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Termonorte Thermoelectric Power Project
(BR-0395)

ENVIRONMENTAL AND SOCIAL IMPACT REPORT
(ESIR)

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LIST OF ACRONYMS

μg	Microgram
ABNT	Brazilian Technical Standards Association
Al_2O_3	Aluminum oxide
ANEEL	National Electrical Power Agency
ANP	National Oil Agency
CAERD	Rondônia Waste and Sewer Company
CCGT	combined-cycle gas turbine
CEMS	Continuous Emissions Monitors
CIPA	Internal Accident Prevention Commission
CLT	Brazilian Consolidated Labor Legislation
Cm	Centimeter
CNPE	National Energy Policy Council
CONAMA	National Environment Council
CONSEMA	State of Rondônia Environmental Council
CPRM	Brazilian Research Company on Mineral Resources
CT	combustion turbine
DAA	Area of Direct Influence
dB(A)	A-weighted decibel scale
DER	State Department of Transportation
DNPM	National Department of Mineral Production
DRT	Regional State-based Labor offices
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, and Construction Contractor
ESDD	Environmental and Social Due Diligence
ESDR	Environmental and Social Due Diligence Report
ESMP	Environmental and Social Management Plan
Fe_2O_3	Ferrous Oxide
FUNAI	Fundação Nacional do Índio
GCOI	Interconnected Operations Coordinating Group
GE	General Electric
H_2SO_4	sulfuric acid
HEC	Hyundai Engineering Co., Ltd.
HP	horsepower
HRSG	Heat Recovery Steam Generators
IBAMA	Brazilian Institute for Environment and Renewable Resources
IDB	Inter-American Development Bank
ILO	International Labor Organization
INPA	Instituto Nacional de Pesquisa da Amazônia
IPAAM	Institute de Proteção Ambiental da Amazônia
Kg	kilogram
Km	kilometer
km^2	square kilometer
KV	kilovolt
LO	Operating License
LP	Preliminary License
m^2	square meter
m^3	cubic meter
MAE	Wholesale Electricity Market Exchange

Mm	millimeter
MMA	Ministry of the Environment, Water Resources and the Amazon Region
MME	Ministry of Mines and Energy
MPF/MPE	Federal and State Attorney General Offices
m/sec	Meters per second
MTPS	Ministry of Labor and Social Security
MW	megawatt
NaOH	sodium hydroxide
NBR	Brazilian Norms (Standards)
NGO	Non-Governmental Organization
NO_x	nitrogen oxide
NR	Regulatory Norms
O&M	Operation and Maintenance
ONS	National System Operator
PCB	polychlorinated biphenyls
PCMSO	Workers Health and Medical Program
PM	particulate matter
PNMA	National Environmental Policy
PPA	Power Purchase Agreement
PPRA	Environmental Risks Prevention Program
PRI	Private Sector Department
Project	Phase II Termonorte Power Project
PRONAR	National Air Quality Monitoring Program
RAS	Simplified Environmental Report
RCQA	Air Quality Control Regions
RIMA	*Relatorio de Impacto Ambiental*
ROW	right-of-way
SEDAM	State of Rondônia Environmental Development Secretariat
SEMA	Municipal Secretariat of Environment
SISNAMA	National System of Environment
SPCC	Spill Prevention, Control, and Countermeasures
ST	steam Turbine
TAC	Terms of Commitment
TEVEL	Petrobras terminal em Porto Velho

I. INTRODUCTION

1.1 The Phase II Termonorte Power Project (the "Project") comprises the development, design, construction, and operation and maintenance of a dual-fuel (fuel oil/natural gas) 345-megawatt (MW) combined-cycle thermoelectric power plant. The Project is located in the Municipality of Porto Velho, State of Rondônia, in northwestern Brazil, adjacent to the existing Phase I Termonorte Power Project, a 64-MW thermoelectric power plant consisting of four 16-MW Wartsilla diesel-fired generators.

1.2 The Brazilian energy shortage, the result of a combination of economic growth and water scarcity in the reservoirs used by hydroelectric plants, led the federal government to accelerate implementation of the Thermoelectric Priority Program established by Federal Decree 3.371/00. The program estimates that over the next 10 years, generation of thermal power in Brazil will increase from 7 to 20 percent of the total energy produced in the country, expanding the Brazilian power supply by approximately 15,000 MW through the installation of 49 thermal power plants in 18 states. The Phase II Project was constructed in fast-paced scheme and achieved phased commercial operation with one turbine in simple cycle using fuel oil in November 2001 to meet the local energy demands.

1.3 The Project provides power to the electrical system that serves the states of Acre and Rondônia. Electricity from the Project is sold to the state owned electricity utility Centrais Elétricas do Norte do Brasil S.A. ("Eletronorte") under a 20-year Power Purchase Agreement ("PPA"). Eletronorte, in turn, sells the power to the respective state distribution companies, namely Centrais Elétricas de Rondônia S.A. ("Ceron") and Companhia de Eletricidade do Acre S.A. ("Eletroacre"). Under the PPA, dispatch of the Project is regulated by the needs of Eletronorte. The plant was designed to operate in either simple- or combined-cycle modes to meet the various dispatch requirements of Eletronorte.

1.4 Termonorte Energia Ltda. (Termonorte or "the Project Company") is a company formed by the consortium of El Paso Energy Corporation and CS Participações Ltda Group. Termonorte Energia Ltda. was responsible for hiring the Engineering, Procurement, and Construction ("EPC") Contractor for the Project, and will operate the power plant.

1.5 The EPC Contractor consists of a consortium formed by Construções e Comércio Camargo Corrêa and Hyundai Engineering & Construction Co., LTD. Construções e Comércio Camargo Corrêa is a leading company in the engineering and construction sector in Brazil and belongs to the Camargo Corrêa Group, one of the largest Brazilian conglomerates. Hyundai Engineering Co., Ltd. (HEC), a Korean company founded in 1974, is one of the pioneers in engineering services in Korea and has grown steadily over the past three decades to become a leading engineering, consulting, and general contractor. The gas turbines were supplied by General Electric and the steam turbine was supplied by Fuji Electric.

1.6 Operation and maintenance of the plant has been contracted between Termonorte Energia Ltda. and Termo O&M Energia Ltda, which is part of El Paso O&M do Brasil Ltda., a subsidiary of El Paso International do Brasil. This contract covers provision by the Operator of the necessary technical assistance and the assurance of adequate management, administration, plant operation and maintenance, power generation, and related activities. El Paso Energy has developed energy infrastructure Projects in Argentina, Australia, Chile, China, Czech Republic, Hungary, Indonesia, Mexico, Pakistan, Peru, and the United States with a total generating capacity of more

than 7,000 MW. In Brazil, El Paso Energy has several energy projects in operation and under construction.

1.7 The Project cost is estimated at US$ 247.9 million. The Sponsors' financial plan envisages equity of US$ 46 million, an IDB Loan of US$142 million, consisting of an A Loan of up to US$62 million and a B Loan of approximately US$80 million, and a loan from BNDES of the equivalent of approximately US$ 62 million in local currency.

II. PROJECT DESCRIPTION

A. Site Location

2.1 The Project is located in the Municipality of Porto Velho, State of Rondônia, Brazil, on the north side of km 7.5 on Interstate Highway BR-364, which connects Port Velho to Cuiabá, in the State of Mato Grosso. The Phase II Project site encompasses approximately 300,667 square meters (m^2), which is set within a rural area on the north side of BR-364 (see Figure 2-1).

2.2 The Project site is bordered to the west by the Phase I Termonorte Power Project and to the south by the Eletronorte PV-1 Substation and Interstate BR-364. No major residential communities are present in the immediate vicinity of the power plant site and private properties lie within a 2-km radius from the Project site. To the north and east, the Project site is bordered by privately owned land, including some recreational facilities such as a tennis club. The power plant Project is consistent with the general intent of the Municipality of Porto Velho for the development of industrial facilities in this zone. Figure 2-2 illustrates the general occupation of areas immediately surrounding the Project site.

B. Project Components and Facilities

2.3 The Phase II Termonorte Power Project was developed in a conventional combined-cycle gas turbine (CCGT) configuration using three General Electric (GE) F7EA dual-fuel (fuel oil/natural gas) combustion turbines (CT) and a steam turbine (ST) from Fuji Electronics. The Project was conceived and designed to commission operation in phases and as such started operations with one turbine in simple cycle using fuel oil in November 2001. The Project is fully operational in as of August 29, 2003 and will operate on fuel oil until natural gas becomes available through the Urucu-Porto Velho Gas Pipeline ("Urucu pipeline"), which is expected to be operational in mid-to-late 2006. The Urucu pipeline is not part of the proposed Phase II Termonorte Project but given the characteristics of the pipeline project, a detailed discussion on the proposed pipeline, impacts and proposed mitigation measures associated with the Urucu-Porto Velho Gas Pipeline project is presented in Annex 1.

2.4 The GE F7EA combustion turbines have a nominal capacity of 77.98 MW and are designed for continuous operation, 24 hours a day, 7 days a week. All three combustion turbines drive dedicated electrical generators. The Project does not have supplemental firing. Waste heat in the flue gas from the combustion turbines are captured in three Heat Recovery Steam Generators (HRSG), one for each combustion turbine. The steam from the HRSGs is used to drive a 117.4-MW single steam turbine, also with its own electrical generator. After the steam has passed through the steam turbine, the steam is cooled in the condenser. Heat from the condenser is then transferred to the cooling tower system in order to recycle the water before being discharged to the Candeias River.

2.5 Sulfur dioxide and particulate matter air emissions are controlled through the use of low-sulfur fuel oil. The combustion turbines in simple-cycle operation employ water injection technology to control nitrogen oxides (NOx) and in combined-cycle mode, steam injection technology will be used to control NOx emissions. Air emissions are discharged from three 30-meter-high steel stacks located adjacent to the HRSGs. The current Project design does not include Continuous Emissions Monitors (CEMS) to monitor emissions from the HRSG stacks.

2.6 Water supply. Water for the power plant is obtained from two sources: 1) water from the Candeias River, and 2) groundwater from two onsite water supply wells. During the initial phase of the Project construction and operation, water will continue to be supplied through two onsite water supply wells. By September 2003, 413 m^3/hour of water from the Candeias River will also become available to the Project site via a 40-centimeter (cm)-diameter pipe approximately 12-km in length. The water intake system is currently under construction on the left margin of the Candeias River, downstream from the Project point of discharge. The water intake consists of a concrete structure whose bottom floor is located below the riverbed. The water from the river flows into the concrete structure where two pumps will convey the river water to the 40-cm-diameter 12-km long water pipe. The intake pipes will be fitted with screens at the end to prevent fish and other aquatic fauna from being drawn into the pipes. The intake screen unit will be cleaned periodically through reverse flow.

2.7 Water treatment. Except for the cooling water, which constitutes approximately 84 percent of the total intake or 413 m^3/hour, raw water from the Candeias River and groundwater from the onsite wells is treated before use. The total volume of raw water treated is approximately 79 m^3/hour, or 16 percent of total raw water intake. The various processes used to treat the approximately 79 m^3/hour generate a maximum effluent flow of approximately 7.25 m^3/hour. The water treatment processes used at the plant include:

- Pretreatment of 79 m^3/hour of raw water;
- Treatment with activated carbon; and
- Demineralization.

2.8 The pretreatment consists of two vertical filter-press units, each with the capacity to filter 80 m^3 of water per hour. The filters are automatically cleaned by reverse-pressure flow, which removes particulates from the filter meshes. The filtered water is pumped to an intermediate storage tank with a capacity to store 300 m^3. The water that results from the reverse-pressure flow associated with the cleaning of the filter-press is pumped to the wastewater treatment unit.

2.9 A portion of the filtered water is subsequently treated by activated carbon, followed by an automated dosage of sodium hypochlorite, at which point the water is considered potable. The potable water will be used for flushing of toilets and washing. Bottled water is supplied for drinking purposes. The activated carbon unit has a capacity to treat 2,000 liters of water per hour. The potable water is pumped to a pressurized storage tank. The filtering material is cleaned by reverse flow. This process produces approximately a maximum of 5 m^3 of effluent per day, which is sent to the wastewater treatment unit.

2.10 The remaining amount of filtered water that is not treated to become potable will undergoes demineralization prior to use as steam make-up water. In combined-cycle mode, the demineralizing system produces approximately 77 m^3/hr of make-up water. The demineralizing system consists of ionic exchange in a resin bed. The resin can be regenerated through reactions of the saturated resins with sulfuric acid (H_2SO_4) and sodium hydroxide (NaOH). The resin regeneration process generates a maximum intermittent effluent flow of 84 m^3 per day. This

effluent stream is pumped to the wastewater treatment unit. The process also generates approximately 83 liters of spent resin per month, which is stored in drums for proper disposal.

2.11 Treatment of the cooling water consists of the addition of sodium hypochlorite to control biofouling organisms. In combined-cycle mode, water from the Candeias Project is also be used to meet the Project's water needs. Table 2-1 presents the water intake and effluent discharge for the Project for both fuel oil and natural gas modes.

