environmental Policy (*Política Nacional do Meio Ambiente – PNMA*). It established the basis for environmental protection in Brazil, by putting in place the appropriate institutional framework and defining the main instruments for environmental management. This policy and its regulations made provisions for the creation of the Brazilian Institute of Environment ("*Instituto Brasileiro de Meio Ambiente, Recursos Naturais Renováveis e Amazonia Legal – IBAMA*"), the National System of Environment *("Sistema Nacional de Meio Ambiente – SISNAMA*"), and the National Council of Environment ("*Conselho Nacional de Meio Ambiente – CONAMA*"), as well as the establishment of the environmental permit system and the environmental impact assessment system (EIA system).

3.14 Permitting Process: Licensing for new Projects is regulated by Federal Law 6938/81, Decree 99274/90, which regulates Federal Laws 6902/83 and 6938/81, and CONAMA Resolutions 001/86 and 237/97. The Brazilian environmental permitting system requires that three licenses (permits) be obtained by all potentially pollutant activities: Preliminary License (Licença Prévia or "LP"), Installation License (Licença de Instalação or "LI"), and Operating License (Licença de Operação or "LO"). For projects listed in CONAMA 001/86 (includes both power plants with nominal capacity above 10 MW regardless of the primary energy source to be deployed and transmission lines of 230 kV and above), an Environmental Impact Assessment (EIA) is required. The CONAMA Resolution 001/86 defines the basic content of the EIA and establishes the public participation requirements. CONAMA Resolution 09/87 regulates the public hearing process associated with the EIA process. Within the EIA process, the LP is granted based upon governmental approval of the project EIA and the RIMA ("*Relatório de Impacto Ambiental*", which is a summary of the EIA). A Public Hearing may be required prior to the issuance of the LP. The LP will be valid for a period of 5 years. The LI is granted based upon governmental approval of a project-specific Environmental and Social Management Plan ESMP ("*Projeto Básico Ambiental*" or "*PBA*") and upon compliance with the LP requirements. It also represents the governmental authorization to start the construction of the proposed project. The LI also establishes specific requirements regarding the mitigation and monitoring of environmental and social impacts during construction. The LI will remain valid for a period of 6 years as of the date of issuance. The LO must be obtained prior to project operation. It will be granted after all the plans and programs defined in the PBA are implemented or are in the process of being implemented, including the necessary review and verification of pollution control equipment. The LO has a validity of 4 to 10 years (CONAMA Resolution 237/97).

3.15 Existing plants must apply for a new permits whenever they plan to modify the production process concept, revamp part of the units or add new facilities to the site, including equipment and/or buildings. (CONAMA Resolution 237/97).

3.16 CONAMA Resolution 237/97 determines that states are responsible for environmental licensing procedures within the territory under their jurisdiction, except for those which have a regional or national influence in environmental issues. In that case, the federal environmental agency (IBAMA) will take over the licensing responsibility for the Project.

3.17 In the State of Bahia the permitting process is regulated by state decree 7967 issued June 5, 2001, which regulates State Law 7799 (Feb 7, 2001). In Bahia, the LP is denominated Localization License (Licença de Localização or LL). State environmental legislation introduced a new type of license – the Alteration License (*Licença de Alteração* or *LA*) to be granted when a Project has modifications to report (technology, operations, localization, etc). The LA can become an additional legal requirement from the part of CRA either during the permitting process itself or throughout the operation cycle of the facility. Also characteristic of the State of Bahia environmental legislation is the Alternative Environmental Licensing, through which facilities already installed and in operation can obtain the environmental permit through a simplified process that is known as Environmental Self-licensing ("*Auto-Licenciamento Ambiental"* or "*ALA*"). Legal provisions for the ALA are established in State Law 7799/2001 and State Decree 7.967/2001. All provisions for conducting an ALA are defined in CEPRAM Resolution 1051/95.

3.18 The State of Bahia also has specific regulations set forth by State Law 2287, April 28, 2000, which address the procedures for transmission line permitting. According to that State Law transmission line Projects less than 20 km do not have to develop an EIA and can be licensed with the support of much simpler assessments, which are to be defined on a case-by-case basis by CRA.

3.19 Air Emissions: The standards for emissions and ambient concentrations are established under the National Air Quality Control Program (PRONAR) and are implemented through resolutions adopted by CONAMA. CONAMA Resolution 03/90 provides a general framework to States and Municipal Governments, which in turn can set more stringent Air Quality Standards. In addition, CONAMA Resolution 03/90 sets the maximum allowable atmospheric concentrations of certain pollutants, above which local authorities will have to declare warnings of "alert" and "emergency" which will lead to execution of pre-prepared contingency "alert" or "emergency " plans. In addition, CONAMA Resolution 08/90 defines air emission limits for external combustion processes with a nominal capacity up to 70 MW and for those with nominal capacities beyond 70 MW.

3.20 The State of Bahia CEPRAM Resolution 41/80 addresses Air Quality Standards for particulate matter, sulfur dioxide, carbon monoxide, and photochemical oxidizing agents. State Decree 7967/01 establishes that the mandatory deployment of air emission control systems, by emission sources, based on the best available technology, shall be decided on a case-by-case basis by CRA. The same State Decree mandates that air emission monitoring systems should also be installed at each facility to verify that its emissions are in compliance with the emission limits. The facility should maintain records of the installation, operation and maintenance of air emission control equipment. Tables 1 and 2 present the Brazilian applicable standards and the World Bank guidelines for air emissions and ambient air quality.

3.21 Noise: CONAMA Resolution 001/90 establishes that the emission of noise from industrial activities should comply with conditions defined in the Brazilian norm NBR-10151 (noise level standards) of the ABNT. For the State of Bahia, CEPRAM Resolution 1179/95 (Annex A) establishes recommended levels for noise. Table 3 presents the Brazilian applicable standards and the World Bank guidelines for noise.

3.22 Water Supply: Federal Law 9433/97 and State Law 6855/95 determine that industrial facilities, irrigation Projects, or any other activity that utilizes water from rivers, lakes, and coastal zones, and from ground aquifers (groundwater) as a water supply source must obtain a specific authorization, concession, or license from the competent state authority. In Bahia, the State Authority for Water Resources (*Superintendência de Recursos Hídricos- SRH*), is the agency responsible for the management of water resources.

3.23 Wastewater Discharges: CONAMA Resolution 20/86 designates all fresh, brackish and saline waters at national level, into 9 classes, according to their prevailing uses. State of Bahia Decree 7765/00 determines that discharge of treated industrial effluents and/or treated sanitary sewage will be subjected to specific permitting procedures by the State of Bahia Water and Sewage Authority (EMBASA) and by CRA. State Decree 7967/01 determines that wastewater and storm water in industrial facilities must be collected in separate onsite systems adequately built to handle such wastewater. Stormwater must be discharged through separate outlets from treated sanitary sewage and/or treated industrial wastewater. According to that State Decree, upon request, industrial facilities should submit to CRA information concerning the characteristics and management of their liquid effluents. Table 4 shows a comparison of CONAMA 20/86 Article 21, World Bank, and Resolution 1332/96 CEPRAM-BA wastewater effluent limits. CEPRAM Resolution 915/94 approved the contingency plan for the area of the Bay of *Todos os Santos*, while CRA Resolution 1152/95 defined that the waters of that same bay belong to class 5, which is also in accordance with the classification set forth in CONAMA Resolution 20/86.

3.24 Solid waste: The main federal regulations that deal with solid wastes are CONAMA Resolutions 03/93 and 23/96. Both rely on norms set forth by ABNT in the Brazilian norm 10004. According to this legislation solid wastes are divided in three different classes as follows: Class I – Hazardous Waste; Class 2 – Intermediate (non-inert) Waste; and Class 3 –Non-Hazardous Waste (inert). This legislation deals with the final disposal of solid wastes, defining requirements for a solid waste management plan, treatment systems and final disposal systems. CONAMA Resolution 06/88 requires that control and inventories of industrial wastes be submitted to each state environmental control agency. The solid waste inventory should contain the following information: waste classification, waste quantity, transportation data, storage procedures, and final disposal treatment procedures.

3.25 At state level, CEPRAM Resolution 552/92 approves the codes related to the control of solid wastes in ships, gas pipelines, and coastal facilities, establishing procedures for the pollution control on the shore line of the State of Bahia by vessels, refineries, and offshore oil and gas (O&G) exploration and production (E&P) activities, among others. State Decree 7967/01 prohibits the disposal of any type of Class I waste through discharge into open areas; open air incineration; discharge into water bodies of any class; discharge into stormwater, and sewage networks; infiltration into soil; and, inadequate storage of said wastes. Also, according to CEPRAM Resolution 13/87 industrial facilities must keep records of all tests and analysis conducted in order to characterize their own solid wastes for a period of one year.

3.26 Transportation and all final destination of Classes I and II solid wastes must be approved by CRA. Also a control document must be prepared and submitted to CRA. The receiving facility used for final disposal/treatment of Classes I and II solid wastes must have a CRA permit. According to these requirements the industrial facilities that generate solid waste are responsible for the cost associated with management, treatment, and disposal of the waste.

3.27 Transportation of Hazardous Products: CEPRAM Resolution 1039/94 regulates the Administrative Rule 01/94, which establishes that the company responsible for the transportation of hazardous products must submit to CRA a request for a specific authorization.

3.28 Flora and Fauna: Protection of flora and fauna is addressed in the following regulations: Federal Law 6938/81; CONAMA Resolution 004/85, and the Forestry Code (*Código Florestal*), enacted by Federal Law 4771/65 and partially modified by Federal Laws 6535/78 and 7809/89. The protection of the Atlantic Rainforest is defined by a Federal Decree (750/93), and regulated in each state by CONAMA, which prohibits the felling, suppression and exploration of primary vegetation or formations that are at an advanced or medium level of succession. Exceptions can be approved in the case such actions are required for projects considered as having a social interest such as the ones for energy production, roads, and mass transportation. Conservation of mangroves is addressed in the Forestry Code. In the State of Bahia, Federal Decree 750/93 is regulated by CONAMA Resolution 05/94, which details the criteria for defining the different regeneration succession steps of the Atlantic rainforest within the state. The official list of Brazilian flora species under threat of extinction is published in IBAMA Regulation 37/92.

3.29 Conservation Units: CONAMA Resolution 02/96 determines the obligation on the part of the owner of a large development project, such as a power plant, to implement at his expenses, what is known as "Conservation Units of Public Domain and Indirect Use". The total required expenditures with such conservation units should be no less than 0.5% of the total project investment value. The agreement to that requirement is a prerequisite for the licensing of all large-scale works that require suppression of significant vegetation.

3.30 Expropriation and Compensation: Given that the passage of a transmission line through private property is of public interest, its negotiation is subjected to the rules and regulations set forth in Federal Decree-Law 3365/41, which regulates land expropriation for public interest. In addition, this process is regulated by Law 8987/95, which covers the concession regime and permission for rendering public services, and Law 9427/96, which created ANEEL.