2.12 Wastewater treatment. The wastewater treatment system receives two separate effluent streams from various processes/areas within the plant, which include: 1) Storm water effluent originating from areas that have potential for oil and grease contamination (maximum flow of 4.16 m^3/hour); and two (2) effluent stream from the potable water treatment and demineralizing treatment systems (reverse flow to clean filters and from ionic exchange, approximately 7.25 m^3/hour). The wastewater treatment system includes:

- Oil/water separator system: a 100-m^3 concrete basin with skimmers capable of treating 5 m^3/hour and an oil-retention tank with capacity of 1 m^3. All effluent streams with potential oil and grease contamination including storm water runoff that has the potential to come in contact with oils and petroleum products will be routed to this system.
- Neutralization system: concrete basin where alkaline or acid solutions are added to the wastewater stream to neutralize its pH. There are four pumps with capacity of 0.84 liters/minute (two for alkaline and two for acidic solutions). The system is also equipped with two air blowers. The treated effluent from the oil/water separator and the effluents from the water treatment units are routed to the neutralization basin.
- Holding basin: all treated effluents will be routed to the final disposition basin along with the cooling water and blowdown effluents. The final disposition basin is equipped with temperature and water-level meters. The quality of the discharged effluent will meet CONAMA 20/86 standards for quality of effluents.

2.13 The site currently has two septic tank systems, both with anaerobic filters and chlorination systems in accordance with Brazilian norms (ABNT-NBR 7229). The maximum volume of treated sanitary waste to be discharged is less than 4,200 liters per day. The septic tanks will be cleaned periodically according to Brazilian norms and specifications. The Project Company has plans to replace the septic systems with a package plant.

2.14 Storm water that does not have the potential to come in contact with oils and other substances will be passed through a system to remove solids. The storm water runoff system will not come in contact with runoff water that is routed through the oil/water separator. However, the treated sanitary effluent is mixed with the storm water system prior to final discharge.

2.15 Water discharge. The Project effluents discharge to the Candeias River and consist of thermal effluent from the cooling tower mixed with other treated effluents from the Project that have passed through the oil/water separator and neutralization systems. The thermal effluent will not receive treatment prior to its discharge to the Candeias River. The discharge point will consist of a single dscharge pipe that will parallel the intake pipe to the point where the intake pipes terminate. The discharge pipes then turn to the north, at a 45-degree angle, and extend upriver beyond the end of the intake pipe. The discharge pipe terminates in a stepwise manner, distributing the thermal effluent over an area of approximately 600 meters.

2.16 Fuel Supply. Light fuel (LFO) oil with a sulfur content of less than 2.0% by weight has been and will continue to be supplied to the site through a tolling agreement with Eletronorte. The fuel oil is shipped from Manaus via double-hulled barges to the Petrobras terminal in Porto Velho

(TEVEL). From TEVEL, the fuel is transported to the site by 30,000-liter trucks. Currently, about 40 to 45 trucks transport fuel to the site on a daily basis, including approximately 30 truckloads for the Phase II Project and 12 for the Phase I Project. It is anticipated that by September 2003, when Phase II is fully operational, approximately 57 trucks will deliver fuel to the site on a daily basis. Eventually, when the natural gas is available through the Urucu-Porto Velho Gas Pipeline, the Project will use natural gas, which will be delivered to the site via gas pipelines under a tolling agreement with Eletronorte. Backup liquid fuel will continue to be available using onsite liquid fuel oil storage tanks.

2.17 Transmission Line. The Project did not involve construction of a transmission line since the Eletronorte PV-1 Substation is located immediately to the south and east of the Project site. Transmission line operation and maintenance are the responsibility of Eletronorte.

2.18 Power Lines and Electrical Interconnections. The Phase II Termonorte Plant is connected to the Rondônia isolated system through a double-circuit 230-kilovolt (kV) transmission line that extends over two pylons and connects to a substation (Eletronorte Porto Velho PV-1), located approximately 700 meters away from the Project site. In addition to serving as the principal Eletronorte substation in the system, PV-1 also houses Eletronorte's primary dispatch center. Besides Termonorte, the system's main power plants include the Samuel Hydroelectric Power Plant, with a 215-MW rated capacity, and the two Madeira thermoelectric plants, with a combined 83-MW rated capacity. Each circuit of the 230-kV transmission line is capable of transporting 70 percent of the total plant output. In the event one line is out of service, it will not be possible to dispatch the Termonorte plant to its full rated capacity.

2.19 The State of Rondonia will be eventually interconnected to the national grid through a new 230 kV transmission line of approximately 1, 000-km total length. A segment of approximately 630-km will be undertaken by private finance, with Electrobras funding the remainder. The line will be constructed along the BR 364 motorway linking Porto Velho to Cuiabá and therefore few environmental and social impacts are anticipated.

2.20 Other plant facilities include fire-suppression equipment, administrative buildings, control system, pumps, storage facilities, parking spaces, and tanks. Although the Phase I and Phase II Termonorte Plants are contiguously sited, they operate independently and do not share common facilities with the exception of the access road substation and existing transmission line. The Phase I power plant uses different technology and consists of four 16-MW light fuel oil-(LFO) fired internal combustion generators with duel-fuel capabilities.

C. Schedule, Project Workforce, and Costs

2.21 The schedule for the construction and operation of the Phase II Termonorte Project overlaps since the Project was conceived and designed to commission operation in phases. Construction of the Project started during the first quarter of 2001 and achieved operation of one turbine in simple cycle in November 2001. On August 29, 2003 the Project began operating with three combustion turbines and a steam turbine in combined-cycle mode. The schedule for operational stages of the Project is provided below:

- Stage 1 (one turbine in simple cycle) — in operation since November 2001
- Stage 2 (two turbines in simple cycle) — in operation since July 2002
- Stage 3 (three turbines and a steam turbine in combined-cycle) — August 29, 2003

2.22 Construction of the Project required a workforce of approximately 800 personnel. The number of construction workers has progressively decreased, as the Project approached its final construction

phase. For the construction phase, Camargo Corrêa employed workers who had worked on similar projects elsewhere in Brazil. Some of the workers were placed in onsite lodging facilities or in houses in Porto Velho. Non-skilled workers were hired from the local communities and the EPC Contractors provided transportation to the site. Labor needs include managers and foremen; technicians; civil, mechanical, and electrical engineers; boiler, steel, electrical, and concrete craftsmen; supervisors; equipment operators and helpers; and other support workers.

2.23 Construction materials and equipment were readily available locally and regionally, and were transported to the Project site by river and highway. The types of building materials required for the Project included concrete, steel, pipe, cable, crushed rock, pavement material, roofing and siding material. The primary equipment included the combustion turbines and electric generators, HRSGs and stacks, steam turbines and electric generators, High-voltage transformers, ductwork, breeching, and flues, boiler feed pumps, steam condensers, high-pressure piping, high-pressure valves, water treatment equipment, tanks, high-voltage switchgear and pipe.

2.24 Required infrastructure for construction and operation of the Project (i.e., roads, water, rail, and port facilities) are in place and are considered adequate for the proposed remaining construction and operation of the Project.

2.25 The operation of the Project requires a staff of approximately 60 people. The operational staff is shared between the Phase I and Phase II Termonorte Plants.

2.26 Total costs for the Project are estimated at US$247.9 million.

D. Analysis of Alternatives

2.27 Location. The current Project location was selected as a result of the alternative analysis, which was performed as part of the Environmental Impact Assessment (EIA) process. The location alternative analysis evaluated the adequacy of four proposed project sites and took into consideration environmental and legal aspects. The alternative analysis indicated that the site near the existing Phase I plant provided more benefits and minimized impacts to the environment and total costs of the Project (e.g. the selection of the Project site near the existing Eletronorte PV-1 Substation eliminated the need for construction of transmission lines).

2.28 Generating Technology. The use of combined-cycle technology provides a significant increase in the thermal efficiency of the power plant by capturing heat energy in the HRSG that would otherwise be wasted. The Project is currently consuming fuel oil because natural gas is not available in the region. Once the Urucu-Porto Velho Gas Pipeline is constructed, it will transport natural gas to the Porto Velho City Gate, which will be located at the Eletronorte PV-1 Substation site. The use of natural gas as the primary fuel will lead to a reduction of air emissions and minimize the potential for oil spills in the Amazonas and Madeira Rivers as well as along the route from TEVEL to the Project site.

III. INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional

Energy Sector

3.1 The National Energy Policy Council (CNPE) has the responsibility to propose national oil and gas policies to the federal government. In addition, CNPE periodically reviews the national energy matrix, promotes the use, and establishes specific guidelines for natural gas (Federal Law No. 9,478/97 and Federal Decree No. 2,457/98). The Ministry of Mines and Energy (MME) is in charge of executing Brazilian energy policy, approving the exploration and development of natural energy resources, and auditing the operation of decentralized industry-related entities.

3.2 The National Electrical Power Agency (ANEEL) is responsible for the regulation and enforcement of production, transmission, distribution, and commercialization of electric energy in accordance to federal policies (Federal Law No. 9,427/96 and Federal Decree No. 2,335/97).

3.3 The National System Operator (ONS) was established to coordinate and control operation of electricity generation and transmission in the interconnected systems with a view to optimizing these activities, functions previously performed by the Interconnected Operations Coordinating Group (GCOI). The Wholesale Electricity Market Exchange (MAE), when fully established, will operate all power purchases and sale transactions, either through bilateral contracts or in the short-term market. The Market Rules were passed in ANEEL Order 290/00, regulating all transactions made on the Wholesale Electricity Market.

Environmental Sector

3.4 At the national level, the Ministry of the Environment, Water Resources and the Amazon Region (MMA) is responsible for coordinating the National Environmental Policy (PNMA). 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 PNMA, such as environmental and emission standards for ambient quality and pollutants. In addition, CONAMA establishes the general requirements for environmental licensing and 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 for issuing the environmental permit in the cases defined by law.

3.5 Federal and State Attorney General Offices (MPF/MPE), which have a constitutional mandate to protect the public and the environment, oversee the environmental practices of government agencies and the private sector, serving an "ombudsman" function. These offices have investigative and prosecuting powers and may bring civil and criminal actions against polluters and those who infringe environmental legislation.

3.6 At the state level, as it pertains to the Termonorte Project, the environmental responsibility for enforcement of environmental legislation and issuance of major environmental licenses falls under the jurisdiction of the State of Rondônia Environmental Development Secretariat (SEDAM). The State of Rondônia Environmental Council (CONSEMA) is a consultative and deliberative body comprised of members of the government, private sector, and non-governmental organizations (NGOs).

3.7 At the municipal level, the Municipal Secretariat of Environment (SEMA) is responsible for land-use planning and municipal policies and legislation. However, municipal legislation and regulations cannot be less stringent than federal and state standards.

Health and Safety

3.8 The responsibility for developing and enforcing the health and safety regulations is assigned to the Ministry of Labor and Social Security (MTPS) and its regional state-based offices (DRT). Stiff penalties, including a construction embargo, may apply for noncompliance. State and municipal authorities have no jurisdiction over labor matters.

B. Legal

Energy Sector

3.9 The regulation of the public provision of electricity is primarily contained in Articles 175 and 121 of the Federal Constitution, which establish that the following are federal responsibilities:

- Services and works of electric energy and exploration of hydroelectric potential of the water resources (together with the states where the hydroelectric resources are found)
- Rendering of public services, either directly or under regime of concession or permit, always by means of public bidding.

3.10 The reform of the Brazilian power sector began in 1995 with the privatization of government-owned electricity utilities and with constitutional amendments allowing private investment in the electricity sector. In 1996, the government undertook regulatory reform by setting rules of a new and competitive electricity market. The new market model opened generation and trading businesses to competition, while transmission and distribution continued as regulated activities.

3.11 Other relevant pieces of legislation that regulate the provision of electricity include:

- 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;
- Federal Decree 2,003/96, which regulates the electric energy production by independent producers; and
- Law 9,648, which includes amendments to all the above legislation as part of the government's reform to introduce greater competition and transparency in the generation of electricity.

Environmental Sector

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 their federal counterparts. In addition, the Brazilian Technical Standards Association (ABNT) issues technical norms and standards addressing specific environmental issues. The content of these standards is generally considered as the best management practice; however, the standards can also be considered legal requirements when recommended by any piece of legislation.

3.13 At the federal level, the most relevant piece of environmental legislation is Federal Law 6,938/81, which created the National Environmental Policy (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 following agencies: the Brazilian Institute of Environment (IBAMA), the National System of Environment (SISNAMA), and the National Council of

Environment (CONAMA). In addition, Federal Law 6,938/81 established the basis for the environmental permit system and the EIA process.