3.31 Archaeological Resources: IPHAN Ruling (*Regulamento*) 07/88 establishes the conditions for requesting authorization to IPHAN for the conducting of archaeological research in the area planned for the right-of-way of the transmission line.

Health and Safety

3.32 The rules and regulations for occupational health and safety in Brazil are defined in the Consolidation of Labor Laws (CLT) and its regulating codes (Normas Regulamentadoras-NRs), as well as in the conventions of the International Labor Organization (OIT) which became part of the Brazilian legislation by Presidential Decrees.

3.33 In Brazil, the two legal texts of greatest relevance to the Termobahia Project are Law 6514/77, which alters the clauses of CLR related to safety and occupational health, and Ruling 3214/78, which approve the Regulatory Procedures (RP) of Law 6514/77. Among the RPs the ones relevant to the Termobahia Project are RP-4, which establishes the specialized services in safety engineering and in occupational health (*Serviços Especializados em Engenharia de Segurança e em Medicina do Trabalho - Sesmet*); RP-5, altered by Ruling 33/83 and later by Ruling 1351/94, which regulates the objectives and attributes of the Internal Commission for Accident Prevention (*Comissão Interna de Prevenção de Acidentes – CIPA*); RP-6, defined by Rulings 06/83, 26/94,

06/92 and 03/92, which established the requirements for personal protection devices (*Equipamentos de Proteção Individual – EPIs*); RP-7, which establishes the Medical Control Program for Occupation Health (*Programa de Controle Médico de Saúde Ocupacional – PCMSO*); and RP-9, which defines the prevention of environmental risks, considering physical, chemical, and biological risks to the health and the integrity of the environment, workers and the natural resources.

3.34 Regulating Code NR05 and Article 163 of CLT require the creation of the Internal Commissions for Accidents Prevention (CIPAS). NRs 07 and 09 require mandatory programs to address issues such as Medical Control and Occupational Health Programs (PCMSO) and Environmental Risks Prevention Programs (PPRA). CEPRAM and the State of Bahia's Secretariat of Health established that the presentation of an occupational health plan be a prerequisite for obtaining operation licenses.

Other (Agreement between Petrobras and Termobahia -ECC)

3.35 This agreement establishes the responsibilities of Petrobras and Termobahia for the Project. Regarding environmental aspects, the contract establishes that:

- Water supply – Petrobrás will supply the total consumption of clarified and filtered water, and demineralized water to Termobahia;
- Site environmental liabilities – Section XVII of the ECC addresses Petrobrás's indemnification of Termobahia for liabilities associated with pre-existing environmental conditions. The subsurface environmental contamination conditions are relatively well defined both at the Termobahia and the "Farofa" site, where considerable investigation has been conducted.

In regards to water discharge, a letter form Termobahia dated May 10, 2001 establishes that Termobahia will utilize the existing outfall to the Mataripe River for discharge of stormwater drainage from its site while process wastewater will be combined with Petrobras' main wastewater discharge into the sea.

C. Project Compliance Status

3.36 Termobahia has obtained the ANEEL Resolution 306 dated October 26, 1999 authorizing Termobahia to be an IPP (Independent Power Producer) and to implement a co-generation thermoelectric unit and its associated transmission system of a restricted denominated UTE Termobahia Phase I.

3.37 The Termobahia Project was conceived as part of RLAM's expansion. The Termobahia Project obtained the environmental license as part of the authorization for the expansion of RLAM. On January 31, 1995, in a joint meeting at CRA, agency officials and representatives of the RLAM refinery agreed that RLAM´s LO renewal and the new required permit for the Phase II expansion of the refinery should be obtained through the environmental self-licensing ("*auto-licenciamiento ambiental"* or "ALA") in accordance with CEPRAM´s Resolution 1051/95, State Law 7799/2001 and State Decree 7.967/2001. The first request for expansion was submitted to CRA in November 16, 1995. The company requested the Phase II expansion permit, which included the installation of a new catalytic cracking unit (FCC) scheduled to enter into operation during the first half of 1999.

3.38 RLAM prepared the expansion feasibility study with a report on environmental impacts, which were analyzed and approved by CRA, as specified in CEPRAM Resolutions 1332/96 and 2046/99. CEPRAM Resolution 1332/96 authorizes the renewal of the LO (Operation License) for Petrobrás, the owner of RLAM, in the county of São Francisco do Conde, Bahia. CEPRAM Resolution 2046/99 defines the permit for the refinery expansion under the ALA provisions. According to that CEPRAM Resolution, the special permit for the refinery expansion will remain valid until August 20, 2002. Under the terms and conditions of that special permit, the Termobahia Project was therefore considered as part of the overall expansion of the refinery. Agency officials recognized that due to the already prevailing environmentally degraded conditions around the RLAM refinery, the implementation of the Termobahia Project would not impose any additional environmental adverse impacts on the local and/or regional environment.

3.39 Considering the environmental setting of the proposed Project area within the refinery, an environmental site assessment (ESA) Phase II in accordance with the American Standard Test and Materials (ASTM) E1527 and E1528 standards was conducted in October 1999 to identify and provide information needed to mitigate existing environmental liabilities.

3.40 To obtain an independent environmental permit separated from the one issued in the CEPRAM Resolution 2046/99 for the expansion of the refinery, Termobahia has filled an administrative request to CRA. CRA submitted that request and its accompanying justification report to CEPRAM, in which it proposes that the CEPRAM Resolution 2046/99 be revoked and two new individual CEPRAM Resolutions be issued, one for each Project (i.e. for the Termobahia and for the Petrobras/RLAM refinery). On July 19, 2000 CRA issued Ruling 416/00 replacing the original Termobahia official designating (company name) of "*Central Termoelétrica – Termobahia of Petróleo Brasileiro S/A – Petrobrás – RLAM* " already written in the CRA´s records to Termobahia Ltda. This administrative procedure for regularizing other environmental permit for Termobahia changed only the name of the Project and does not separate yet the technical requirements (*Condicionantes*) defined by CRA for Petrobras/RLAM from those of required by CRA from Termobahia.

3.41 On June 25, 2001 Termobahia submitted to CRA the modifications of the Termobahia Project that are currently being reviewed. A new permit, the Alteration Permit (*Licença de Alteração* - LA) is now required under the most recent CRA regulations. The separation of the technical requirements will be addressed in this new permit. In case that this LA is considered not necessary by CRA, Termobahia will file another administrative request for the separation of requirements between RLAM and Termobahia.

3.42 An EIA was prepared for the Termobahia Project during the second semester of year 2000 to support the evaluation of the proposed power plant by international financial institutions. The EIA was made available to the public in February 2001.

3.43 Licensing for the transmission line is the responsibility of Termobahia Ltda and is being conducted in accordance with the specific environmental licensing process as required by CRA. The Localization License (*LL*) for the transmission line was issued through CEPRAM Resolution 2544 of December 3, 2000 and the Installation License (*LI*) was obtained through CEPRAM Resolution 2707, dated March 28, 2001. The authorizations for the clearing of vegetation which is required for development of the topographical survey and the demarcation of the right-of-way (ROW) were obtained from IBAMA (Authorization 677 of December 19, 2000). The transmission line authorization for operation has also been obtained from ANEEL through its Resolution 14 dated

January 24, 2001, which declares the area of the ROW of the transmission line as one public interest. The ROW encompasses land under jurisdiction of the counties of São Francisco do Conde and Candeias. These municipalities also issued the authorization for the construction of the Termobahia-Jacaracanga transmission line on June 9, 2000 and June 13, 2000 respectively. Studies have been proposed for an Archaeological Survey Program in the Area of Direct Influence of the Termobahia-Jacaracanga transmission line (February 2001).

IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

A. Environmental Conditions

4.1 The Project is located on a brownfield site within Petrobras' Landulfo Alves Refinery (RLAM) in an area dominated by industrial developments. The land reserved for the implementation of Termobahia includes some abandoned buildings and is located adjacent to a contaminated area, which was used by Petrobrás to dispose of oil and other wastes. The Direct Area of Influence (DAI) of the Project as defined in the EIA corresponds to a 10 km-radius around the power plant, which includes RLAM, undeveloped areas and the towns of São Francisco do Conde, Madre de Deus and Candeias. The 13-km long transmission line will extend from Termobahia crossing a small mangrove area, agricultural and undeveloped areas to the Jacaracanga Substation in CHESF.

Meteorology

4.2 The Project area is located close to the shore of the Atlantic Ocean and poses a peculiar microclimate governed by ocean circulation and by the effects of continental and sea winds. Due to its latitude, the region is subject to strong solar radiation. The Project area is characterized by a hot, humid climate typical of the tropical regions. Climatic data have been monitored at a station in Salvador, and these data indicate an annual average temperature of 25.5°C. The area experiences significant rainfall on an annual basis with Salvador receiving an average of 2099 millimeters (mm) of precipitation. Sixty percent of this precipitation occurs during the wet season between April and August.

4.3 Meteorological parameters have been monitored at three stations in RLAM. These data are directly representative of the Project area and were used in dispersion modeling as discussed later in this report. The wind rose produced from a combination of these three stations confirms the strong influence of microclimatic factors in the Project area. Specifically, the wind flow in the Project area is dominated by the land-sea breeze and the predominant wind direction at the site is from the East. During the daytime, winds are from the East (the Baia de Todos os Santos) at an average speed of 3 meters per second (m/s). At night time this flow is reversed although the night time land breezes have lower wind speeds. Winds from the West are much less frequent and have lower windspeeds.

Air Quality

4.4 The City of Salvador is a major metropolitan area with a significant air pollution contribution from motor vehicles. The existing RLAM units are a major stationary source in the area. Ambient air quality data for the region is based on two limited monitoring campaigns. The 1994 and 1995 exploratory survey conducted by the Federal University of Bahia on the Metropolitan Region of

Salvador (North of Todos os Santos Bay and close to RLAM) indicated that sulfur dioxide (SO_2) and ozone (O_3) concentrations exceeded the hourly air quality Brazilian standards while the highest reading of 311 ug/m^3 was just below the national ambient standard of 320 micrograms per cubic meter for nitrogen dioxide (NO_2). Results reported by CETREL (1998) from the Metropolitan Region of Salvador air monitoring network reported exceedances for the one-hour concentration NO_2 standard. Ozone levels are also in excess of the national standards. Based on the limited air quality information, the air quality conditions at the Project site appear to be fair (for particulate matter) to poor (for NO_2, O_3 and SO_2). Particulate levels monitored in the area are within the ambient standards at all locations and do not appear to exceed the 50 μg/m^3 trigger level for a moderate air quality designation. However, annual levels of sulfur dioxide exceed the trigger level to be designated as an area with moderate air quality. The short term SO_2 values may also meet the criteria for a poor air quality designation under World Bank guidelines. In any case, the monitored values of NO_2 are over 98 percent of the one-hour standard, and short-term values of ozone exceed the ambient standards. Elevated one-hour values of SO_2 were also observed. However, no 24-hour averages were available for comparison with the ambient standard. In general, annual average concentrations are below the ambient standards.

Geology, Geomolphology and Soils

4.5 The Project area is located within the "Escudo Oriental", a regional basement composed of metamorphic and intrusive rocks from the Lower Proterozoic and/or Archaean. Large sediment areas occur in the DAI, as part of the petroleum sequence, resulting from a continued deposition, with no regional discordance, representing facies of a regressive, lacustrine depositional system, with the localized development of deltas.

4.6 RLAM is located at the lowland region, between 0 and 100 m above mean sea level. The relief of the area can be classified as plain, presenting only a few significant slopes. The soil is characterized as podzolic red-yellowish-allic, composed of high activity clay, medium texture, and clayish alluvial soils. Amidst large plain areas, small isolated, hemisphere shaped hills can be observed, with mean elevations around 50 m. The site area is located in the middle slope of one of those typical hills. The local geology is predominantly composed of clayish silt with fine to medium, gray-yellowish sand.

4.7 The transmission line partially crosses the municipal districts of Nossa Senhora das Candeias and São Francisco do Conde, through hills and elevations related to the Ilhas Group (characterized by thick beds of sandstone, silt, shale, and limestone) and the Formation Barreiras (mainly gross to fine sandstone of argillaceous matrix and varied coloration) as well as recent Quaternary sediments along the drainage pattern, and silty clay sediments, locally sandy ones, related to the swamps that border Todos os Santos Bay, mainly in the mouth of Rivers, as well as plains related to the existing mangroves.

Site Subsurface Conditions

4.8 A Phase II Environmental Site Assessment (ESA) was conducted to characterize soil and ground water quality and identify potential liabilities on the proposed Termobahia property itself. Seven boring profiles varying from 12 to 20 meters depth show a predominance of clayish silt with fine to medium sand. A total of 27 samples were analyzed for volatile organic compounds (VOC), total petroleum hydrocarbons (TPH), oil and grease, and metals to identify any potential environmental liability due to soil and groundwater contamination. The ESA detected minor amounts of soil

contamination of TPH with levels of 1,600 mg/kg and observations of a dark, elastic material in one of the monitoring sites located within the Project boundary. This level is above "inert" (50 mg/kg) but well below "critical" (2,525 mg/kg) as defined by the Dutch soil contaminants standards. The Termobahia site has been graded and prepared. According to site personnel, there was no evidence of contaminated material encountered during these activities. Phase II soil and groundwater investigations at and directly adjacent to the site were conducted and no evidence of contamination was reported.

RLAM's Subsurface Conditions

4.9 The area adjacent to the Project site, known, as "Farofa" was used by Petrobrás for many years to dispose of oil and other types of wastes. Field investigations were conducted between December 2000 and February 2001 using ground-penetrating radar (GPR). The GPR survey was combined with data from a total of 60 monitoring wells and over 127 laboratory analyzed samples. At present, the most significant contamination appears to be limited to within 8 meters of the surface because of the relatively impermeable nature of the bedrock in the area consisting of "free product" (10,000 m^3) and contaminated soil (50,000 m^3 primarily containing Polynuclear Aromatic Hydrocarbons). The "Farofa" is hydraulically downgradient and thus should not affect subsurface conditions at the Termobahia site.

Hydrology

4.10 The São Paulo basin, with an area of about 40 square kilometers, is the principal basin in the region. The São Paulo river has its beginning in the northern part of the municipality of Candeias and flows toward the South on a course of approximately 16 km. It is a perennial river that flows over the sediments of Ilhas Group. It is characterized, in the studied section, by vast and open valleys, of low gradient, generally "U"-form, sinuous pattern. Close to its mouth, before reaching the swamp, it crosses a passage of irregular relief, with steep hillsides and narrow V-form valleys, in the strip of reforested land. North of this location where the route is projected for the transmission line, there is a dam in its bed, denominated Represa Correia, used for supplying Petrobrás with industrial water.

4.11 The Mataripe River, the secondary basin in the studied area springs in the municipality of São Francisco do Conde and it also flows over the sediments of Ilhas Group. It is characterized by presenting a short course, approximately 5 km, and its section of larger volume begins in the lands under influence of the tide, where the mangrove lies. The valleys are wide and open "U"-form, of low gradient and plain bottom. Its drainage basin is mainly located within the estuarine areas directly influenced by the Bahía de Todos os Santos. The Project site is close to the Mataripe river channel. The transmission line crosses portions of both the Mataripe and Sao Paulo Rivers Basins. The sedimentary soils and rocks present in the basin areas are generally clayish–silt in nature, not much consolidated and, thus, very vulnerable to erosion, especially when subject to deforestation. The Bahía de Todos os Santos presents certain degree of environmental impact on water quality as a result of the industrial activity within the area. The Bay does not include any protected species or organisms.

Water Quality

4.12 Most of the waterbodies within the DAI of Termobahia meet the water quality standards for Class 7. Deviations from the standards established at Resolution CONAMA 20/86 for Class 7 water

bodies were observed for dissolved oxygen (flood and ebb tides) and 5-day biochemical oxygen demand (BOD5) (ebb tide) for one of the sampling points and oil and grease for another analysis (flood tide). Sediments and biota analysis demonstrate chronic contamination by hydrocarbons and related products, although no contamination by solvents was identified. The cause of this contamination has been associated with oil exploration, refinery, and distribution activities that take place within the Mataripe River basin.

4.13 The area where the Mataripe River is located presents a predominantly industrial use pattern that has been considered the cause of the interference of the local environmental quality. A monitoring water quality campaign was conducted in June 2000 to characterize the Mataripe River baseline conditions. Deviations from Class 7 Water Bodies Resolution were related to dissolved oxygen (DO), biochemical oxygen demand (BOD) and oil and grease levels were identified. The sediment samples indicate high concentrations of some metals (Zinc, Copper, Lead, and Cadmium).

4.14 Within the Project site, the analysis of ground water levels in the four monitoring wells in the area indicate that the groundwater flows from north to northwest (i.e. from the plateau where the Termobahia power plant will be located towards the Mataripe River channel). Evaluation of groundwater samples demonstrate that results for TPH, oil and grease, and metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti, Zn) comply with Portaria 36 of the Brazilian Health Ministry. Based on the results of the ESA Phase II, groundwater beneath the site has not been impacted although it is very likely to have been impacted in the "Farofa" area.

4.15 There are several on-going sampling efforts that have been developed as a result of the increasing awareness of the sources of environmental pollution in the entire Baia de Todo os Santos. Spearheaded by the efforts of CRA, a total of 28 sampling points throughout the industrialized portion of the Bay are sampled. Two of the sampling points are in the Termobahia area, where a number of chemical parameters are elevated. Mercury, lead, and cadmium are found in concentrations in exceedance of health-based criteria, but these compounds are not attributed to RLAM. Many activities in the area are contributing to surface water and sediment contamination and RLAM's most likely contribution to the area contamination is generally petroleum hydrocarbon contamination and Polynuclear Aromatic Hydrocarbons.

Flora and Fauna

4.16 The Project area is located in an area where the Atlantic Rainforest was originally present with associated ecosystems presenting dense "Ombrófila" forest and pioneer formation with fluvial and marine influences. The vegetation is represented by remaining species of "capoeiras" (cascavaleira Crotalaria retusa and several gramineous species) mangrove (Rhuzophora mangle, siriuba do brejo, Avicena shaueriana e Laguncularia racemosa). The distribution of mangroves in the area of the Bahía de Todos os Santos is not continuous and most of the mangrove spots are located at the margins of the fresh water discharge channels, which are influenced by the tides, in fluvial estuaries. Threats to the mangroves are related to land clearings for urban, industrial or port expansions; sanitary and industrial pollution, especially by heavy metals; and accidental contamination related to both the extraction and transport of oil and related products.

4.17 The studied area, located at the northern edge of the Bahía de Todos os Santos, presents two mangrove spots close to the refinery, at the margins of Mataripe and São Paulo Rivers. Due to their locations, these spots receive a large amount of sediments carried by the continental drainage. The main vegetable species identified were *mangue-vermelho, Rhizophora mangle, mangue-*

branco, Laguncularia racemosa, mangue de botão, Conocarpus erectus and *Spartina*. A small area with mangroves is also part of the area of direct influence of the transmission line.

4.18 Similar to the refinery plant, part of the Project site is located in an area that has been filled in, but once was a mangrove area. However, re-forestation of the area follows a pattern similar to the dense "Ombrófila" forest formation. At the proposed site, to the west of the old hotel, Petrobrás has maintained a nursery for seedling production. Many species common to the "Mata Atlantica" have grown, interspersed with eucalyptus and fruit species.

4.19 The area crossed by the transmission line is now deprived of its original characteristics due to deforestation of its Atlantic forest and associated native vegetation. Almost the whole area is occupied by eucalyptuses (*Eucalyptus sp*) and pine trees (*Pinus sp*) for reforestation. Arboreal species forming orchards prevail in small lands, with areas covered by forage grass, whereas in small farms and ranches fructiferous trees prevail, with rare native specimens and scattered eucalyptuses and pine trees.

4.20 In general, the amount of regional fauna is poor, considering that the studied area is part of the northeast rainforest area, an environment that previously hosted great biodiversity, but today is one of the most threatened ecosystems in Brazil. Typical fauna, such as "capoeiras" formations are present in the area, such as *Crotophag ani* and Passer *domesticus,* which can be found in areas impacted by anthropogenic activities. The loss of fauna is associated with both the reduction of the vegetative coverage and hunting. Due to the continuous availability of food sources and natural shelter, a large variety of fauna make use of mangroves for feeding and breeding purposes. Mangrove fauna is basically represented by mollusks, fish and crabs. Crabs provide the local communities with subsistence and commercial income.

4.21 No rare, endemic, and/or endangered species were identified at the Project Site or along the transmission line. None of the aquatic species registered or observed in this study are included in the list of threatened or endangered species issued by IBAMA.

4.22 The vegetative cover was surveyed for Termobahia's overall site as reported in "Vegetal Cover of the Area for Termobahia's Implementation" dated November 1999, followed by the "Termobahia Access Road Characterization of the Vegetation" dated December, 1999 and, finally, the "Area to be Reforested around RLAM's entrance" in January 2001. Each one consisted of an inventory and presented one of the following conclusions: – 1) the vegetative cover of the area is not a native formation but, rather, the result of landscaping and reforestation; 2) there are areas of mangrove, but they will not be disturbed as they are outside the 75 meter buffer requirement and the area directly affected by the road construction can be characterized as an abandoned orchard with no rare native species or species in the process of extinction observed at any location, and 3) a plan for re-forestation of an area where native vegetation was apparently removed (the pond located at RLAM's entrance) including species types and planting patterns.