3.14 The Brazilian environmental permitting process requires that three licenses (permits) be obtained for all activities which are potentially pollutant: Preliminary License (LP), Installation License (LI), and Operating License (LO). For projects listed in CONAMA 001/86 (including power plants with nominal capacity above 10 MW), an EIA is required. CONAMA Resolution 001/86 defines the basic content of the EIA and establishes the public participation requirements. CONAMA Resolution 09/87, meanwhile, regulates the public hearing process associated with the EIA process. The LP is granted based upon governmental approval of the project EIA and the *Relatório de Impacto Ambiental* (RIMA), which is a summary of the EIA. The LI is granted based upon government approval of a project-specific Environmental and Social Management Plan (ESMP) and represents the governmental authorization to start construction of the proposed project. The LI also establishes specific requirements regarding the mitigation and monitoring or environmental and social impacts. The LO must be obtained prior to project operation.

3.15 CONAMA Resolution 002/96 determines that projects with significant environmental impact shall establish an environmental conservation area/unit, and that a minimum of 0.5 percent of the total project cost be spent for the acquisition of the necessary areas. Excess funds (e.g., when areas cost less that the established percentage) can be used in infrastructure and monitoring activities within the area, at the discretion of the state environmental regulatory agency.

3.16 CONAMA Resolution 237/97 defines the appropriate jurisdiction for the environmental permit. Federal jurisdiction applies to projects that are located in two or more states, cross national boundaries, are likely to have impacts beyond the Brazilian territory, or deal with nuclear energy or radioactive waste. State licensing authority falls upon the vast majority of cases, including those projects that may have impacts over more than one municipality (as in this particular case). The licensing authority of any jurisdiction will send copies of the EIA to the other environmental authorities for their review and comment.

3.17 CONAMA Resolution 279/01 establishes simplified procedures for the environmental permit process for electric utilities of small potential impacts, including power plants (thermal, hydro, and wind), transmission and distribution lines, and any associated system. According to this resolution, public utilities must present a Simplified Environmental Report (RAS) when applying for the previous license. Based on the RAS, the environmental agency, within a period that will not exceed 10 days, will define whether the project will fall under the simplified procedure or will require the full EIA procedure. According to the simplified procedures, the environmental agency will issue the environmental permit within a maximum period of 60 days.

3.18 Federal Laws 8.171/91 and 8.987/95 establish that electric utilities are obligated to restore the environmental conditions in the impacted area. Federal Decree 95,733/88 establishes that large- and medium-scale projects, funded totally or partially by federal monies, must include in the project budget a minimum of 1 percent of the total budget to prevent or mitigate the project's negative impacts. Other relevant federal legislation/regulations that may apply to the Project are addressed below.

3.19 Air Emission and Air Quality. The National Air Quality Monitoring Program (PRONAR) was created through CONAMA Resolution No. 005/89 to provide guidelines for the protection and management of air quality within the national territory. CONAMA Resolution No. 003/90 establishes air quality standards, sampling methods, and quality levels to assist in the preparation of an Emergency Plan for Critical Episodes of Air Pollution. The Resolution No. 003/90

classifies areas within the national territory according to their use and air quality characteristics. According to the guidelines provided in this Resolution, areas are categorized as either Class I, II, or III. Emission standards were established by CONAMA Resolution No. 08 of December 6, 1990, which sets emission standards for particulate matter and sulfur dioxide for facilities that burn coal and fuel oil. A summary table of Brazilian ambient air quality and emissions standards is presented in Table 3-1 and Table 3-2 respectively.

3.20 In the State of Rondônia, air quality monitoring relative to the PRONAR program and the development of emergency plans to restrict polluting activities during periods of thermal inversion or other critical atmospheric conditions falls under the jurisdiction of SEDAM, which should monitor air quality and provide municipalities with guidelines for the adoption of primary and secondary air quality standards that classify areas within their jurisdiction.

3.21 Article 40 of State Decree No. 7903/97 establishes requirements regarding use, pollution prevention, and control of air deterioration in the State of Rondônia. This decree divides the State into six air quality monitoring areas (*"Regiões de Controle de Qualidade do Ar – RCQA 1 through 6* " [Air Quality Control Regions]) according to their air quality conditions. Air Quality Region RCQA 1 includes the municipalities of Porto Velho, Guajará-Mirim, Nova Mamoré, Candeias do Jamari, and Jamari. The permitting and approval of new projects within a certain air quality region depends on the emission characteristics of the project and the supporting evidence that they will not significantly deteriorate the air quality once operational.

3.22 Waste Management. Several CONAMA resolutions deal with waste management and regulate requirements for a complete waste inventory (including storage, transportation, and final disposal methods), submittal of inventory forms to the state environmental agency, classification of used lubricant oil as hazardous waste, and procedures for its storage, treatment, and disposal. Such CONAMA resolutions include No. 06/88, No. 05/93, and No. 09/93. The ABNT has also issued a number of standards that relate to waste management, such as waste classification and characterization (NBR 10,004). There are also standards addressing the final disposal of wastes.

3.23 Rondônia state legislation also requires the preparation of specific project plans for the handling, storage, and disposal of wastes, subject to the approval of SEDAM. Article 71 of State Decree No. 7.903 emphasizes this requirement, particularly with respect to any kind of wastes that have toxic, biological, radioactive, inflammable, explosive and radioactive properties that are harmful to human health and the environment.

3.24 Water Management. The most important piece of water legislation is CONAMA Resolution 20/86, which establishes standards for quality of superficial water bodies and requirements and limits for wastewater and/or effluent discharges. Most recently, Federal Law 9,433/97 establishes the Water Resources National Policy and creates the National System of Water Resources Management. Water quality standards for Class 2 waters (which are applicable to the Project) and World Bank effluent guidelines for new thermal power plants are presented in Table 3-2.

3.25 Fauna and Flora and Forest Management. The most relevant legislation at the federal level in this area is Federal Law 4,771/65 (Forestry Code), which defines as permanent preservation areas forests and other forms of natural vegetation along the rivers and around lakes and other natural or artificial reservoirs. It sets provisions to authorize the clearing of these forests if previously authorized or when absolutely necessary for the implementation of public interest projects. Procedures to manage native forests and requirements for cutting and transporting forest resources are defined at the state level.

3.26 Mineral Resources. Under the Brazilian Mining Code, established by Federal Law 227/67, the extraction of stones and slate (quarry) (Class II mineral resources) to serve as raw material for construction requires a specific authorization from the local administration authority and from the National Department of Mineral Production (DNPM). CONAMA Resolution 010/90 determines that the quarry to serve as Class II mineral resources is subject to the environmental permitting procedures.

3.27 Noise. CONAMA Resolution 001/90 establishes criteria for noise emissions from any industrial, commercial, social, or leisure activities. It also addresses the contents of Brazilian Norms (NBR) 10151 as the suitable noise evaluation method and NBR 10152 as the applicable noise levels for areas of different use (residential, commercial, and industrial). Table 3-3 depicts the land uses and noise levels for the Brazilian and World Bank standards.

3.28 Historic and Archeological Heritage. The primary regulation addressing the issues related to the protection of the historic, artistic, aesthetic, cultural, and archeological heritage/patrimony is Federal Law 3,924/61. This law determines that any site in which there is evidence of occupation by paleoamerindians or of temporary settlements of the ceramic period is defined as historic or archeological monuments. The legislation also establishes the general requirements for the excavation procedures.

3.29 Expropriation. The expropriation process, regulated by the Law-Decree No. 3,365 of June 21, 1941, occurs in two stages. In the declaratory stage, ANEEL, the organization responsible for the regulation of electricity concessionaires, publishes a resolution determining the area to be expropriated for public utility. In the expropriation stage, the concessionaire is allowed to acquire and compensate the affected properties in the areas to be expropriated.

3.30 Environmental Crimes. Recent Federal Law 9,605/98, regulated by Federal Decree 3,179/99, establishes punishments for environmental crimes, including environmental damages provoked by human actions.

Health and Safety

3.31 Health and safety regulations in Brazil are primarily established by the Ministry of Labor at the federal level. The federal legislation establishes the set of general requirements and details through Regulatory Norms (NR). However, complementary health, safety, and industrial hygiene requirements are established through Technical Norms and Standards issued by the ABNT.

3.32 The 1988 Federal Constitution provided for the reduction of labor risks through health, hygiene, and safety measures (Article 7, XXII). Chapter V of the Brazilian Consolidated Labor Legislation (CLT) contains numerous sections and provisions to guarantee this objective, including the use of personal protective equipment (PPE).

3.33 Federal Law 6,514/77 is the primary instrument governing occupational health and safety standards. Subsequently, the Ministry of Labor issued Administrative Norm 3,214/78, known as NRs – Normas Regulamentadoras. Programs for medical control of occupational health (Administrative Rule No. 8/96) need to take the NR provisions under consideration. The principal legislation regarding occupational health and safety follow: a) CLT and its regulations (NR); and b) International Conventions of the ILO. NR 05 and Article 163 of the CLT define that every company must create and operate an Internal Accident Prevention Commission (CIPA). NR 07 and 09, respectively, define requirements for the Workers Health and Medical Program (PCMSO) and the Environmental Risks Prevention Program (PPRA).

C. Project Compliance Status

3.34 The Project EIA (including the water intake and discharge pipelines) was finalized and submitted in late 2000 for technical review by SEDAM. A public hearing was held on February 12, 2001, and the Developers also held public forums prior to the official public hearing. Refer to Section VII for information on public consultation and information disclosure activities. The Project EIA was approved by the state environmental agency and SEDAM issued the Installation License No. 001491 in March 2001. Subsequently, the Interim Operations License for operation of the first turbine of the Phase II Project was issued in November 2001 and the license for the second turbine in May 2002. The operation license No. 003178 authorizing full operation of the Project at its generation capacity (i.e. 340 MW) was issued in December 2002.

3.35 While the Project environmental permitting process was conducted in accordance with the procedures required by federal Brazilian regulations, the adjacent Phase I Termonorte power plant was not. SEDAM issued the LP and LI for the Phase I Termonorte Project without following the standard procedures outlined by CONAMA resolutions. According to CONAMA Resolution 005/86, an EIA is required for any power generating facility with a capacity of 10 MW or higher. The EIA for the Phase I Project was determined to be a preliminary document that did not meet CONAMA's requirements. In addition, the Project did not have the authorization from ANEEL, the Summary EIA report (RIMA) was not made available to the general public and no public hearings were conducted. In April 2000, the Public Ministry filed a motion against the Project that led to an injunction. A Term of Commitment (TAC) was signed and the Phase I Termonorte Project became compliant, after which construction was allowed to proceed.

3.36 The Public Ministry also filed a motion against the preliminary license issued in August 2002 for the construction of the Urucu-Porto Velho Gas Pipeline. In April 2003 a federal judge suspended the Urucu-Porto Velho Gas Pipeline preliminary license and as September 2003 there is no expected date for the construction of the pipeline. Refer to Annex 1 for details on the proposed Urucu-Porto Velho Gas Pipeline.

IV ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 The Project site is located approximately 7.5 km west and south of the City of Porto Velho, within a generally rural area with limited residential development. The Project is adjacent to the existing Phase I Termonorte Power Project and the Eletronorte PV-1 Substation. The Project site is characterized by a low density of natural fragmented vegetation, which inhibits nesting, creation of habitat, and plant food for birds and other species.

A. Environmental

4.2 Climate. The State of Rondônia is located in the extreme western portion of the Amazon region in northern Brazil. The region is subject to a continental forest rainy, tropical climate. Average temperatures typically exceed 18°C during the coldest months and 25°C during the warmest months of the year. The rainfall patterns are characterized by rainy summers and dry winters. Average annual rainfall in Porto Velho is 2,172.26 millimeters (mm). The months of June, July, and August are the driest and have the lowest precipitation, averaging 20.2 mm. The average annual relative humidity in Porto Velho is 84.76 percent. Predominant wind direction is from the

north and from the northwest. Average wind velocities range between 2.5 and 3.1 meters per second (m/sec).

4.3 Air Quality. SEDAM does not maintain an ambient air quality monitoring program in the general area of the Project. However, 30-day air quality monitoring campaigns have been conducted as part of the Project's Environmental Monitoring and Control Program, and are continuing at three locations near the Project site. At each site, particulate matter, sulfur dioxide, nitrogen dioxides, and carbon monoxide are measured to assess air quality conditions in the general Project site. Results of the air quality monitoring program indicate that the area is subject to occasional exceedance of particulate matter (particles greater than 10 µm) due to local traffic of vehicles on unpaved roads. Monitoring of sulfur dioxide and carbon monoxide indicate that these parameters are present in very low to no-detection levels. Nitrogen dioxide concentrations have been recorded at values near the Brazilian secondary standard of 120 $\mu g/m^3$. The area is subject to the effects of controlled fires, and the exceedances of particulate matter and nitrogen oxides may be associated with these events. The air quality monitoring stations are not equipped with meteorological stations. Therefore, there are no data for a comparison of air pollutant concentrations with meteorological conditions (wind speed and direction, relative humidity, barometric pressure, and ambient temperatures). Overall, results of the air quality monitoring indicated moderate-to-good air quality conditions in the areas of the monitoring stations.