4.23 Aquatic sampling was conducted at three locations at the Mataripe River and RLAM's effluent discharge point into Bahía de Todos os Santos for phytoplankton, chlorophyll, zooplankton, zoobenthos, icthiofauna. Mangrove with water was analyzed for temperature, pH, COD, DO, total nitrogen, total phosphor, and other field measurable parameters as well as metals such as zinc, iron, mercury, arsenic, cadmium, and lead, and volatile organics benzene, toluene, xylene, and ethyl-benzene. The results reported exceedances of a number of parameters but the results have been largely superceded by more recent sampling as reported in the EIA.

B. Social-Economic Conditions

4.24 Petrobras's activities in the region have had a major influence on the demographic dynamics of São Francisco do Conde and Candeias for the last few decades. Before development of the refinery, the Mataripe district, in which the two communities are located, was largely rural. Population growth and urbanization were rapid following establishment of the refinery in 1955. Now, approximately 91 % of the Mataripe district's population lives in urbanized areas. As of the year 2000 census, the smaller of the two communities, São Francisco do Conde, had 26,208 inhabitants, of which 21,791 (83%) were living in urbanized zones of the municipality. Candeias had 76,748 residents in 2000, with 69,108 (90%) living in urban zones. (IBGE, 2001).

4.25 The economically active population in Candeias in 1996 numbered 10,218 persons (14.7% of the 1996 population), while in São Francisco do Conde it was 5,422 persons (22.3% of the 1996 population). The economic basis of both communities is mainly characterized by urban economic activities, mainly deriving from RLAM such as manufacturing, trade, commercial services, and government. Agricultural activities account for the smallest proportion of employed persons, although most of the land of the two municipalities is undeveloped or in agricultural uses. Livestock and poultry are the principal agricultural products of Candeias and São Francisco do Conde.

4.26 Data on income and employment indicate that for most workers, wages are low and occupations are low skilled. Poverty and unemployment levels are high, welfare levels are low, and the quality of life for most residents is inferior. In Candeias, 22% of the population is illiterate and 50% of those age 25 or older had fewer than four years of schooling (1991 data). Comparable data for São Francisco do Conde showed 28% of the residents as illiterate and 58% of those 25 and older having fewer than four years of school.

4.27 Candeias became a regional center, due to its size and available infrastructure, providing support to the industrial activities of the area. In contrast, São Francisco do Conde, which is not directly located across the industrial routes of the region, does not play a significant role in the regional economy. However, since RLAM and the petroleum product distribution companies associated with it are located within its municipal boundary, São Francisco do Conde's municipal finances depend in part on the charges and taxes associated with the refinery complex. The municipality receives considerable revenue from taxes on RLAM. Small portions of the region's industrial workers also live in this city, although few have professional capabilities.

4.28 Housing conditions are marginal to poor in the two municipalities. In Candeias, 57% of the population lived in homes with adequate water supply, and only 27% of domiciles had adequate sanitary waste disposal installations (unshared facilities draining into septic tanks or sewer systems) (1991 data). In addition, the pressure of rapid population growth has resulted in the increase of inadequate municipal services. The cities have not been able to keep up with the requirements for public utilities and other economic and social services and infrastructure. Health conditions have been improving in the Project area communities. The majority of deaths occur from diseases associated with aging (in 1991, life expectancy in Candeias was 59 years, while in São Francisco do Conde it was 62). Data for the year 1996 for infant mortality were characterized as significantly improved from 1991: These data indicate increasing accessibility to public health services.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

A. Construction Phase

Flora and Fauna

5.1 The areas to be occupied with the construction of the components for implementation of the Project do not present any significant vegetation or fauna. The vegetation cover of the area under study is not a native formation but rather the result of the implementation of a landscaping and reforestation Project.

5.2 The route of the transmission line crosses a mangrove area at the Mataripe River, but the towers interconnecting the line across this area will not be located within the mangrove areas. For the remaining route of the transmission line, only some reforested areas will be crossed. Areas with steep slopes will require additional civil works for the installation of the towers and supportive structure. Compacting of soil for trucks and machines, noise and removal of vegetation will cause disturbance of the habitat.

Air Quality and Dust

5.3 During construction, earthmoving activities and heavy equipment usage will cause short-term impacts on ambient air quality. Given the relatively tropical nature of the Project area, fugitive particulate emissions are not expected to be a significant consideration during construction. No significant fugitive dust was observed during the Project site visit. Vehicle traffic and heavy equipment will result in emissions of gaseous pollutants and particulate matters. However, these emissions will be spread over the construction area and are not expected to result in significant impacts.

5.4 The earth moving necessary for the implementation of the various works increases the levels of dust in the border areas. With respect to construction, the most affected people will be the construction and refinery workers. For the construction of the transmission line, this impact may be less because the earth moving necessary for the implementation of the towers is less and restricted to several areas. If, however, roads need to be cleared and built to provide access to tower locations, the impact could increase to beyond the immediate area of the towers, depending on the length and amount of roads to be constructed.

Noise

5.5 Noise caused by the machines such as saws, jackhammers, pile drivers, and a variety of excavation equipment could temporarily frighten away the pre-existing fauna. Considering the characteristics of the habitats presented above, the impact is relatively small.

5.6 The receptors nearest to the Project are the RLAM offices located some 200 meters from the construction site. It is expected that, at this point, the construction work noise level will have fallen to that far lower than the background noise measured on the site, and therefore be inaudible. There are no communities in the vicinity that could be affected by any environmental discomfort caused by the sounds emitted during construction of the Project.

Land Use

5.7 The need to acquire areas for constructing the transmission line is not anticipated. The largest part of the route crosses areas owned by Petrobras. In the rest of the area, there are some 20 medium to large size properties, the soil use of which is essentially pastureland and deforested areas. The survey indicated nine urban real estate properties and 11 rural ones, which shall be affected by the installation of the transmission line, which should not result in a significant change in land use.

Construction Traffic

5.8 There is an increased risk of accidents, degradation of road infrastructure and jeopardizing of the refinery's and local road system outside the Refinery due to the increased heavy vehicle traffic. Expected traffic includes wide and heavy loads of larger pieces of equipment for the power plant on the access roads to RLAM or on the accesses common to the Project and to RLAM.

Environmental Liabilities (Soil Contamination)

5.9 The subsurface environmental contamination appears to be very minor at the Project site based upon the result of the borings as part of the Phase II subsurface investigations and observations made during the grading of the Termobahia. The "Farofa" area, where considerable dumping of oily material has been conducted, lies directly to the north/northwest of Termobahia. However the Farofa area is downgradient of Termobahia Project site.

Erosion

5.10 There is the risk of silting of the waterbodies during the construction of Termobahia and of the TL as a result of the exposure of erosive material. Civil works may lead to silting of waterbodies and access routes, the instability of embankments and slopes compromising the existing structures (roads and surrounding buildings).

Disposal of Solid Waste

5.11 Most of the solid residues that will be generated in this phase of the Project are from demolition material considered inert. RLAM has an area for disposal of demolition material, and the domestic waste shall be directed, together with waste generated by the refinery, to the LIMPEC landfill.

Landscape

5.12 The towers will impact the natural landscape. In addition, some areas will be needed to stockpile cables and other materials for the construction of foundations and metallic towers.

Social

5.13 The social impacts of the Termobahia Project will derive primarily from mobilization and demobilization of the construction workforce. Levels of direct employment will vary widely over the two-year construction period, averaging around 250 jobs, but peaking at 400 during the height of civil construction activity. Most workers will be recruited from the Salvador area, where the more skilled construction workers reside. The majority of the workers will be bussed in by the contractor from Salvador with the rest of the labor hired from among the inhabitants of the region. Unskilled manual workers, which are primarily connected with the civil works, are proposed to be hired on a day-to-day basis from people showing up at the Project entryways from nearby communities.

5.14 The Project might attract an influx of itinerant workers from outside the local area hoping to find work during the construction phase. Hiring manual workers at the Project entryways is troubling because it can reinforce the desire of itinerants to migrate to the area. If large numbers of non-local workers were to descend on these communities for prolonged periods of time, living in squatter encampments, the municipalities' ability to provide housing, sanitation, police protection and other governmental services and facilities could be strained, imposing hardships and costs on the residents. The existence of sanitation, health, and safety facilities at Termobahia would not alleviate this problem, because they would not be available to persons not employed on the Project.

5.15 During the implementation phase of the transmission line installation, there may be negative impacts associated with importation of recruited workers on small towns and settlements, such as Caroba and Dende.

Health and Safety

5.16 The impacts on the occupational health and safety are typical for this type of work. Occupational hazards exist during construction of the power plant. Critical safety issues during construction include transportation of equipment and materials to and within the site; handling and storage of materials on site; crane and other heavy equipment operation; work on scaffolding, platforms and other work at height; hot work such as welding; excavations and trenching; confined space work; working with and around electrical, hydraulic and other energized systems; and potential for fires, explosions, spills and other emergencies.

5.17 No adverse health conditions or critical worker safety conditions are expected during construction. No occupational health concerns were identified as a result of the proximity to RLAM. Construction health and safety concerns include exposure to chemicals (e.g., fuels, degreasers, welding fumes) and dusts (e.g., silica); exposure to noise and radiation; exposure to extreme temperatures; and general sanitary conditions (toilets, showers, food preparation and eating facilities, and drinking water provisions). The setting of the cables themselves will increase the risk of accidents due to the rugged terrain and steep access of the transmission line.

B. Operation phase

Air Quality

5.18 The principal impacts during operation of the Project are the emissions from the gas turbines and cooling towers. The air emissions from the plant stack will include NOx, carbon monoxide (CO), particulate matter, and trace amounts of SO_2 and unburned hydrocarbons. Emissions will be controlled using dry, low-NOx combustion technology. The EPC guaranteed emission levels will comply with the applicable Brazilian emission standards and the World Bank guidelines for New Thermal Power Plants included in the Pollution Prevention and Abatement Handbook, July 1998. The cooling towers will emit small amounts of particulate matter, but given the amount of emissions and low plume rise from the tower cells, the cooling tower is not expected to have significant impacts.

5.19 The presence of elevated background concentrations is likely due to refinery operations. RLAM has conducted preliminary dispersion modeling, which predicts high concentrations for all pollutants (Table 5). While dispersion models may significantly overpredict short-term concentration levels, these results confirm the findings of the two sampling programs. The

modeling identified five units within RLAM as the principal contributors to the elevated concentrations of NOx. One of these sources, Unit 51, includes the five old boilers to be removed from service following completion of Termobahia.

5.20 The Project should result in a reduction in RLAM boiler operation. When Phase I becomes operational, two of the five Unit 51 boilers will be removed from service and the other three Unit 51 boilers will operate at approximately one-half load. The decommissioning of all five boilers is expected when Phase II becomes operational. In order to evaluate the potential air quality impacts from the Phase I of the Termobahia power plant, the Sponsor used dispersion modeling to quantify the contribution first from current operations of the Unit 51 boilers, and then separately from the Project.