4.4 Fresh Water Hydrology. The general area of the Project is located within the sub-basin of the lower Candeias River. The Candeias River is one of the main tributaries of the Jamari River, which, in turn, flows into the Madeira River. The Madeira River is an important river in the area, associated with regional transportation of goods and fishing. The Project site is located near the confluence of the Candeias River with its two largest tributaries, the Garças River and Preto River, located on its left and right margins, respectively. These two tributaries have clear water, low concentrations of suspended solids, and pH ranging from 5.0 to 5.5, possibly due to the chemical composition of soils/rocks in the region, which are predominantly acidic. Their average flow rate in the summer is 10 m^3/sec and 70 to 90 m^3/sec in the winter. The waters of the Candeias River are greenish in color, with a pH of around 6.6 and a relatively high level of suspended solids. Minimal average flow rate during the dry season is 45 m^3/sec and maximum flow rate is approximately 800 m^3/sec during the rainy season. Small "igarapés"[1] in the area of the Project that also belong to the Candeias River sub-basin include the Periquitos, Tênis Clube, Bate-Estaca, and Grande. The Igarapé Tênis Clube is approximately 6 km long and receives the water generated by the Phase I Termonorte Project (64 MW) by means of a smaller drainage channel named Igarapé Velho (The Phase II Termonorte Project currently discharges its effluent to the Igarapé Velho. Beginning in September 2003, the Project will discharge directly to the Candeias River). This igarapé flows into the left bank of the Garças River, in the vicinity of the Porto Velho Industrial District. The Garças River in turn, flows into the left bank of the Candeias River, at a point 6 km upstream from the City of Candeias do Jamari.

4.5 Hydrogeology. The sedimentary formations that form the basins of the Madeira and Candeias rivers constitute the best groundwater aquifers in the area. These sediments are relatively very homogeneous. On the Porto Velho Cuadrangle the most important stratigraphic sequence is that represented by Paleo-Protozoic/Mesozoic rock units (Jamari Foundation) and Cenozoic rock (detrital and residual layers). The sedimentary formations consist of clayey sand beds that have lenses of clay and sand. In the area of Porto Velho, there is a good aquifer within a sandy layer that may produce water at a rate between 14 to 50 m^3/hour. The average depth of this sandy aquifer is approximately 60 meters. Specific flow rates are generally considered to be satisfactory

[1] In the Amazon region, "Igarapés" are small tributaries and streams that may or may not be perennial in nature.

and vary from 0.70 to slightly more than 20 m^3/hour/meter. However, the typical specific flow for other wells in the area is 1.25 m^3/hour/meter. With regard to the Project site, the flow rate is generally around 3 m^3/hour and the specific flow rate is 1.2 m^3/hour/meter.

4.6 Geology and Geomorphology. The region of Porto Velho has an extensive surface layer of Tertiary-Quaternary alluvial sediments overlay crystalline rocks of Lower and Middle Proterozoic. These crystalline rocks are part of one of the oldest geotectonic plates on earth, known as the Guaporé Craton. This craton, together with the one from the Guaianas', constitutes the continental shield that shapes the Amazon depression. The Amazon region is geologically stable, with no historical records of tectonic activities (seismic and volcanic). The most recent tectonic events took place approximately 115 million years ago, in the region of the foothills of the Serra dos Parecis Mountains in the southeast portion of Rondônia.

4.7 Geomorphology. The Project site is located within the geomorphological unit known as the "*Planalto Rebaixado da Amazônia Occidental*" (Low Plateau of the Western Amazon), where there are inter-river mesas with weak drainage. The surface relief is generally flat, very slightly sloping in the general direction from southwest/northeast, with a low degree of susceptibility to accelerated erosion. Local morphology shows evidence of a process of mechanical morphogenesis, in a past semi-arid climate that formed relict surface relief features. These topographic features show rectilinear slopes and tabular surfaces that have been eroded by present-day processes under climatic conditions that are currently hot and humid.

4.8 Soil and Subsoil. A soil survey conducted in the area of the Project site indicated the presence of latosols, cambisols, and gleys. Soil classifications were based on the study entitled "*Levantamento de Solos*" (Soil Survey) conducted by Tecnosolo-DHV-EPTISA Consortium for preparation of the Socio-Economic-Ecological Zoning of the State of Rondônia. The area of the Project is located within the region of dystrophic Red-Yellow Latosols, as identified by Standard Penetration Tests during field work conducted by Granito Const. e Sondagem Ltda. for Termo Norte. Boreholes drilled indicated the presence of latosols from 0.5 to 5.5 meters below ground surface. The soil consistency varies according to water content, ranging from friable to hard when dry and plastic when wet. This soil has physical properties that make it suitable for supporting large structures, with a resistance factor indicating values between 1.5 and 5.5 kg/cm^2.

4.9 Flora. The general region around the Project is characterized as Amazon Rain Forest and consists of a variety of tropical flora and fauna. The Sub-Mountain Open Rain Forest is the predominant forest type in the general area of the Project. The lower vegetation has two distinct groups: those where the vines (cipós) are predominant and those where palm trees are predominant. In those places where the vegetation is dominated by palm trees, there are areas of dense growth where palms are intertwined with parts of other trees, forming uniform and continuous upper canopies. In areas where vines are predominant, they form dense mantles in the spaces that exist between the trees. Common palm tree species such as "paxiuba barriguda" (*Iriartea deltoide* Ruiz & Pav.), "patauá" (*Oneocarpus speciosa* Mart. Ex- Spreng), and "açaí" (*Euterpe precatoria*) are found in areas close to small streams that are subject to seasonal flooding. The palm trees "mumbaca" (*Astrocaryum gynacanthum* Mart.) and "babaçu" (*Attallea speciosa* Mart. Ex-Spreng.) prefer higher ground, although they also occur in depressions in the terrain.

4.10 Previous studies conducted at the Project site have identified three distinct environments or habitats, each with different types of vegetation. These include:

- *Anthropogenic Environment* – Characterized by the presence of secondary vegetation, which includes shrubs, grasses, or weeds. This type of altered vegetation covered most of the site where the Phase II Termonorte Project is located.

- *Secondary Forest "Capoeirão" Environment* – Characterized by extensive brushwood vegetation that is in the advanced stages of recovery and in the process of becoming secondary forest, which is characterized by sub-tree layers that continue to be very dense.
- *Forest-Type Environment* – Characterized by secondary forest in a very advanced stage of recovery, which may become native forest environment. This follows the banks of a small watercourse, with trees that reach heights of up to 16 meters. This type of environment occurs in the northern portion of the site as a small patch of vegetation and has not been affected by construction of the Project.

4.11 The Area of Direct Influence of the Project (a 2-km radius around the site) does not include areas with undisturbed vegetation cover. However, some small patches of vegetation do exist in the Area of Indirect Influence. These include Belmont Road, Penal Colony Road, "*Recanto dos Pássaros*": BR-364 highway and River Candeias Road, all within 15 km from the Project site.

4.12 Terrestrial Fauna. Results of field studies in the Project Area of Direct Influence (DAA) indicated a low degree of diversity of species and a low density of those species that were found. The study confirmed the correlation between the diversity of species and the degree of anthropogenic impact on the environment. In addition to the sparse natural vegetation cover that existed on the site prior to the construction activities, the site is also surrounded by other facilities such as the University of Rondônia for Languages and Exact Sciences, recreational clubs, and the Eletronorte PV-1 Substation. All these factors inhibit the presence of terrestrial fauna in the Project area.

4.13 Aquatic Ecosystems. The results of the aquatic study near the areas of the Project water intake and discharge on the Candeias River show some physico-chemical parameters to be outside of normal limits for potable water. These results could be interpreted as "natural pollution" that result from the presence of organic material such as riverbank vegetation, wildlife waste, and the occurrence of biological and mineralizing processes in situ and in the surrounding areas. The stretch of the Candeias River that extends upstream from the point of water intake to the confluence with the Garças River is in a state of degradation, the result of existing anthropogenic activities such as untreated sewage and other effluents that are discharged from the town of Candeias do Jamari. Other anthropogenic activities that contribute to the degradation of the river include disturbance of the riverbed and riverbanks by dredging and sand quarries. Qualitative and quantitative results indicated that both the macro and micro biota are below normal productivity standards. In general, the aquatic environment of the Candeias River in the area of the Project intake and discharge structures can be characterized as altered by the various anthropogenic activities cited above.

4.14 The small rivers called igarapés of the Madeira River Basin play an important role in the maintenance of the fish community structures in the region. They serve as seasonal migration routes for some important species. The environment of igarapés lead to the development of fish populations that thrive in those particular environmental conditions due to the influx of food from external sources and the absence of predators. Consequently, the small igarapés may have distinct fish communities from the larger rivers. "Bagre" is the main commercial fish in the region. During the rainy season, when the river basin is flooded, other commercial fish species such as: "jatuarana" (*Brycon* spp), "pacu" (*Myleus* spp), "jaraqui" (*Simaprochilodus* spp), "curimatã" (*Prochilodus* spp), "tambaqui" (*Colossoma macrocomum*), "pirapitinga" (*Colossoma brachycomum*), and "sardinha" (*Triportheus* spp) leave the tributaries of the Jamari River to lay their eggs at the confluence of the Jamari and Madeira River. At the end of the reproduction period, these fish return to feed in the flooded forests, riverside lakes, and igarapés. The fish that live in the Madeira River Basin (including the Candeias River and Jamari River) are important commercially and for the subsistence of local communities.

4.15 Noise. Results of a noise survey conducted during operation of the 64-MW Phase I plant in October 2001 showed that noise levels along the site boundary ranged from 42 to 64 dB(A), with the maximum noise level at the nearest residential receptor reaching 51.2 dB(A).

4.16 Cultural Resources. A survey of the archeological resources in the general area of the Project site was conducted as part of the environmental studies completed in connection with Phase I of the Project. The results of the survey did not show any evidence of cultural, historical, or archeological resources. The presence of charcoal on the surface at the Project site is more likely to be associated with the presence of burned roots than with the presence of any kind of material that could be connected with prehistoric activities.

B. Socioeconomic Conditions

4.17 Land Use. The Project site is within a rural zone that is designated for multiple use. To the northeast, the site is bordered by Porto Parque, a recreational center that belongs to the Universal Church. To the south and southeast, the sites is bordered by the Eletronorte PV-1 Substation and Interstate BR-364. The Project site is surrounded by small rural properties, which serve as secondary residences and weekend getaways for the Porto Velho middle class. The area also hosts a number of recreational centers that belong to local companies. These include the Bank Workers Club, the AABB Club, and the Porto Velho Tennis Club. A short distance from the Project site, there is a large area dedicated to Class II natural resource exploration. This area extends from the Paranaense Ceramic Facility to the Cascalheira and São Francisco districts. Abandoned quarries have been used as waste disposal sites by the City of Porto Velho. The mining activities are reportedly carried out without proper planning or good environmental practices. North and northeast of the Project site, meanwhile, private properties have been illegally occupied by a few low-income families.

4.18 Demography. The Municipality of Porto Velho covers an area of 30,634 km^2, with a demographic density of approximately 8.87 inhabitants/km^2.

4.19 Access Roads. The site can be accessed by road from downtown Porto Velho via 7 de Setembro Avenue and Nações Unidas Avenue, which connects to the Trevo do Roque intersection. At that point, the road intersects km 1 of Interstate BR-364, which connects Porto Velho to the City of Cuiabá.

4.20 Ports and Waterways. The Madeira River is the most important navigational river in Rondônia. However, 7 km upstream of the City of Porto Velho and for a distance of 360 km, navigation on the Madeira River is interrupted by numerous rapids and waterfalls. From Porto Velho to the confluence of the Madeira River with the Amazon River, a distance of 1,100 km, the river becomes navigable, averaging depths of 2.80 meters in the dry season and 8.20 meters during the raining season.

4.21 Electrical Energy. Residential and commercial sectors account for 70.4 percent of all electrical in the state, consumption, with the residential sector alone accounting for a total consumption of 47.1 percent. In 2000, the Phase I Termonorte Project began operation and 64 MW were added to the local system. With the operation of the Phase II Termonorte Power Project, an additional 345 MW of generating capacity will be added to the local grid, thereby meeting the energy needs of the State of Rondônia. The addition of the Phase II Termonorte Power Project will also allow for the export of electricity to the State of Acre and for the completion of the interconnection of all the municipalities in Rondônia.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

5.1 Construction of the Project is complete and the Project reached full commercial operations on August 29, 2003. Most of the environmental impacts generated during the construction of the Project were localized within the construction area itself. Site preparation included clearing existing vegetation and minor grading. The Project site is relatively flat and its preparation did not require large-scale earthmoving activities. Civil construction activities included principally the development of a site drainage system, roads and foundations. The cooling water intake and discharge infrastructure involved the construction of an 11-km corridor that accommodates the intake and discharge pipelines. The environmental impacts were limited to the area immediately adjacent to the pipeline corridor, which is located directly contiguous to an existing Eletronorte transmission line ROW (the area of the Eletronorte transmission line ROW is a linear corridor cleared of major vegetation). Much of the necessary infrastructure for construction of the power plant, including transmission lines, substation, and highways, were already in place when construction of the Project began in early 2001.

A. Construction Phase

Environmental Impacts

5.2 Air Quality. Air quality impacts associated with construction activities resulted from fugitive emissions (i.e. particulate matter released into the atmosphere through non-combustion sources at the facility) associated with site grading, exhaust emissions, stockpiling, and spillage from vehicles are the major air quality impact during construction. Specifically, dust and other particulates from truck movement, wind erosion of soil surfaces, construction activities, and the movement of waste during plant operations are all fugitive emission sources. These emissions did not emanate continuously from clearly defined point sources, but were usually short term and sporadic depending upon construction activities and meteorological conditions. Air quality impacts associated with construction of the water pipeline were minimal and limited in aerial extent and time. Due to high precipitation in the region, the ground is moist nearly year round, thereby minimizing impacts from fugitive emissions.

5.3 Freshwater Hydrology and Water Quality. The construction of the intake and discharge structures on the banks of the Candeias River increased the turbidity in the water due to disturbance of the sediments in the banks and riverbed. However, given that the river bed has a width of approximately 20 meters at the location of the water intake and discharge, and that the volume and flow of river water, which ranges from a minimum of 45m3/sec to 800 m3/sec during the dry and rainy seasons respectively, these incidents caused very minor localized impacts such as some disturbance to the bottom communities, but limited in aerial extent. Potential impacts to freshwater hydrology and water quality during construction of the power plant were minimal. The construction of the power plant had the potential to directly impact a small creek (Igarapé do Velho) located near the plant. Oil and lubricants spills were minimal and no impact on groundwater at the Project site was generated. Due to the nature of the surface soil in the area of the Project (red lateritic soil), surface runoff still carried portions of the fines and clays to the nearby stream during large rainstorms.

5.4 Geology and Geomorphology. Construction of the proposed Project did not significantly alter the geomorphology of the Project site. The site was already relatively flat and covered by secondary

vegetation. After the necessary grading was completed, the overall topography of the site was not significantly different from the immediate surrounding areas.

5.5 Soils and Subsoil. The Project has been constructed within a parcel of land previously assigned for the expansion of the Phase I Termonorte Power Project. Construction of the Project did not affect any agricultural activities or other land use. Potential adverse impacts to the soil and subsurface during construction included contamination from spills of fuel, lubricants, or chemicals of concern. Most of the top soil that was removed during the earthmoving and grading associated with site preparation has been used within the site.

5.6 Flora. Older aerial photos of the Project site prior to any construction activity indicate that the site was mostly covered by shrubs and grasses and had already been significantly altered by anthropogenic activities. Construction of the Project did not require the clearing of the large trees that are part of the Forest-Type Environment, located in the northern portion of the Project site. Impacts to terrestrial flora and fauna have been limited to the Project site, the ROW of the water and wastewater pipelines, and the site of the water intake and discharge structures.

5.7 Fauna. The Project site is located adjacent to the existing Phase I Termonorte Plant, the Eletronorte PV-1 Substation, and Interstate BR-364. Noise, heavy traffic, and industrial activities in the surrounding areas have reduced the presence of animals in the Project vicinity. A site-specific survey of the biotic communities conducted in association with the EIA did not identify the site as an area of limited biodiversity. The survey indicated that the area did not serve as a breeding ground for terrestrial animals such as birds and mammals. Therefore, construction activities did not have a significant impact on the local terrestrial fauna.

5.8 Aquatic flora and fauna. Impacts to the aquatic flora and fauna were limited to the areas near the water intake and effluent discharge structures. During construction of the water intake structures, the riverbanks and beds were disturbed, which may have caused organisms to avoid the immediate area, and some benthic organisms may have been killed. The construction activities also increased the amount of suspended solids in the river water. Observations of the construction site for the water intake and discharge structures indicate that impacts on the river water quality and on the aquatic communities were minor and of short duration.

5.9 Cultural Resources. Based on the results of the cultural resources study conducted during preparation of the EIA, there are no cultural resources at the power plant site or along the alignment of the water and wastewater pipelines. Therefore, there were no impacts during construction.

5.10 Noise. Site-specific noise levels were monitored at the Project site and indicate the noise levels are within legally acceptable limits. Although noise levels during construction increased over existing ambient levels, these impacts are minor and of relatively short duration, and did not significantly impact offsite residential areas.

Social Impacts

5.11 *Demography*. The maximum number of workers on-site did not exceed 1,000 workers during the peak of the construction period. Workers were mobilized from nearby communities and no onsite housing facilities were built to accommodate the workforce. Therefore, demographic and social impacts related to large construction campsites and temporary housing, such as social conflicts and increased infrastructure demand, have not occurred.

5.12 Land Use. The power plant site is zoned for industrial development by the Municipality of Porto Velho, which intends to attract other businesses to the general area. The Project has been constructed to be compatible with surrounding land uses, including the Phase I Termonorte Plant and the Eletronorte PV-1 Substation. Some country homes and company clubs are present within a 2-km radius of the Project site; however, the construction of the Project has not have an adverse impact on the surrounding land use. The water and effluent pipelines have been constructed adjacent to the existing Eletronorte transmission line ROW and impacted the land use along that corridor. Direct impacts and limitations to land use will be limited to the area immediately adjacent to the ROW for the pipelines.

5.13 Socioeconomics. No adverse socioeconomic impacts have been identified in association with the construction of the Project. The construction stimulated the local economy through the creation of direct jobs as well as the purchase of goods and services. Construction of the Project did not involve the relocation of families or rezoning of the area.

5.14 Aesthetics. The Termonorte Power Plant has been built in an area already characterized by the presence of industrial facilities and is adjacent to a major interstate highway that sustains heavy truck traffic. The 30-meter stack and other structures are not noticeably visible from the main highway and do not constitute a major aesthetic problem.

5.15 Infrastructure and Roads. The Project's main entrance is on the north side of Interstate BR-364, the major road connecting the cities of Porto Velho and Cuiabá. This highway is already characterized by heavy truck traffic associated with the transport of goods. One negative impact on the traffic on BR-364 involves the current configuration of the road at the power plant entrance. Although BR-364 is an important interstate road in this region, it only consists of two lanes in the area of the Project, one in each direction. As a result, trucks block traffic as they enter the plant, thereby posing a potential safety hazard. The Sponsor is currently lobbying the city authorities to make modifications to the entrance to the facility or implement alternatives to address this problem.

Health and Safety

5.16 Occupational hazards associated with the construction of the Project were typical of medium-scale construction work. Health and safety concerns during construction included the following hazards such as transportation of equipment and materials to and within the site, handling and storage of materials onsite, use of cranes and other heavy equipment, work on scaffolding, platforms, and other work at heights, welding, excavations and trenching, confined-space work, electrical and other energized work, hydraulic work, fire, explosion, spill, and other emergencies. As of the end of construction, no serious injuries or accidents have occurred at the site, indicating that the health and safety plans are satisfactory.

B. Operation Phase

Environmental

5.17 Air Quality. Air quality impacts were evaluated for both the Project and Termonorte Phase I facilities. Both the Project and Phase I power plants are being initially fired using LFO fuel, and both power plants will be converted to natural gas upon completion of the Urucu-Porto Velho Gas Pipeline. The air quality analysis considered the cumulative impacts of the two power plants operating both with LFO and natural gas fuels. Operation of both power plants using either fuel

will result in atmospheric emissions of nitrogen oxides (NO_X), sulfur dioxide (SO_2), particulate matter (PM), and carbon monoxide (CO).

5.18 The Project turbines may operate at different loads due to Electronorte's demand (i.e. less generation compared to the 78-MW capacity of each turbine). The operation of the turbines at loads below 60-MW impedes the injection of water and or steam to control NO_x as water could destabilize the burner's flame. To address reasonably possible operating conditions, dispersion studies using the Industrial Source Complex Short Term (ISCST3), a U.S. Environmental Protection Agency (USEPA) regulatory model, version 02035, were developed for the following six scenarios to estimate ground-level concentrations of targeted pollutants:

(i) Two combustion turbines operating in simple-cycle mode on fuel oil at a) 50-percent load (35 MW) no water injection, b) 100-percent load, and c) 70-percent load (50 MW) no water injection.

(ii) Three combustion turbines operating in combined-cycle mode on fuel oil at a) 50-percent load (35 MW) no water injection, b) 100-percent load, and c) 70-percent load (50 MW) no water injection.

(iii) Phase I operating all four units on fuel oil at full load.

(iv) Phase I operating all four units on gas at full load.

(v) Phase I operating all four units on fuel oil at full load and three combustion turbines operating in combined-cycle mode on fuel oil at a) 50-percent load (35 MW), the lower load limit based on the likely dispatch below which the turbines are operated at uncontrolled NO_x emissions, b) 100-percent load, and c) 70-percent load (50 MW).

(vi) Phase I operating all four units on gas at full load and three combustion turbines operating in combined-cycle mode on gas at a) 50-percent load (35 MW), the lower load limit based on the likely dispatch below which the turbines are operated at uncontrolled NO_x emissions, b) 100-percent load, and c) 70-percent load (50 MW).

5.19 An area of influence around the facility of 26 km by 22 km was used for the modeling, with receptors placed on a 100-meter grid. The four identical stacks of Phase I, which were built as a single structure, were considered as a single source for modeling purposes. Hourly meteorological data was used totaling 17,544 hourly measurements recorded at the meteorological station located at Porto Velho Airport in the City of Porto Velho. The station is located at a distance of 13.5 km northwest of Project and the region between the airport and the area of influence is nearly flat and has no large water surfaces (lakes). The raw data were pre-processed for model input, including stability class and height of mixing-layer calculations. The information from the Phase I facility indicates that its emissions comply with all applicable Brazilian and World Bank emission standards and guidelines with the exception of World Bank guideline for particulate matter. The Phase I facility has a reported PM emission rate of 71 mg/N m^3, under both LFO and natural gas, which exceeds the World Bank guideline of 50 mg/N m^3. Phase I particulate emissions are in compliance with the Brazilian standard of 350 grams per million kilocalories.

5.20 Modeling results show that the location of the maximum 24-hour and annual concentrations occurred southwest of the site, at a distance of approximately 5.7 to 7.8 km. Maximum impacts for the 1-hour, 24-hour, and annual average NO_x impacts for the combined Phase I and Phase II Termonorte power plants were 310 $\mu g/m^3$, 64$\mu g/m^3$, and 31 $\mu g/m^3$, respectively. These results reflect operation of both Phase I and Phase II on LFO at 50-percent load and are also within the applicable Brazilian and World Bank standards and guidelines. Maximum impacts for SO_2, CO, and PM for both the Phase I and Phase II facilities combined were all well within the applicable Brazilian and World Bank standards and guidelines (see Table 5-1 and 5-2). Modeled impacts for all other scenarios were lower than those presented above.

5.21 The modeled results were then added to the background concentrations obtained from the existing ambient air quality monitoring stations operated by Termonorte. Twenty-four hour ambient air quality measurements for NO_2 taken before Phase II began operation in January 2002 have all been well below the World Bank limit of 150 milligrams per cubic meter (mg/m^3) and show that average daily concentrations have never reached more than 50 mg/m^3 in the dry season. Most of the daily measurements in the dry season vary only slightly around an average of 30 mg/m^3. This would imply a maximum 1-hour concentration of some 60 mg/m^3, using USEPA recommended factors for conversion between 1-hour and 24-hour measured concentrations (USEPA-454/R-92-019, "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources"). When adding the maximum 1-hour ambient background concentration of 60 $\mu g/m^3$ to the maximum 1 hour concentration for the combined Phase I and II facilities of 310 $\mu g/m^3$, the predicted concentrations would exceed the Brazilian 1-hour standard of 320 $\mu g/m^3$.

5.22 Modeled impacts for all other scenarios combining the impacts for both power plants for PM, SO_2 and CO were well under Brazilian and World Bank standards and guidelines (See in Table 5-1), event though PM measurements have presented a few violations of the Brazilian and World Bank 24-hour limit. However, these violations only occur in the dry season at stations PA1 and PA3, located on unpaved roads in the suburban fringe of Porto Velho. Modeled impacts for PM from the combined Phase I and Phase II facilities are quite low and will have minimal impact on the overall levels of PM in the region.

5.23 Fresh Water Hydrology and Water Quality. The extraction of water and the discharge of the Project effluents have the potential to impact the quality of the water in the Candeias River. The total volume of water to be extracted will be 492 m^3/hour. This volume is relatively insignificant (0.3 percent), even when compared to the minimal flow of the Candeias River of approximately 162,000 m^3/hour. Therefore, water extraction will not significantly impact the flow of the Candeias River.

5.24 The impacts of the thermal discharge in the Candeias River were addressed in a modeling study conducted to define the extent and characteristics of the thermal plume. The modeling results demonstrated that the temperature of the thermal plume would be between 0.02 and 0.03°C within 19 meters of the point of discharge. The alternation in the temperature of the river will be minimal due to the ratio between the minimum river flow rate of 162,000 m^3/hour and an effluent flow rate of approximately 60 m^3/hour, corresponding to 0.04 percent of the minimum river flow rate. Based on these results, the thermal discharge will be well within the Brazilian standards and World Bank guidelines. The World Bank guidelines state that the effluent should result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution takes place, which is defined as 100 meters from the point of discharge.