Dispersion Model – Source Definition

5.21 The ISCST3 model was used in the ambient air quality assessment and combines two (Schulman-Scire and Huber-Snyder) algorithms for predicting air quality impacts and the associated building wake effects. The Schulman-Scire algorithm is applicable when the stack height is less than the building height plus one half of the lesser of the building height or width, and takes into account the wind-direction-specific building heights and widths when determining wake effects. The Huber-Snyder algorithm is applicable when the stack height is between 1.5 H_b and 2.5 H_b, and uses the actual building height and the maximum Projected width for all wind directions. An USEPA approved software package, Building Profile Input Program (BPIP), was used to calculate the direction specific building dimensions and the resulting GEP stack height. The direction specific building dimensions generated by BPIP were used in the ISCST3 modeling. This approach is consistent with generally accepted practices. ISCST uses a steady-state assumption (that is, emissions and meteorological conditions do not change over a one-hour period). The model can analyze the interaction of multiple sources. The ISCST model results were then used to compare with the applicable standards and guidelines. Input to the models consists of source data and emissions estimates, meteorological data, and receptor data.

Emission Estimation

5.22 The point sources considered for this analysis consist of the Project turbine stack and the Unit 51 boilers. Information on the boilers is contained in an emissions inventory done for RLAM. The calculated emissions and other exhaust parameters for the Termobahia Project and the Unit 51 boilers are presented in Tables 6 and 7. All averaging intervals assumed operation of the turbines at full load for 8,760 hours per year. The emissions from the turbines are based on EPC guarantee levels for both natural gas and refinery gas provided by the Sponsors incorporating the proposed pollution control measures; note that the levels for sulfur dioxide and particulate matter are very conservative estimates. Emissions from the boilers have been based upon operations data and published emission factors, and are contained in the 1999 RLAM emissions inventory. This inventory was reviewed and appears to have been prepared using generally accepted practices and emission factors. The measured fuel oil consumption of the boilers was applied to the emission factors suggested in the USEPA document AP-42 ("Compilation of Air Pollutant Emission Factors"). These factors are derived from the operating data from multiple similar facilities, which are expected to provide a conservative estimate of emissions.

Meteorological Data and Receptor Networks

5.23 Over one year of meteorological data has been collected at three stations in RLAM. When the data sets from these three stations are combined, a complete hourly data set was developed. Use of these "On-site" data is consistent with accepted modeling practices.

5.24 The receptor network consisted of receptors spaced 1000 meter apart. Each receptor was assigned an elevation so that impacts on complex terrain could be quantified. Discrete receptors were also located at cities nearby to the Project area.

Modeling Results

5.25 The results for the combined Phase I and Phase II turbines and the modeling results for the Unit 51 boilers are presented in Table 8. It should be noted that the maximum impacts from the boilers do not occur at the exact location of the maximum impacts from the Project. However, all the maximum impacts occur in the same general region. Therefore the two sets of results can be directly compared to determine the effects of the Project and potential boiler shut downs.

5.26 For nitrogen dioxide, the key parameter of concern for this project, the modeling for Phase I alone indicates that the maximum one-hour nitrogen dioxide concentration would be 34.5 micrograms per cubic meter and 69.0 micrograms per cubic meter for both Phase I and Phase II. Note that the modeling assumes that all the emissions of nitrogen oxides are in the form of nitrogen dioxide, which is an conservative assumption and thus will overestimate potential impacts. Adding this increase to the maximum monitored value, without consideration of the reduced boiler operation, could result in an exceedance of the Brazilian one-hour standard, while no problems would likely appear with the 24 hour and annual standards. The modeling predicts that the Unit 51 boilers alone could cause a violation of the Brazilian one-hour nitrogen dioxide standard. The modeling indicates that operation of both phases of the Termobahia Project in conjunction with the shut down of the Unit 51 boilers would result in a net air quality benefit in terms of nitrogen dioxide.

Increase in the Demand for the RLAM Water Treatment Systems

5.27 All water to be used by Termobahia will be supplied by the existing RLAM systems and will have capability to support the extra demand imposed by Termobahia's needs. Water will be supplied by RLAM via existing water supply authorization from the Catu River and Pedra de Cavalo. The total consumption of freshwater expected for Termobahia ranges between 350 m^3/h and 550 m^3/h, depending on the condensate back flow from the refinery.

Water Discharge

5.28 Sanitary wastewater will be fed into an on-site sanitary wastewater treatment plant consisting of a septic tank and an anaerobic filter. Process wastewater will be conditioned to meet Brazilian and World Bank Guidelines limits and discharged to the RLAM wastewater discharge system into the Bay. The effect on the flow from Termobahia is expected to be minimal on RLAM's wastewater discharge and will meet discharge limits imposed on RLAM. The Project will discharge stormwater into the The Mataripe River, and will comply with applicable Brazilian wastewater discharge standards. During the flow of the tides, the effluents would be transported up river, which will affect the coastal forests and swamps located upstream from the discharge point. However, the percentage of volume to be discharged would be low and limited to rainy episodes, in which various runoffs into the Mataripe River will increase the flow towards the Bay.

Noise

5.29 The following noise levels are expected for Termobahia equipment: fenceline noise guarantee is 68 dB(A) for Phase I and 70 dB(A) for phases 1 and 2 operating together, and an estimated 55 dB(A) in the administrative buildings (laboratory, control room and offices). According to the EIA, the predicted increase in noise levels should not exceed the recommended standards for the closest receptors. Given that the Project is located in an industrial area, noise levels are not anticipated to exceed Brazilian standards and World Bank guidelines. It is also expected that noise from the cogeneration plant will not be heard by the fauna existing in the mangrove closest to the Project.

5.30 Based on federal and state legislation and on the Projection for noise from Termobahia equipment, a study was made of the effect on RLAM workers, since there are no living quarters nearby. Discrete receptors considered were: the refinery restaurant, offices, and employees' club. The assessment of this impact was carried out based on parameters established by state and federal legislation, mainly CONAMA Resolution 01/90 and CEPRAM Resolution 1150/95, both based on ABNT NBR 10151 and NBR 10152, - ABNT 10151 – community acceptance of the noise; - ABNT 10152 – acoustic comfort. The laws refer to the impact on the nearby community, herein, given the specifics of the location of the plant, the community is understood as refinery employees, principally in the refinery offices, in the Training Center, and in the restaurant. The EIA provides some simplified theoretical estimates of the noise levels at various receptors. These calculations seem to indicate a likely impact from Termobahia, which according to the owner, should not exceed 70 dBA at the plant's limits.

Vegetation

5.31 During the operational phase of the transmission line installation there may be a need for removal of vegetation in order to keep it away from energized cables and to decrease the risk of work accidents and encounters with poisonous animals during the maintenance of cables, isolators, and towers.

Social

5.32 As a mitigating measure for the workforce demobilization the EIA proposes adoption of a Labor Force Demobilization Plan to ease the assimilation of workers as they are laid off through initiation of agreements with various institutions, including municipal governments, SINE, SINAI, and SENAC. The objective would be to provide assistance in finding new jobs and upgrading skills. According to the EIA, the responsibility for undertaking such actions would rest with the Sponsors, via its contractors. The mechanism for implementing such a program is not described, nor is the chain of responsibility laid down.

Health and Safety

5.33 No adverse impacts associated with the health and safety of the workers are expected during the operational phase of the Project, with the exception of the risk of typical accidents associated with the routine activities at the plant. Adequate health and safety standards and procedures should be followed during the construction and operation steps of the plant.

C. Positive Impacts/Benefits

5.34 The most significant positive impacts are related to the potential deactivation of the five 40 year old boilers firing fuel oil at RLAM, which would significantly reduce the SOx and particulate matter emissions from the power generating facilities and this will improve local ambient air quality.

5.35 The Project will add new generation capacity to third parties. The Project will have a positive impact by generating and providing electric energy to the system. This will help advance the development of new industries and the improvement of the residential supply. When compared to other usual generation technologies, natural gas thermal plants are the best option considering environmental, technical and economic factors, as well as Petrobras' need for steam and electric energy and the available energy sources in the targeted region. This need is reinforced by the fact that Petrobras presently consumes a large amount of electric energy supplied by the Interconnected System.

5.36 The Project will generate positive impacts or benefits to the local area as a result from jobs generated by the construction work and the commercialization of goods and services. During construction, the Project will generate direct jobs (approximately 250 jobs, reaching 400 during the peak periods) and indirect jobs, with the consequent enhancement of the local economy, in particular in the municipalities of Candeias and São Francisco do Conde. During operation, the operating staff of about 40 people will make a permanent contribution to the well-being of the communities where they live. The Termobahia Project would have a positive temporary economic impact on the local area, and would do less to directly improve long-term economic and social conditions under current institutional arrangements (i.e. job training programs, and local government welfare activities).

VI. ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

A. Construction Phase

Soil Remediation at RLAM

6.1 Regarding the Farofa area, a proposed plan has been developed by an environmental consulting firm ("*SAPOTEC*") oriented to (i) remove and, potentially, reuse, free phase product and (ii) treat residual contaminated soil. At this time, SAPOTEC has estimated the free product to be 10,000 m^3 and the estimated amount of contaminated soil (primarily containing Polynuclear Aromatic Hydrocarbons) is 50,000 m^3. This soil would be treated by some combination of low temperature thermal desorption, bioremediation, and immobilization scheme. Final concentrations of petroleum hydrocarbons in the soil could vary from 5000 to 1000 ppm total petroleum hydrocarbons. Estimated costs are in the 11,000,000 to 14,000,000 R$ range.

6.2 Both of these areas are being addressed as part of conditions imposed on RLAM by the CRA. In addition, CRA has ordered that RLAM institute a number of studies to evaluate the presence and extent of soil and groundwater contamination.

Flora and Fauna

6.3 A maintenance and preservation program will be implemented to preserve the mangrove areas along the margins of Mataripe and São Paulo Rivers. This will include a system for preventing

contaminants from reaching the mangroves as a result of accidental discharges. Monitoring procedures will be established to identify toxicity levels and respond with emergency actions in order to minimize any damages caused by an accident.

6.4 The occasional risks associated with hunting within vicinity of the Project area, especially mangrove areas, will be mitigated by providing the workers with training on avoiding the hunting of crabs, the clearing of vegetation, and other procedures.

Degradation of the Areas due to Removal of Borrowed Material and Disposal of Waste Material

6.5 The mitigation measures will be standard good engineering practice corrective and controlling measures such as the reinforcement of the most vulnerable embankments located near the areas directly disturbed. In addition, the Sponsors will implement measures to minimize impacts on topography and to reduce erosion potential during construction of the Project, including the following:

- Minimize removals of vegetation and near-surface soils during site preparation; Re-vegetate the areas affected by construction;
- Construct a runoff collection system, place silt traps, fences, or hay bales, as necessary, and cover bare ground;
- Select appropriate right-of-way for access to the construction sites;
- Restrict vehicles from crossing streams and entering non-existing roads;
- Maintain natural drainage patterns; and
- Leave tree stumps and roots in place;

6.6 To minimize impacts on surface water and groundwater during construction of the Project, the EPC Contractor will design the slope areas to maintain natural drainage patterns. In addition, the EPC Contractor will provide collection systems to prevent infiltration and to protect the groundwater resources. A plan for areas degraded by construction activities will be designed to minimize the impacts caused by the earthworks and the utilization of borrow pits and disposal areas. The intent of this program is to integrate these areas to the predominant scenery of the region, controlling erosion processes, recovering flora elements and providing a future use.