5.25 Potential impacts to the water quality of the Candeias River may occur if parameters of the effluent exceed established standards or if the discharge contains chemicals of concern in concentrations that may impair or alter the quality of the river water. The predicted quality of the effluent will comply with Brazilian standards and World Bank guidelines.

5.26 Other potential impacts to fresh water hydrology and water quality during operation of the power plant include contamination of the local aquifer by petroleum hydrocarbons resulting from spills.

5.27 Entrainment of Aquatic Organisms. The cooling water intake system will impact aquatic organisms including macroinvertebrates and fish through impingement and entrainment. Small organisms that can pass through the intake screens will be entrained into the cooling water

system, many of which will be killed or injured by mechanical and thermal stress. Larger organisms such as fish could be impinged or trapped on the intake screens, and some of those will die. The second potential impact to aquatic organisms is from the discharge of thermal effluent from the cooling system. However, as described in the preceding paragraphs, the thermal modeling results demonstrated that the temperature of the thermal plume would be between 0.02 and 0.03 °C within 19 meters of the point of discharge. Based on these results, the thermal discharge will have only minimal impacts to aquatic organisms in the Candeias River.

5.28 Noise. The expected cumulative noise impacts from the Project and Phase I was conducted by Hyundai in July 2002. The predicted combined noise levels along the Project boundary with both the Project and Phase I operating at full capacity will range between 50 and 65 dB(A), while noise levels at the nearest residential receptor will range from 54.1 to 54.6 dB(A). Based on this information, the combined noise levels from both the Project and Phase I will meet the applicable 65 dB(A) and 70 dB(A) maximum night-time and daytime noise levels at the property line as required in the Brazilian standards. However the Project would not be in compliance with the 45 dB(A) maximum night-time limit as established in the Thermal Power Guideline included in the World Bank Pollution Prevention and Abatement Handbook.

5.29 Soils and Subsoil. Operation of the Project should not adversely impact soils. The slope of the Project site has been designed to prevent erosion during operation. The potential for contamination of the soil and subsurface has been minimized through implementation of secondary containment tanks with impervious surfaces and appropriate surface drainage, and wastewater treatment prior to disposal. However, despite the measures and instruments installed to prevent spills, two incidents have occurred at the Project site. The first spill took place in September 2000 associated with the operation of the Phase I power plant. The second spill was related to the operation of the Project and occurred in early March 2003. The 2000 spill was considered large, and the oil reached the nearby water body (Igarapé do Velho). Local NGOs voiced their concerns about damage to the surface water bodies and the aquatic ecology. The March 2003 spill involved a small volume, approximately 150 liters, and was contained within an unlined holding basin near the Igarapé do Velho. A site visit conducted on March 27, 2003, did not indicate staining or damage to soil and vegetation downgradient from the temporary unlined holding basin. The local and state environmental authority accepted the clean-up efforts.

5.30 Flora and Fauna. Impacts to terrestrial flora and fauna will be minimal since the Project site has been previously affected by anthropogenic activities. Impacts to terrestrial fauna will likewise be minimal due to the previously disturbed nature of the Project site and general lack of suitable habitat. The majority of impacts to terrestrial fauna and flora will be limited to the immediate Project area.

5.31 Cultural Resources. Operation of the power plant and water intake structures will not adversely impact cultural resources.

5.32 Solid Wastes. It is estimated that during the operation of the plant, the following solid wastes will be generated: residual fuel from the fuel treatment unit: ~ 20 tons/month; residual lubricant oil: ~ 1,000 liters/month; residual ionic resins: ~ 83 liters/month; sludge from the water and wastewater treatment units: ~ 21,000 liters/month; and domestic waste from office and other supporting building: ~ 10,000 liters/month.

Social

5.33 Land Use. Operation of the Project will not adversely impact land use. The power plant site is zoned for industrial development. The water intake and effluent discharge pipelines have been located primarily adjacent to the existing Eletronorte transmission line ROW to minimize impacts to other land uses.

5.34 Socioeconomics. No significant adverse socioeconomic impacts are anticipated.

5.35 Aesthetics. Operation of the Project will not adversely impact the aesthetics of the adjoining landscape. The Project will operate in an area that has been significantly altered by other industrial facilities including the Eletronorte PV-1 Substation and Phase I Termonorte Plant. The Project is located near a major interstate road, which sustains heavy truck traffic. The power plant will be compatible with existing visual resources, and no significant impacts to the current aesthetics and landscape are anticipated.

5.36 Fuel Transportation. Fuel oil for the operation of the Project will continue to be shipped from Manaus via double-hulled barges to the Petrobras terminal in Porto Velho. The potential exists for an accidental spill during transportation between Manaus and Porto Velho, including the offloading and storage facilities at Porto Velho. Petrobras has established a good safety record with regard to oil spills and has developed the necessary emergency response plans to be implemented in the event of an accidental release of fuel oil.

5.37 Fuel oil will be transported from the Petrobras fuel storage facility in Porto Velho to the Project site by 30,000-liter trucks. At full operation, the combined Phase I and the Project facilities will receive approximately 57 fuel oil transport trucks per day. The fuel trucks will access the power plant through the main entrance on the north side of BR-364. This interstate road is already characterized by heavy truck traffic due to the transport of goods. One negative impact on the traffic on BR-364 is associated with the current configuration of the road at the power plant entrance. Even though BR-364 is an important interstate road in the region, in the area of the Project it consists of only a two-lane road, one in each direction. Given this limitation, when trucks are entering the Plant, they stop traffic and this may pose a safety hazard. The Project Company lobbying the city authorities to make modifications to the entrance to the facility or implement alternatives to address this problem.

5.38 Resettlement. No resettlement is required for operation of the Project.

Health and Safety

5.39 The nature of health and safety concerns in the operation phase change from outdoor to indoor occupational hazards, such as appropriate lighting and ventilation, noise levels, and fire prevention, among others. The proposed technology (i.e., fuel oil/natural gas-fired combustion turbines) has a good safety record. While the plant operates on oil fuel, additional health and safety concerns include potential spills during transportation and loading operations. When the Project starts to receive natural gas through the Urucu-Porto Velho Gas Pipeline, the potential for fuel spills will be reduced. Projects of this nature typically incorporate various safety devices such as pressure-sensitive shutoff valves and fire suppression systems. Therefore, the possibility of explosion is minimal.

Indirect Impacts

5.40 The principal indirect impact of the Project is associated with the construction of the Urucu-Porto Velho Gas Pipeline. The Urucu- Porto Velho Gas Pipeline is being developed as a separate

project from the Termonorte Power Plant. The Project and the Phase I Termonorte Power Plants will be the principal users of the natural gas transported by the Urucu- Porto Velho Gas Pipeline. The 522-km pipeline will be constructed through portions of the Amazon rain forest and will pass within several miles of the borders of indigenous lands, small communities and natural conservation areas. Given its location and the nature of constructing a pipeline in a pristine area, the Urucu- Porto Velho Gas Pipeline could result in potential ecological, health and safety and labor impacts, with social impacts likely be more broadly distributed and may affect small communities throughout the general area. The Bank assessed the impacts and proposed mitigation measures associated with the construction and operation of the Urucu pipeline during its environmental and social due diligence analysis. Annex 1 presents a summary of the principal environmental and social aspects associated with the Urucu- Porto Velho Gas Pipeline.

C. Positive Impacts/Benefits

5.41 Prior to the installation of the Project and the Phase I Termonorte Projects, the State of Rondônia relied heavily on the electricity generated by hydroelectric power plants. Due to unfavorable weather conditions that led to lower-than-expected precipitation rates in the late 1990s, Rondônia faced an energy crisis. The Phase I power plant was constructed within a very short time to ease the energy shortfalls caused by low reservoir levels. The Project will bring greater energy reliability to the state of Rondônia.

5.42 A significant positive aspect of the Project is that combined-cycle generation is highly efficient and minimizes the formation of greenhouse gas emissions as compared to other fossil fuel technologies. Combined-cycle projects greatly reduce environmental and social impacts as compared to hydroelectric projects. Impacts associated with air emissions will be reduced once the Project converts from fuel oil to natural gas.

5.43 Positive impacts have resulted from the employment opportunities created by the construction of the Project. Economic benefits have been provided to the local economy of the area through the purchase of goods and services. At the local level, the Project has employed as many as 800 workers during the construction phase. At the regional level, the Project has a positive impact on the economy through the creation of indirect jobs and demand for services and equipment that might be provided by local or regional suppliers, as well as generating increased tax revenues.

5.44 The Project will also improve the quality of life and economic viability of the area by providing a reliable source of electric energy. This power supply is especially important to the economy of the State of Rondônia, in view of the significant electric power shortages that have been experienced in many regions of Brazil. The Project will add 309 MW of energy to the isolated grid system, which will eventually be connected to the National Grid.

5.45 The Project will also have an important environmental benefit associated with the decommissioning of a host of older thermoelectric power units in use in various areas of the state including the City of Porto Velho. These older units are significant sources of noise and atmospheric pollution since most employ aging, less-efficient technologies, are located near homes, and did not have emission or noise controls. Table 5-2 lists the units that have been decommissioned in Rondônia from 1999 to 2002 due to the implementation of the Phase I and the Project. Table 5-3 also lists the Rio Branco units that are within the Rondônia-Acre Transmission Connection and which may be decommissioned as a result of the implementation of the Phase I and the Project.

VI. ENVIRONMENTAL, SOCIAL AND HEALTH AND SAFETY MANAGEMENT.

6.1 The project's primary potential negative environmental impacts derive from the power plant's operation, specifically air quality emissions and cooling water intake and discharge. While the plant operates on fuel oil, there is also the potential for oil spills and related emergencies associated with the storage, transport, and handling of fuels. The prevention and mitigation measures established for each of the identified environmental impacts have been prepared and implemented separately. While the EPC constructors have prepared various documents to assess and mitigate impacts during construction, a consolidated Environmental and Social Management Plan (ESMP, or Plano Básico Ambiental in Portuguese) was developed and has been implemented for operation of the plant. Construction of the Project started in January 2001 and the first combustion turbine entered operation in November 2001. Since that time, the Project has been under construction as well as in operation. Trained personnel are responsible for verifying and supervising compliance with the preventive and mitigation measures established for each stage of the Project. The ESMP includes a monitoring program of air emission, air quality, wastewater quality, and noise levels. Descriptions of the various environmental, social, and health and safety mitigation and monitoring measures are presented in this section.

A. Mitigation Measures

Construction Phase

6.2 Construções Camargo Corrêa and Hyundai Engineering & Construction, the two construction companies that constituted the EPC Contractor, developed a concise ESMP to identify potential environmental impacts and health and safety hazards that could have developed during construction of the Termonorte Project. The ESMP included standard good practices and procedures for environmental protection and social management during construction.

Environmental

6.3 Air Quality. Major air quality concerns at construction sites included an increase in dust from traffic and exhaust gases from vehicles and heavy equipment. Control measures included good maintenance of vehicles and heavy equipment as well as maintenance of access roads, which were wetted down to control dust emissions during dry conditions.

6.4 Fresh Water Hydrology and Groundwater Quality. Measures adopted to protect surface water quality included a good waste management plan which prevented wastes generated at the site from reaching or being disposed off at the nearby Igarapé do Velho. Straw screens and other soil erosion measures also prevented excessive amounts of solids from reaching the surface water body. Groundwater quality was protected with good collection and disposal of oil and its derivatives. Septic tanks were placed at a safe distance from the onsite wells to prevent sanitary waste from being drawn to deeper groundwater.

6.5 Geology and Geomorphology. The site preparation required minimal earthmoving work. No significant leveling work was required, so the geology and geomorphology were not significantly affected and no mitigation measures were implemented.

6.6 Soils. The EPC Contractor used a combination of standard practices to minimize soil erosion such as straw screens, riprap rock structures, and shrub palisade. The site is being landscaped to prevent soil erosion and increase water infiltration.

6.7 Flora and Fauna. Palm trees were spared and the fragment of rain forest located to the north and in the northeast portion of the Project site was not cleared.

6.8 Noise. Heavy equipment and trucks used silencers to minimize noise levels within the construction site.

6.9 Waste. Solid waste generated during the construction phase was sorted and adequately stored in appropriate drums or containers. General solid waste produced at the construction site was separated from solid waste generated at restrooms, lodging facilities, and shops. Solid wastes were transported three times a week to the authorized Porto Velho Municipal landfill. Wastes generated at the onsite medical ambulatory are segregated from all other types of solid waste and stored in special containers for adequate disposal. Standard practice of disposal is incineration by a local hospital. The area designated for vehicle and equipment fueling and maintenance is provided with metallic trays for collection of possible spills. In addition, oil recovered from the oil/water separator is also collected and all spent oil and derivatives are transported to an authorized oil recycling facility, as required by Brazilian regulations.

Social

6.10 Lodging facilities within the site for non-local workers and transportation services for local construction workers were available through the EPC Contractors.

6.11 No relocation of families was required for the construction of the Project. Since the Project does not involve construction of transmission lines, there were no special provisions to assess potential families outside of the Project area. The water intake/discharge pipeline was constructed adjacent to the existing Eletronorte transmission line ROW and did not require any relocation of families.

Health and Safety

6.12 An Internal Accident Prevention Commission (Comissão Interna de Prevenção de Acidentes [CIPA]), a Workers' Health and Medical Program (Programa de Controle Médico e Saúde Ocupacional – [PCMSO]) and an Environmental Risks Prevention Program (Programa de Prevenção de Riscos Ambientais [PPRA]) was implemented in accordance with Brazilian Labor Legislation. The PPRA identified risks and hazards associated with each individual task/function, identified the appropriate personal protection equipment (PPE) to be used by workers when performing specific tasks as well as the required training.

6.13 The EPC Contractors also developed a Health and Safety Plan and a Contingency and Emergency Plans. The workers were trained and informed on the content of the Contingency and Emergency Plans as well as the communication processes used during emergencies.

Operation Phase

Environmental

6.14 Air Quality. Initially, water injection for NO_x control while firing LFO was not possible at loads below 60-MW as water could destabilize the burner's flame. However, Termonorte and General Electric, as the turbine manufacturer, modified the operation of the combustion turbines control system to allow for the use of water injection at partial load as low as 30-MW output. Partial-load scenarios without water/steam injection for NO_x control will now occur only as transient

conditions, primarily during startup and shutdown. Operation of the Project below 35 MW is highly unlikely given the anticipated dispatch of the facility and the operational flexibility of the simple-cycle and combined-cycle modes of operation. Therefore, no violations to the ambient air quality standards are anticipated.

6.15 When the plant begins operating in combined-cycle mode, NO_X emissions will be controlled with steam injection and steam injection will be operational at lower loads. When the Urucu-Porto Velho Gas Pipeline is constructed, both the Project and Phase I will operate on natural gas, and emissions will be greatly reduced. Natural gas is the cleanest fossil fuel source, and power plants using combustion turbine technology in combined-cycle configuration have significantly increased efficiencies over more conventional technologies. The increased efficiency translates to a reduction in the pounds of air pollutants emitted per megawatt of electricity produced. The use of gas with extremely low-sulfur content guarantees low emissions of SO_2 and particulate matter.

6.16 Fresh Water Hydrology and Quality. The volume of water to be pumped from the Candeias River is extremely small when compared to the total volume of the river. Therefore, no impact to the river hydrology and flow is expected. In regards to the thermal impacts, the result of the model indicates that the thermal plume will be largely confined to the area immediately around the point of discharge and no significant thermal plume is expected to form that would adversely impact the aquatic community. In general, the impacts on the aquatic ecosystem will be minimized through the use of cooling towers, which reduce both the temperature and volume of the cooling water discharge. The process effluents from the Project will be treated prior to being disposed in the Candeias River in order to meet Brazilian standards and World Bank guidelines.

6.17 Entrainment of Aquatic Organisms. Potential impacts to aquatic organisms during operation of the Project are primarily associated with the intake and discharge of the cooling water system. Measures have been taken in the design of the water intake structure to minimize the impact of impingement on aquatic organisms. The water intake structure will be constructed in a manner to minimize the inflow velocity. In addition, the intake pipe will be fitted with a metal screen that will prevent the entrainment of larger organisms. Since the river water moves relatively slowly into the intake structure, it is anticipated that fish and other mobile organisms will be able to swim away from the structure, thereby minimizing impacts to the aquatic organisms.

6.18 Noise. The results of the Site Noise Survey and Calculations Report prepared by the EPC Contractor indicate that the Project will comply with Brazilian noise standards. Mitigation of noise generated by the Project and or the Termonorte Phase I Project could be required if the area is to remain rural/residential. However, the Municipality of Porto Velho has expressed it intent for the development of industrial facilities in this zone, which would allow a noise contribution of the Project at the closest receptors of 70 dB(A) as established in the Thermal Power Guideline included in the World Bank Pollution Prevention and Abatement Handbook. If monitoring indicates any violation of these limits, the Company will implement additional corrective measures to meet in-country compliance.

6.19 Soils and Subsoil. Fuel storage tank and chemical storage areas have secondary containment. Areas that have the potential to contain oil and grease or other chemicals have a drainage system that take runoff and effluent to the oil/water separator for treatment. Storm water drainage in areas not susceptible to the potential presence of oil/grease or chemicals do not require treatment prior to discharge. To prevent potential soil erosion and increase infiltration of surface runoff, areas around the facility will be vegetated.

6.20 Terrestrial Flora and Fauna. In an effort to minimize impacts to terrestrial flora and fauna, the portion of the Project site that had fragmented forest areas was not cleared during site preparation. Since then, the Project developers have purchased additional land around the plant to increase the greenbelt (buffer zone). The newly acquired land will be preserved and will protect those species that currently inhabit the fragmented forest.

6.21 Waste. The plant already possesses a good collection, classification, packing, labeling, temporary storage, and disposition program for all the residues generated during the operation stage. Domestic wastes generated in the plant are collected and sent to the Porto Velho municipal landfill. The sludge and residual solids from the treatment facilities that are not deemed hazardous are disposed at authorized facilities. Oily sludges and other wastes with high fuel content are sold to cement plants that burn these substances as co-process fuel, or they are disposed of at authorized recycling centers.

6.22 The residual lubricant oil and the ionic resins will be recycled by their respective manufacturer/distributor, while the residual fuel oil will be used as supplementary fuel (co-processing) at local cement facilities. The sludge from the water and wastewater treatment units will be disposed at local incinerators. The domestic solid waste will be disposed at local municipal landfills.

6.23 Fuel Transportation. Petrobras requires to the companies transporting fuel to train their personnel, carry on emergency response equipment and develop specific emergency response procedures. In regards to the Project, four companies (Planalto, Rondonpetro, Cemape and Vieira) have fulfilled Petrobras requirements and have been authorized to transport the LFO fuel for the Project. Reportedly, during the almost two years of operation of the Project, no accidents have occurred. In addition and in accordance with Petrobras requirements, all transportation companies must have insurance. Table XX includes the table of content of the emergency response plan (Plano de Emergência de Transporte [PET]), which is being implemented by PlanAlto Ltda.

6.24 The Project Company has contracted the design of a modification to the highway to allow for a better access in front of the main entrance of the Plant. This modification to the road will provide extra space for fuel trucks entering the Project site and freeing the lane to avoid disruption of traffic. Eventually, when the natural gas is available through the Urucu-Porto Velho Gas Pipeline, the Project will use natural gas, which will be delivered to the site via gas pipeline. Impacts associated with the fuel oil delivery system will be eliminated, and impacts associated with the use of natural gas will be minimal.

Health and Safety

6.25 The requirements of the Brazilian Labor Legislation apply to both the construction and operation phases. Therefore, the company will prepare and implement an Internal Accident Prevention Commission (CIPA), a Workers' Health and Medical Program (PCMSO), and an Environmental Risks Prevention Program (PPRA). These programs will be consolidated under a Health and Safety Plan (HSP) for the operation phase. The estimated cost of implementing the HSP is approximately US$60,000, effective with the start of plant operation. The Project company will develop a Contingency and Emergency Plan that will be consistent with the existing Mutual Assistance Plan (PAM) of the CIPS, currently managed by Petrobras, and which will include a Spill Prevention, Control and Countermeasure Plan (SPCCP).

B. Monitoring Programs

Construction Phase

6.26 Air Quality. Personnel visually observed fugitive dust during construction. When appropriate, the construction surfaces were wetted down to control dust emissions from the site. In addition to the onsite air quality monitoring conducted concurrently with the construction and partial operation of the Project, offsite stationary air quality stations were used to establish air quality conditions in the general area of the Project. Three stations are used to monitor offsite ambient air quality conditions, specifically measuring levels of of NOx, SO_2, PM, and CO. Although the location of these air quality monitoring stations raises some questions as to their relevance to the Project site, they have generated information that can be used to assess broad ambient air quality conditions in the general Project area.

6.27 Water Quality. While the Phase II Termonorte Project is partially operational, groundwater and surface water at the temporary discharge point have been monitored on a monthly basis, as required by SEDAM. The list of parameters includes several physical, chemical, and biological parameters. In addition, a field study was conducted in August 2002 to assess and establish baseline conditions at the Candeias River, the water body that will receive the effluents from the Phase II Project beginning in August 2003. The five groundwater wells have also been monitored, which include of the three water supply wells at the Phase I Plant and two wells at the Phase II Project site.

6.28 Noise. Several noise monitoring events have been conducted in the general area of the Phase I and Phase II Project site since 2000 in an effort to assess background noise levels. Noise levels are in compliance with World Bank guidelines for Industrial Zones within the property fence line. Appendix D presents a Consolidated Noise Monitoring Report.

6.29 Waste. Solid wastes generated during the construction were disposed according to local requirements, and recycling of plastic, woods, metals, and used oil was encouraged. General domestic waste was collected and disposed by the Municipality of Porto Velho. The municipality does not have licensed solid waste disposal facilities, but disposes of domestic solid wastes at large open pits.

6.30 Soil. Should any of the organic soil remain unused upon completion of landscaping of the Project, the remaining material will be disposed at a location previously approved by local authorities. Any soil material that may be removed during excavation for the foundation of structures will also be used onsite or disposed at an authorized location.

6.31 In addition to the specific monitoring activities addressed above, the following monitoring activities were conducted during construction to ensure that good management practices were followed.

- *Implementation of the Environmental and Social Management Plan:* compliance with the ESMP to ensure protection of the environment and social aspects. These include inspection of waste storage, handling and disposal, inspection of septic tanks, and inspection of the site to ensure that soil erosion measures are employed, etc.
- *Compliance with the Project Health and Safety Plan:* compliance with the HSP is monitored to ensure the safety of workers and the public. These include inspections of worker's proper use of PPE and safety practices during performance of activities outlined in the PRRA, inspection of housekeeping at the construction site, etc.

- *Community Relations:* community relations, including the conduct of construction workers at the site and routine contacts with local authorities in the adjoining communities.

Operation Phase

6.32 Air Quality. Air quality monitoring will continue through the use of the three offsite monitoring stations and by performance tests that show the operational levels of emissions. This monitoring requirement is also part of the Terms of Commitment that the Project owner signed with the Government of Rondônia. Performance monitoring for atmospheric emissions will be implemented as part of the plant commissioning process. Stack tests will be performed quarterly for the first year after the plant becomes fully operational, and the emission test data will be submitted to SEDAM.

6.33 Water Quality. During operation of the Phase II Project, the water quality of the Candeias River and groundwater must be monitored in accordance with requirements of the Terms of Commitment. The list of parameters is the same list outlined under Monitoring during construction. According to information in the Terms of Commitment, there should be four (quarterly) sampling events in the first year after the Plant becomes fully operational.

6.34 Flora. Portions of the Project site that were impacted during construction with native plants, and the Project will preserve the already existing fragments of forests within the property. The Project site will contain a significant green belt (buffer zone) that will also be preserved. In addition, the Project will provide funds to support the management of other conservation areas administered by the State of Rondônia. Impacts to terrestrial flora and fauna along the water intake and discharge pipeline ROW were limited primarily to the approximately 5-meter ROW. Terrestrial impacts were minimized by locating the pipeline ROW adjacent to an existing transmission line. Construction of the pipelines resulted in the loss of some trees and other vegetation. Since the water intake and discharge ROW was located contiguous to an existing ROW, impacts to terrestrial fauna were also effectively minimized.

6.35 Noise. Noise measurements will be conducted quarterly during the first year after the plant becomes fully operational to ensure to compliance with Brazilian standards and World Bank guidelines.

6.36 Soils and Subsoil. Operation of the Project should not adversely impact soils. The grade of the Project site has been designed to prevent erosion during operation. Impacts to soils from the release of oils and other chemicals will be controlled through the construction of secondary containment and surface drainage that takes runoff from water with potential contamination to the onsite wastewater treatment unit. The Plant also has developed a Spill Prevention, Control, and Countermeasures (SPCC) plan and emergency response plan to provide fast spill response and control within the facility. The potential for contamination of the soil and subsurface has been minimized through implementation of secondary containment tanks with impervious surfaces and appropriate surface drainage, and wastewater treatment prior to disposal.

6.37 Social and Environmental Compensatory Measures The Project owner signed a Terms of Commitment with the Government of Rondônia in which 15 entities, organizations, and groups are to receive financial compensation. The total costs of these social and environmental compensation programs total 2,724,766 Brazilian Reais. The status of this compensatory program is presented in Table 6-1. Ongoing community relations will be performed including the conduct

of operational workers, distribution of information about the Project, and sponsorship of community events to communicate with local communities.