6.7 Most of the waste material will be disposed of in locations already utilized by Petrobrás for this purpose and which, according to RLAM have the capacity to hold the volume of waste material that will result from the excavation. Domestic waste shall be directed to the LIMPEC landfill.

Construction Traffic

6.8 To minimize the impact as a result of heavy vehicles traffic and in order to avoid interfering in RLAM internal traffic and resulting impacts on the workers' safety and roadway infrastructure, an independent access has been built to the Termobahia area. Vehicles impacts will be controlled through the adoption of the usual safety measures, such as marking the accesses, controlling truck traffic (using cargo covers, washing the trucks' tires before leaving the construction area so as not to carry mud and sediment to the accesses used in common with RLAM).

6.9 According to EPC contractor personnel, they are working with local officials to plan and monitor the condition of roads and bridges before, during, and after the transport of the heaviest pieces of equipment by truck and to define the routes to be taken and precautionary and monitoring measures during the transport of turbines and heavy equipment to the site.

Noise

6.10 Noise levels will meet Brazilian industrial area standards and World Bank Guidelines for new Power Plants. Construction workers will be protected from noise by the labor safety measures taken by the auditive conservation program.

Air Quality and Dust

6.11 This impact will be minimized by the regular moistening of the areas of non-compacted material, temporary fills, borrowed and disposal areas, the pile of stored organic material, etc. The EPC Contractor will spray water on roads and excavation piles to control dust during construction of the Project. The EPC Contractor will pave and/or surface the roads with non-hazardous dust control materials. The EPC Contractor will also provide proper maintenance of construction vehicles to reduce impacts on air quality. Another important measure to be adopted to minimize this impact is the immediate recovery of the areas after their utilization (borrowing, disposal).

Land Price Speculation on Right-of-ways for the Transmission Line

6.12 A property register was prepared for the areas crossed by the transmission line. The indemnification for the restriction of the land use imposed on the owners of the areas will be performed at market prices. The company shall document the condition and survey the topography of properties the transmission line crosses and provide support to the owners and their representatives to properly, fairly, and appropriately indemnify the affected landowners. The indemnification shall establish a criteria whereby the original intended uses of the property are not significantly impacted. In the worst case, the areas might be acquired. Purchase of the areas will be made according to the market value. The Company has undertaken to establish a line of communication with the landowners in order to negotiate. Besides that, the Project is being submitted for environmental licensing with CRA, which could eventually establish additional requirements. The National Electric Power Agency (ANEEL) has already declared the area as a "public utility". Right-of-way over crossroads and other similar structures should be obtained from the appropriate responsible transportation official. Crossings with roads and other structures must be previously approved by the officials responsible for the structure.

6.13 During the construction phase of the transmission line, the EPC Contractor is proposing to conduct the following mitigation measures:

- Construction of a plant nursery for the production and distribution of seedlings of native and fructiferous plants for rural properties of the region which are crossed the by the transmission line;
- Establishment of a rescue program for the native animals found and captured during the implementation of the enterprise, for transferring them to an area to be chosen by indication of CRA-State Environmental Resources Center;
- Assure special operational cares in the areas of implementation of the foundations in order to avoid erosion from soil excavations being carried during rainy periods;
- Avoid the improper accumulation of residues in the proximity of the places where the foundation locations;
- Avoid the construction of metallic towers in places where flood and/or erosive processes may occur, in order to guarantee the operational efficiency of the implemented system;
- Adoption of preventive measures, as the temporary protection of the soils, destined to avoid erosive processes during the works of earth movement;

- Immediate protection of the deforested hillsides and the embankments through any type of fixation of the soil, as grass planting;
- The lands should be maintained clean, without refuse material or any other materials that can put in risk the safety of the area and of transmission line;
- Appropriate disposal of rests of materials from excavations, in a place to be defined by the municipal governments of Candeias and São Francisco do Conde;
- Establishment of a program to inform the workers, through lectures, about the correct behavior for the environment protection during the execution of the services, highlighting the commitment of the company with the environmental preservation and emphasizing the importance of protection of existing flora and fauna in the areas adjacent to transmission line domain strip;
- Supply the workers who will be exposed to excessive levels of dust and noise, and damages caused by poisonous animals, with individual protection equipment;
- Appropriate packaging, for subsequent withdrawal by the municipal utilities from Candeias and São Francisco do Conde, of the domestic garbage generated in the construction site, not allowing it to be disposed in neighboring lands or in the place of the works, for not favoring the proliferation of vectors;
- For civil works, prioritize the contracting of workers from the vicinities of the site, benefiting this way the population of low income;
- Construction of movable latrines of obligatory use for the workers, as a measure for prevention of diseases;

Social Impacts

Mobilization of the Labor Force

6.14 The Sponsors will develop a socio-economic action plan in connection with the construction phase of the Project. The Sponsors have committed to frequent communications with the local government representatives. In principal, the socio-economic action plan will consist of two components: 1) identifying "initial" mitigation measures that are agreeable to both the Sponsors and the local communities, and 2) monitoring the effectiveness of mitigation over time and making changes, if necessary. The Sponsors and the EPC Contractor will ensure that reasonable and necessary mitigation will be implemented and that flexibility will be provided so that actual mitigation will correspond with actual impacts.

6.15 The socio-economic Action Plan will include the following significant elements:

- Project Liaison. A local liaison will be appointed for the Project. The liaison will meet with the municipal leaders and present an estimate of the likely increase in population, construction schedule, and other Project-related information. The liaison will ask the community leaders to provide feedback on whether problems are expected in such areas as housing, public services, transportation, noise, etc. A Local Community Affairs Representative will also be appointed.
- Assistance in Community Affairs. The Sponsors will participate in meetings to discuss with the people and the officials whether additional mitigation is needed.
- Space for Vendors. The Sponsors will provide an organized, separate space away from construction activities for food vendors.
- Busing Workers to Site. The Sponsors will bus all construction workers to the site. The workers will not be allowed to use personal vehicles to commute to the site.
- Training Local Residents. The Sponsors will train local residents to become plant workers.

- Financial Assistance. Termobahia will cooperate with local communities and will provide academic scholarships to local students.

6.16 The manpower demobilization at the completion of the civil works will be treated by a specific plan so the workers can be dismissed according to the needs of the Project construction timetable, and massive dismissals can be avoided. Proposed actions, such as agreements with labor organizations and municipal administrations will seek to find other jobs for the demobilized manpower.

Increase in the Demand for Sanitation, Safety and Health Services in the Refinery

6.17 It appears that the existing capacity within RLAM is such that it has taken into consideration the dynamics of a widely varying number of employees, given it's other plans for upgrades, construction, etc. Considering that the existing systems have capacity to serve to an identified temporary demand, no associated measures are proposed.

Operation Phase

Air Quality

6.18 Air emissions from the combustion process will be controlled through the use of natural gas and refinery gas fuels and dry, low-NOx combustors. Air emissions of the Project will comply with the applicable Brazilian and the World Bank Guideline for New Power Plants included in the Pollution Prevention and Abatement Handbook, July 1998.

Increase in the Demand for the RLAM Water Treatment Systems

6.19 A monitoring program for the amount of water received by Termobahia is recommended to guarantee that flow rates stay within the forecast interval, to facilitate the management by RLAM and the necessary water supply for Termobahia.

Water Discharge

6.20 Effluent discharge will comply with Brazilian and State standards as defined by the environmental legislation in force (CONAMA Resolution 20/86) and the limits included in the World Bank Guideline for New Power Plants. The control measures cover the adoption of a system for the systematic monitoring of Termobahia effluents before discharging the stormwater into the Mataripe River and process water to RLAM's discharge point.

Disposal of Wastes

6.21 A variety of solid wastes, both non-inert (Class II) and inert (Class III) will be produced by Termobahia. Termobahia will dispose of all these wastes in accordance with applicable law, likely at the LIMPEC Industrial landfill.

Noise Generation

6.22 The Sponsors have indicated that the equipment of the power plant has been designed that the noise emissions at the plant boundary will meet the Brazilian standard and the World Bank guidelines.

Vegetation

6.23 During normal operations of the transmission lines there should be permanent pruning of the arboreal specimens and limitation of the traffic of vehicles along the domain strip, after the energizing of the transmission line.

B. Environmental and Social Monitoring Programs

6.24 Proposed monitoring activities during Project operation include air quality, water effluents, noise, mangroves areas, and soil and groundwater. The Sponsors and the EPC Contractor will develop an Environmental Compliance Monitoring Plan for the Project. This plan will include the procedures of sampling and analysis that will be followed, a comparison of the monitoring data with the applicable standards, and the measures that will be taken to correct the situation when violations are observed or noticed.

Air Emissions

6.25 The Project Company will equip the turbine stack with continuous emissions monitors (CEM) for NOx and oxygen. The CEM will be operated in accordance with the USEPA guidelines for quality control and quality assurance.

Ambient Air Quality

6.26 RLAM is required to install and operate a minimum of three ambient air quality monitoring stations. The stations will monitor nitrogen oxides, sulfur dioxide, and particulate matter on a continuous basis.

Water Effluents

6.27 Effluent will be monitored prior to its discharge into the RLAM discharge point in accordance with the parameters established by Resolution CONAMA 20/86. The following parameters will be monitored: (i) daily- pH, Temperature; (ii) weekly – dissolved oxygen (DO), Oils and greases, Biochemical oxygen demand (BOD), Suspended Solids (SS), Suspended Solids Volatile (SSV), Chemical Oxygen Demand (COD); (iii) semi-monthly – Heavy metals, total Iron; (iv) monthly – Alkalinity, hardness, Chlorides, Conductivity, Color, Sulfide, Acute toxicity. Discharge monitoring of stormwater to the Mataripe River will be conducted in accordance with World Bank Guidelines.

Mangrove Areas

6.28 Measures addressed to protect the mangrove include monitoring of the Termobahia effluents.

Soil and Groundwater

6.29 A groundwater monitoring plan will use monitoring wells (installed or under construction) at the boundaries of the site to monitor the local groundwater quality, especially at the boundaries between the Termobahia site and adjacent areas with known contamination (i.e. “Farofa”). This plan will include the procedures of sampling and analysis that will be followed during monitoring, a comparison of the monitoring data with the applicable standards, and the measures that will be taken to correct the situation when violations were observed or noticed.

Noise

6.30 The Project Company plans to collect samples at four to eight locations over multiple times, dates, and conditions. The locations will be selected so that they are representative of the existing environment. In addition, the Project Company will conduct a noise survey within the first year of commercial operation.

C. Health and Safety

6.31 Alstom, the EPC Contractor, has modified its standard health and safety procedures and produced a Project specific document to be followed by employees of Alstom and its subcontractors during construction. The manual contains procedures for a facility of this type (e.g., energy isolation procedures, safety responsibilities, hot work procedures, use of manual and power tools). The procedures are well organized, divided into Objective, Definitions, General and Technical Requirements sections. As an example, the electrical hazards procedure is appropriate in scope and detail for a Project of this type. The procedure provides the type of information and requirements, which one would need to work safely at an existing power facility.

6.32 The Sponsors and the EPC Contractor will assign an experienced safety professional to enforce and supervise the application of the required safety measures. The Sponsors and the EPC Contractor will provide the workers with the necessary Personal Protection Equipment (PPE).In addition, the EPC Contractor will implement the following measures to promote hygiene and health for the construction workers

- Provide workers with protective equipment, including eye guards, ear plugs, gloves, etc.
- Train workers in handling dangerous materials and electrical equipment
- Instruct workers in medical first aid
- Provide appropriate procedures for disposal of construction debris.

6.33 Alstom uses its Safety and Environmental Protection Manual (February 2001), for first induction training. This Manual provides a brief discussion of general safety and environmental practices. It is similar in nature to those prepared by insurance companies for distribution to new employees of major construction companies. This document covers environmental and health and safety general construction concepts. General training is provided to the workers based on this manual and through the employee's signature on the Training Certificate (page 95), this document serves to acknowledge that the employee received training.

6.34 RLAM has it's own Environmental and Health and Safety procedures which are followed within RLAM. The procedures are primarily environmental programs and cover such areas as environmental risk, waste management and waste effluents. The procedures are sufficiently detailed for their purpose. Operational Environmental Health and Safety procedures will be prepared prior to operation of the Termobahia Project.

6.35 The Project Company will prepare and implement a Health and Safety Program to effectively manage the safety and occupational health concerns in connection with plant operations. The H&S Program will be in accordance with the Brazilian regulations and IADB Guidelines. This H&S program will include, as minimum, material safety data sheets, H&S risk identification, H&S procedures, monitoring plan, medical surveillance plan, training, as well as accident investigation, record keeping, and reporting.

6.36 Termobahia will implement codes and procedures in accordance with the valid legislation and compatible with the BS 8800 principles. Health and safety standards and procedures will be implemented in accordance with the requirements of the Brazilian legislation.

D. Contingency Plan and Procedures

6.37 Termobahia will prepare a Contingency Plan, both for the construction and the operation of the Project. The plan will include a description of the potential Project risks, hazards and emergencies and the interaction with any risk episode at RLAM. The plan will include the necessary procedures, equipment, training, responsibilities, and resources required to adequately control and respond to potential project risks and emergencies.

6.38 The EPC Contractor will develop a Spill Prevention Control and Countermeasure (SPCC) Plan for use during construction of the Project. The SPCC Plan will include the following:

- A facility diagram showing areas where chemicals and oil are stored or handled;
- Typical and maximum quantities of chemicals and oil stored onsite;
- Identification of likely pathways;
- Locations of spill containment materials and cleanup equipment;
- Procedures for dealing with various types of anticipated spills and releases;
- Safety precautions for personnel involved in spill cleanups;
- Notification requirements for regulatory agencies, the Project Company corporate contacts, and community individuals;
- Actions that the facility personnel should take in the event of a spill;
- Actions that the local/regional authorities and contractors will take in the event of a spill;
- Current listing of names and telephone numbers of the emergency coordinator and alternates;
- Evacuation plan for facility personnel;
- Procedures for handling potential emergencies or major accidents, including, fire, explosion, structures collapse, and traffic accidents involving heavy vehicles;
- The Project Company will develop an Emergency Plan (including SPCC Plan) for use in connection with operation and maintenance of the Project. The Project Company will develop and finalize the document prior to plant operations.

E. Environmental, Health and Safety Management

6.39 The EPC Contractor will develop an Environmental and Social Management Plan (ESMP) for the Project. The ESMP will identify the details and specific actions that will be implemented in order to meet all applicable environmental standards. The ESMP will establish an organization with a clear understanding of the responsibilities that will be critical to protecting human health and safety during construction of the Project. The ESMP will include detailed descriptions on mitigation and control measures, monitoring and sampling procedures, quality control, public consultation and information disclosure program, and reporting procedures.

VII. PUBLIC CONSULTATION

7.1 According to Brazilian environmental legislation, Projects such as Termobahia should be submitted to public hearings during the permitting process previous to the issuing of the Localization License. A public announcement was made by issuing the Expansion License that authorizes Petrobrás –

Petróleo Brasileiro S/A – Refinery Landulpho Alves/RLAM to transfer Natural Gas and Refinery Gas into Electric Energy and Steam, in Mataripe, Municipality of São Francisco do Conde, Bahia, in a widely distributed local newspaper, as required in the Resolution CEPRAM N# 2046, dated of 08/20/1999. However, no public hearing was required by CRA/CEPRAM as part of the Environmental Self-Licensing ALA process.

7.2 As per request of the IDB, the Project EIA was made available to the local public in February 2001. The Environmental and Social Impact Brief (ESIB) was also made available in the city halls of Candeias, São Francisco do Conde and Madre de Deus.

7.3 Public consultations on the Termobahia Project were held on July 4, 2001 in the City of Candeias and on July 5, 2001 in the city of São Francisco do Conde and Madre de Deus. Notice of the presentations was published in two state newspapers and advertisements were placed in schools, churches, hospitals, and at the city hall. Contacts with property owners were being made individually. These notices indicated the time, date, and venue of the hearing, as well as the reason for it. An information folder of the Termobahia Project was distributed during the presentation. Prior to the presentations, the EIA was made available in the State Environmental Control Agency in Salvador.

7.4 Approximately 60 persons, including the mayors, local government representatives, teachers and other members of the communities attended the presentation in Candeias while approximately 100 persons participated in the meeting in São Francisco do Conde. According to PROPEG, there are no non-governmental organizations (NGOs) active in the environmental sector in the area and none were present at the events. The main questions focused on the distribution of the benefits between the municipalities of the region – Candeias, São Francisco do Conde and Madre de Deus – especially the generation of new jobs. The representatives of Candeias and São Francisco do Conde asked for a list of types of professionals that will be required for the Project in order to establish training for workers so that Termobahia's needs could be met through local support, not only during construction but during operation as well. Specific questions on environmental issues were related mainly to atmospheric emissions. The environmental benefits, specifically the abatement of atmospheric emissions by the deactivation of the five old boilers, were emphasized. No legal aspects were presented or questioned by those present. No specific questions were submitted on health and safety matters.

7.5 It was also stressed by both communities that this was a new event for the communities as it was the first time that something like that was performed in the region. None of the industries that have been installed in the last years performed public presentations, consultation or public hearings.

VIII. RECOMMENDATIONS

8.1 The Bank (IDB) proposes to require as part of the Loan Agreement that Termobahia Ltda (the Project Company) and all portions of the Project shall, at all times during the life of the Loan Agreement, comply with each of the following:

(a) All applicable environmental, health and safety Brazilian regulatory requirements, including all environmental, health and safety requirements of the Project contracts, and any subsequent modifications, and all requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project or the Company.

(b) All aspects and components of the various Project-related environmental, health and safety plans/documents.
(c) Applicable aspects of the World Bank Thermal Power Guidelines for New Plants (World Bank Pollution Prevention and Abatement Handbook, 1998), including emissions, air quality ambient noise levels and waste water discharge limits.
(d) Applicable aspects of the World Bank General Environmental Guidelines (World Bank Pollution Prevention Handbook, July 1, 1998).
(e) Applicable aspects of the World Bank Monitoring Guidelines (World Bank Pollution Prevention Handbook, July 1, 1998).
(f) Applicable aspects of the International Finance Corporation General Health and Safety Guidelines (1998).
(g) Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable which could potentially have negative environmental, social, or health and safety effects.
(h) Send written notice of any and all noncompliance with any environmental requirement of the Loan Agreement and any significant environmental, social, or health and safety accident, impact, event or environmental claim.
(i) Ensure that all companies contracted for construction or operation activities comply with the applicable environmental and social requirements of the Loan Agreement.
(j) Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the project.
(k) Implement an environmental, health and safety management system that is consistent with ISO 14001 and BS 8800 (for environment and health and safety, respectively), for the construction and the operation phases.

8.2 Prior to the date of Financial Closure, the Company must present, in form and substance acceptable to the IDB:

(a) Environmental and Social Management Plan (ESMP) for the construction phase;
(b) Health and Safety Plan for the construction phase,
(c) Contingency Plan and Spill Prevention and CounterControl Plan for the construction phase;
(d) Present a finalized approach to operate Termobahia and RLAM in order to mitigate and control the potential for exceedances of the short-term ambient air quality standards, in particular the one-hour Brazilian nitrogen dioxide standard.

8.3 Prior to First Disbursement of the Loan, the Company shall present, in form and substance acceptable to the IDB, the results of the finalized framework for ambient air quality monitoring during project operation.

8.4 Prior to the initiation of operations and Technical Completion, the Company shall submit, in form and substance acceptable to the IDB, the:

(a) Environmental and Social Management Plan for the operational phase,
(b) Health and Safety Management Plan for the operational phase,
(c) Contingency Plan and Spill Prevention and CounterControl Plan for the operational phase, and
(d) Environmental, Health and Safety Management System for the operational phase.

8.5 Prior to each disbursement, the Company must certify compliance with all environmental, social, and health and safety requirements in the Loan Agreement.

8.6 During the life of the Loan Agreement, the Company must prepare and submit an Environmental and Social Compliance Report, in form, content and frequency as agreed between the IDB and the Company.

8.7 The Bank will monitor the project's environmental, social, and health and safety aspects via internal Bank supervision actions (e.g., site visits, review of documentation, etc.) and will contract an external independent environmental consultant to assist the Bank in supervision/monitoring of the Project. In addition, the Bank will have the right, as part of the Loan Agreement, to contract for the performance of an independent environmental, health, and safety audit, if needed.

TABLE 1

AIR EMISSIONS STANDARDS [(a)]

Pollutant	Design (Based on EPC)	Brazilian Limits CONAMA Resolution 008/90 ©	World Bank Limits (Pollution Prevention Handbook; July 1998)	US E Perfor
Sulfur Dioxide (SO_2)	N/A Natural gas or refinery gas only	N/A	2,000 mg/m^3 (700 ppm)	
Nitrogen Dioxide (NO_2)	28 ppm	N/A	155 ppm (750mg/m^3 - Coal Fired)	7
Particulate	10 mg/m^3	N/A	50 mg/m^3	

Notes: [(a)] lb/MMBtu – pounds per million Btu; mg/m^3 – milligrams per cubic meter ; ppmv - parts per million (volume); I joule

[(b)] USEPA NSPS SubPart GG for gas turbines

© The National standards apply only to coal or fuel oil

The EPC guaranteed emission rate for CO is 16 ppm

TABLE 2

BRAZILIAN, USEPA AND WORLD BANK AMBIENT AIR QUALITY STANDARDS [a]

Pollutant	Averaging Time	Ambient Standards (micrograms per cubic meter)		Wo (Poll Hand
		Brazilian	USEPA	
Sulfur Dioxide (SO_2)	24-hour	365	365	
	Annual	80	80	
Nitrogen Dioxide (NO_2)	1-hour	320	- - -	
	24-hour	---	- - -	
	Annual	100	100	
Total Suspended Particulate (TSP)	24-hour	240	- -	
	Annual	80	- - -	
Fine Particulate (PM_{10})	24-hour	150	150	
	Annual	50	50	
Carbon Monoxide (CO)	8-hour	40000	40000	
	1-hour	10000	10000	
Ozone [c]	1-hour	160	235	

Notes:

[a] $\mu g/m^3$ – micrograms per cubic meter

[b] The carbon monoxide standard is a rolling average not to be exceeded more than once per year.

[c] The USEPA ozone standard is not to be exceeded more than once per year over a three year period.

TABLE 3
NOISE LIMIT VALUES
WORLD BANK AMBIENT NOISE GUIDELINE AND BAHIA REQUIREMENTS

	Maximum Allowable L_{eq} (hourly measurements), in dB			
Receptor	Daytime		Nighttime	
	07:00 - 22:00		22:00 - 07:00	
	World Bank (1)	Bahia (2)	World Bank (1)	I
Residential; institutional; educational	55	70	45	
Industrial; commercial	70	70	70	

Note: dB- Decibels

Source:

(1) World Bank General Environmental Guideline (World Bank Pollution Prevention Handbook, Ju

(2) CEPRAM Resolution 1179 – Annex A

Measurements must follow instructions set forth in CEPRAM Resolution 1179 and NBR 10151

TABLE 4
WASTEWATER EFFLUENT LIMITS

Constituent mg/L except as noted	CONAMA 20/86 Art 21	WORLD BANK	RESOLUTION 1332/96 CEPRAM - BA
Aluminum, Total as Al	0.1	Not specified	-
Ammonia as N	5	-	5
Arsenic, as As	0.5	Not specified	-
Barium as Ba	5	Not specified	-
BOD	-		60
Boron as B	5	Not specified	-
Cadmium as Cd	0.2	Not specified	-
Calcium, Total as CaCO3	Not specified	Not specified	-
Chromium as Cr04	0.5	0.5 (total)	0.5
Clorophormium	1	-	-
CN	0.2	-	0.2
COD	-		90
Copper Total as Cu	1	0.5	-
Dicloroetano	1		
Floating materials	Absent		absent
Fluoride as F	10	Not specified	-
Free Halogen Residual		0.2	
Hg	0.01	-	-
Iron	-	1	-
Iron, soluble	15	-	-
Lead as Pb	0.5	Not specified	0.5 as PbO
Manganes soluble	1		
Manganese, Total as Mn	-	Not specified	-
Molybdenum as MoO4		Not specified	-
Nitrite as N	-	-	10
Oil and Grease	20 (veg) – 50 (min)	10	20 (veg) - 50 (min)
Organoclorados, solvenst	0.05	-	-
Organic Phosphorated Compounds	1		
PH, standard units	5.0-9.0	6.0-9.0	6.0-8.0
Phenols	0.5 C6H5OH		0.5 C6H5OH
Selenium as Se	0.5	Not specified	-
Silver, as Ag	0.1	Not specified	-
SO3	1	-	1
S	1	-	1
Sulfeto Carbono	1		
Temperature °C	Max. 40 C. temperature rising at water body must not exceed 3 C		40
Tetracloreto Carbono	1		
Tin as Sn	4	Not specified	-
Total suspended solids	1 ml/L	50	-
Tricloroetano	1	-	-
Zinc, Total as Zn	5	Not specified	5

Discharging operation: maximum discharge flow must not exceed 1.5 times the average daily discharge flow for the plant.

Notes:

1. Baseload as defined in the definitions in Exhibit D ofEPC Contract
2. This temperature is at the Steam Measuring Point near the Facility boundary.
3. This pressure is at the Steam Measuring Point near the Facility boundary andis kept constant by Petrobras.
4. Performance Guarantee values include normal, long-term, steady-state, Operationblowdown from the cycle in accordance with Exhibit D of EPC Contract
5. Calculated per Annex 1 ofEPC Contract
6. This Capacity Factor is defined in Exhibit D of EPC Contract
7. The Capacity Factor Test and Reliability Test may be run at part load in
8. Accordance with Petrobras's dispatch instructions.

TABLE 5.
RESULTS OF PRELIMINARY DISPERSION MODELING FOR RLAM SOURCES (MICROGRAMS PER CUI

Pollutant	Averaging period	Predicted Concentration	National St
Sulfur Dioxide	24-hour	689	365
	Annual	224	80
Nitrogen Dioxide	1-hour	1125	320
	Annual	34	100
Carbon Monoxide	1-hour	607	40000
	Annual	236	10000
Total Particulate Matter	24-hour	40	240
	Annual	8	80

TABLE 6
TERMOBAHIA POWER PLANT STACK PARAMETERS AND EMISSION RATES

ID	Stack Height (m)	Stack Diameter (m)		Exhaust Velocity (m/s)	Exhaust Temperature (K)	NO_X (g/s)	CO (g/s
Main Stack	40	5.5		15.0	374.2	25.0	8.7

Note: The Phase I and II stacks would be identical

TABLE 7
UNIT 51 BOILER SOURCE PARAMETERS

Source		Stack Height (m)	Stack Diameter (m)	Stack Temperature (°K)	Stack Velocity (m/s)	Emission Rates (g/s)			
						SO_2	NO_X	PM_{10}	C
Stack 51 1&2		70	1.42	523	20.2	3.6	26.6	0.6	1.
Stack 51 3&4		70	1.42	523	20.2	3.6	26.6	0.6	1.
Stack 51 5		50	2.60	523	8.5	2.7	13.3	0.4	2.

TABLE 8
MODEL RESULTS FOR UNIT 51 BOILERS AND TERMOBAHIA PHASES I AND II (MICROGRAMS PER CU

Pollutant	Averaging period	Unit 51 Boilers	Unit 51, Boilers 1, 2, and 3	Termobahia Phases I and II
Nitrogen Dioxide	1-hour	391.9	235.7	69.0
	Annual	8.5	4.8	1.07
Carbon Monoxide	1-hour	28.2	17.2	24.01
	8-hour	11.5	5.8	12.4
Sulfur Dioxide	24-hour	10.0	4.5	0.365
	Annual	1.2	0.65	0.021
Particulate Matter	24-hour	1.5	0.74	3.15
	Annual	0.2	0.11	0.192

Figure 1

Project Location within the Landulfo Alves refinery (RLAM) in Mataripe.

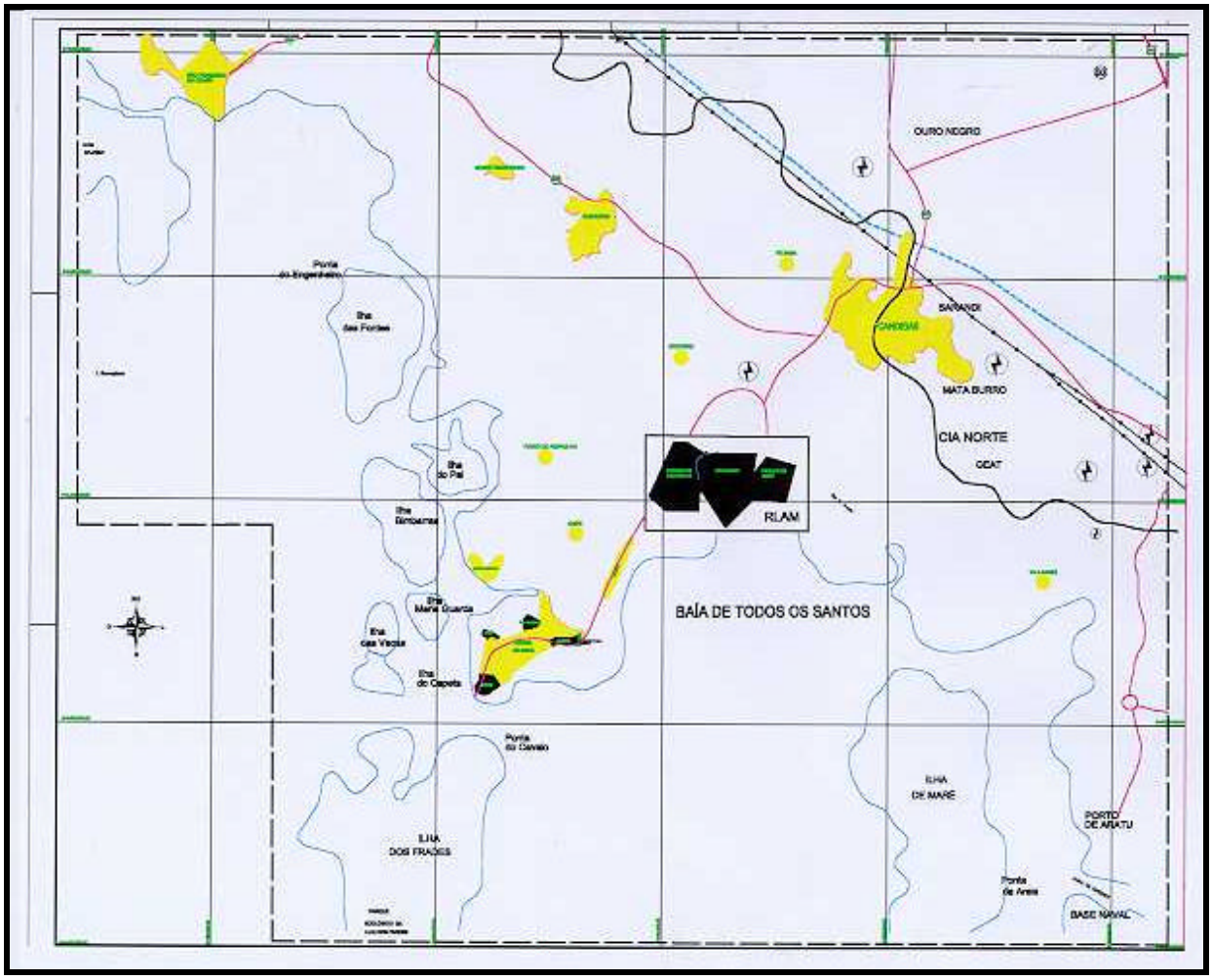

Figure 2

Aerial View of RLAM.