Indirect Impacts

6.38 In connection with the proposed financing of the Termonorte Phase II Project by the IDB, the sponsors of the Urucu-Porto Velho Gas Pipeline have agreed for the benefit of the Bank to a series of commitments, including compliance with environmental related regulations, adequate information disclosure, to have an independent annual environmental, social, health and safety audit performed on the pipeline, and to meet with IDB and/or their designees to discuss areas of concern associated with environmental, social, health and safety, and labor aspects. A Letter Agreement formalizing such commitments is expected prior to financial closure of the Project.

C. Cost, Schedule and Responsibilities

6.39 The Project owners are responsible for the costs associated with execution of all control, monitoring, mitigation, and compensatory programs that have been approved for the Project. SEDAM has the authority to demand that the programs and measures be executed within the schedule proposed in the PBA and the Operation License.

6.40 Relevant specific conditions stated in the Termonorte Operations License for the power plant include:

- The Developer must present copies of documents from the vendor and/or buyer of the used oil. Documents must be presented on a quarterly basis.
- The Developers must submit quarterly reports, properly registered and signed, that detail the volume of used oil produced at the facility, the volume removed, and the name of the company that removed, transported, and disposed of the used oil.
- The Developer must conduct the environmental control and monitoring programs (air emissions, air quality, noise, final disposal of used fuel and lubricant oils, effluents and surface water bodies). Reports must be submitted to SEDAM on a quarterly basis.
- The Developer must comply with the proposed mitigating measures (social communication, Emergency Action Plan, landscaping and green belt).
- The Developer must comply with the environmental programs presented in the Attachment I and II of the Interim Operations License, as well as with other legal requirements. Attachment I is the Environmental Control and Monitoring Programs and Attachment II is the Terms of Commitment for Environmental Compensation.
- Non-compliance with the conditions may results in the cancellation of the above-mentioned license.

6.41 Since the year 2000 SEDAM has been benefiting from a program financed by the G-VII group for institutional strengthening. The program includes training on environmental management, environmental monitoring and the control of contamination. The program has resulted in the hiring of additional staff and the training of operational personnel. Additional information can be found at http://www.rondonia.ro.gov.br/secretarias/sedam/sedam.htm In addition, SEDAM has singed cooperation and training agreements with technical institutes and universities, including CREA, Rondonia's Federal University (UNIR), privates universities such as UNIPEC, FARO and UNIRON and the Amazonian Survillance System (SIVAM).

D. Supervision and Control of Project Mitigation and Monitoring

6.42 The EPC Contractor was the responsible party charged with supervising implementation of the monitoring, control, and mitigation measures. The Plant Operator is responsible for supervising implementation of the monitoring, control, and mitigation measures during the operational phase. The Project is already in operation. Observation of the plant's full operation indicates that the Project operator is committed to using the best available technology and implementing standard good practices to mitigate potential impacts during full operation of the facility.

E. Health, Safety, and Environmental Management

6.43 The Project has developed and implemented a Health, Safety, and Environmental (HSE) Management System for construction and operation of the Project. During the construction phase, implementation of the HSE system is the responsibility of the EPC Contractor. During operational phase, implementation of the HSE system is the responsibility of the facility operator. Review of the documents already developed and implemented for construction and operation of the Project indicates that standard practices and procedures have been applied, and that no additional HSE plans are required.

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

7.1 The Project EIA was finalized in December 2000 and submitted to SEDAM for review. In January 2001, SEDAM submitted copies of the EIA to IBAMA, the federal Brazilian environmental agency. On February 12, 2001, a public hearing was held in the City of Porto Velho, which was attended by municipal and state officials, members of the press, local residents, and representatives of NGOs. As part of the public consultation process, the Sponsor conducted technical meetings with local authorities and organizations to present the results of the EIA, and to provide additional information on the Project. Technical meetings were conducted with the following authorities and organizations:

- Regional engineering, architecture, and agronomy council in the State of Rondônia
- Industrial and commercial council in the State of Rondônia
- Forum of non-governmental organizations
- State university
- Municipal mayor and municipal secretariats and authorities
- Vice-governor and state authorities
- Local schools

Furthermore, the Sponsor implemented an open-door policy (termonorte de portas abertas) that provided guided tours of the plant to any local community members and organizations.

7.2 Overall, the public consultation process for the Phase II Termonorte Power Project has provided the public with access to general Project information and an understanding of the Project characteristics. This process has been in compliance with applicable Brazilian regulatory requirements.

VIII. RECOMMENDATIONS

8.1 The Bank (IDB) proposes to require as part of the Loan Agreement that Termonorte (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) The Project will only use light fuel oil (LFO) oil with a sulfur content of less than 2.0% by weight and an ash content of less than 0.06% by weight or will use natural gas.
(h) 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.
(i) 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.
(j) Ensure that all companies contracted for construction or operation activities comply with the applicable environmental and social requirements of the Loan Agreement.
(k) Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the project.
(l) 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 financial closing, the Company shall submit, in form and substance acceptable to the IDB, the:
(a) A report confirming the feasibility of the use of water/steam injection for the control of NOx at the reduced loads modeled during the due diligence;
(b) Present the classification of the land surrounding the Project as industrial, in particular at the location of the noise closest receptors or present a plan to reduce the noise contribution of the Plant to comply with the noise levels included in te World Bank Thermal Power Guidelines for New Plants (World Bank Pollution Prevention and Abatement Handbook, 1998);
(c) Enhance the monitoring of the Project air emissions by means of reliable and real-time monitoring such as by the use of Continuous Emission Monitoring Systems (CEMS);
(d) Assess the location of the existing ambient air quality monitoring stations to include the operation of the Project and modify the locations of the stations if necessary;
(e) Improve SPCC training of response personnel to enhance their preparation, including conducting drills as part of the spill response training and improve maintenance of all valves and equipment associated with fuels and the effluent stream to prevent malfunction and releases to the environment;
(f) Conduct noise monitoring following start of operation of the full Phase II Project to confirm compliance with applicable standards and guidelines. Monitoring should be conducted within the plant, at the fence lines, and at the nearest residential/commercial areas;

(g) Conduct monitoring in the Candeias River to confirm compliance with Brazilian and IDB/World Bank guidelines. Monitoring should be conducted at the end-of-pipe, within a short distance downstream from the discharge point, and upgradient from the discharge point. In addition, some physico-chemical parameters should be measured with depth, not just at the surface;
(h) Conduct biological monitoring of aquatic communities to assess potential changes in their assemblage or abundance;
(i) Finalize design and construct turning lane into Project site entrance from BR-364 to minimize potential traffic accidents;
(j) Environmental and Social Management Plan for the operational phase for both the Project and the Termonorte Phase I Project;
(k) Health and Safety Management Plan for the operational phase for both the Project and the Termonorte Phase I Project;
(l) Contingency Plan and Spill Prevention and CounterControl Plan for the operational phase for both the Project and the Termonorte Phase I Project;
(m) Environmental, Health and Safety Management System for the operational phase for both the Project and the Termonorte Phase I Project; and
(n) The Letter Agreement formalizing the commitments by sponsors of the Urucu-Porto Velho Gas Pipeline which include compliance with environmental related regulations, adequate information disclosure, to have an independent annual environmental, social, health and safety audit performed on the pipeline, and to meet with IDB and/or their designees to discuss areas of concern associated with environmental, social, health and safety, and labor aspects.

8.3 Prior to First Disbursement of the Loan, the Company shall (a) relocate the existing air quality monitoring stations to locations more directly aligned with the modeled areas of impact, as indicated by the most recent air dispersion model results and (b) install and operate CEMS or equivalent technology to monitor emissions.

8.4 On an annual basis, the Company must certify compliance with all environmental, social, and health and safety requirements in the Loan Agreement.

8.5 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.

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.

Figure 2.1
Project location

Figure 2-2
Occupation of areas immediately surrounding the Project site.

TABLE 2 -1

Project Water Balance – Phase II Termonorte Project

	Complete Configuration of Project (3 Combustion Turbine and a Steam Turbine in Combined Cycle	
Fuel	**Diesel**	**Natural Gas**
Maximum capacity	**349,18 MW**	**359,14 MW**
(1) Potable water and make-up water for HRSG	78,48 m3/hr	78,70 m3/hr
(2) Potable water for general consumption	1,83 m3/hr	1,83 m3/hr
(3) Demineralized makeup water	70,17 m3/hr	69,62 m3/hr
(4) Water injection for NOx control and for water loss	63,86 m3/hr	57,26 m3/hr
(5) HRSG purging water	4,26 m3/hr	4,83 m3/hr
(6) Cooling water	355,71 m3/hr	413,29 m3/hr
(7) Water lost through evaporation from cooling towers	318,47 m3/hr	371,62 m3/hr
(8) Cooling system capacity	27.924 m3	27.924 m3
(9) Recovery of Condensate	356 m3/hr	413 m3/hr
(10) Effluent stream from the demineraling system	6,48 m3/hr	7,25 m3/hr
(11) Blowdown from cooling system	41,50 m3/hr	46,50 m3/hr
(12) Effluent from drainage of areas potentially contaminated	3,88 m3/hr	4,16 m3/hr
(13) Treated effluents	51,86 m3/hr	57,91 m3/hr
(14) Steam for the steam turbine	426,6 m3/hr	482,56 m3/hr
(15) steam from the steam turbine that is condensated	362,74 m3/hr	420,16 m3/hr
(16) Steam to warm up fuel	0 m3/hr	5,2 m3/hr

TABLE 3-1

Ambient Air Quality Standards (Brazilian Standards and World Bank Guidelines)

Pollutant	Sampling Time	Primary Standard[1]	Secondary Standard[2]	World Bank Guidelines[3]
			($\mu g/m^3$)	
PM_{10}	24-hour	150	150	150
	Annual Average	50	50	50
Particulate Matter	24-hour	240	150	230
	Annual Average	80	60	80
Nitrogen Dioxide	1-hour	320	190	ND
	24-hour	ND	ND	150
	Annual Average	100	100	100
Sulfur Dioxide	24-hour	365	100	150
	Annual Average	80	40	80
Carbon Monoxide	1-hour	40,000	40,000	ND
	8-hour	10,000	10,000	ND
Ozone	1-hour	160	160	ND

Source:
[1] CONAMA Resolution 003/90, Primary standards are concentrations, which, if exceeded, could impact human health.
[2] CONAMA Resolution 003/90, Secondary standards are concentrations, which, if not exceeded, caused the minimum adverse impact on human health, flora and flora, materials, and the general environment.
[3] World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants, July 1998
ND: Not defined

TABLE 3-2

Brazilian Surface Water and Industrial Effluent Quality and World Bank Guidelines for New Thermal Power Plants

Parameters	Termonorte II Effluent Quality (From PBA)	CONAMA 20/86 Standards (Article 5 - Class II Rivers)	CONAMA 20/86 Standards (Article 21 - Effluent Quality)	World Bank Group Guidelines for New Thermal Power Plants [1]
Oil and Grease		Virtually Absent	Up to 20 mg/L	10 mg/L
PH	9	6-9	5.0 and 9.0	6.0 and 9.0
Total Suspended Solids	50 mg/L	NA	NA	50 mg/L
Total Dissolved Solids	1,500 mg/L	500 mg/L	NA	NA
Total Residual Chlorine [2]	0.2 mg/L	0.01 mg/L	0.01 mg/L	0.2 mg/L
Chromium		0.5 mg/L	0.5 mg/L	0.5 mg/L
Copper	0.5 mg/L	0.02 mg/L	1.0 mg/L	0.5 mg/L
Iron	5 mg/L	0.3 mg/L	15.0 mg/L	1.0 mg/L
Zinc	1.0 mg/L	0.18 mg/L	5.0 mg/L	1.0 mg/L
Temperature Increase [3]	Less than or equal to 3°C	Less than or equal to 3°C	Less than or equal to 3°C	Less than or equal to 3°C
Aluminum	1.8 mg/L	0.1 mg/L	0.1 mg/L	NA
Ammonia	5 mg/L	0.02 mg/L	5.0 mg/L	NA
Barium	0.07 mg/L	1.0 mg/L	5.0 mg/L	NA
Boron	5.0	0.75 mg/L	5.0 mg/L	NA
Cadmium	0.1 mg/L	0.001 mg/L	0.2 mg/L	NA
Lead	0.3 mg/L	0.03 mg/L	0.5 mg/L	NA
Tin	4.0 mg/L	2.0 mg/L	4.0 mg/L	NA
Soluble Manganese	1.0 mg/L	0.1 mg/L	1.0 mg/L	NA
Nickel	0.5 mg/L	0.025 mg/L	2.0 mg/L	NA
Silver	0.1 mg/L	0.01 mg/L	0.1 mg/L	NA
Total Dissolved Solids	1,500 mg/L		NA	NA
Total Phosphate	10	0.025 mg/L	NA	NA

[1] From Pollution Prevention and Abatement Handbook, World Bank Group, July, 1998.

[2] Chlorine shocking may be preferable in certain circumstances. This involves using high chlorine levels for a few seconds rather than a continuous low-level release. The maximum value is 2 mg/L for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/L. (The same limits would apply to bromine and fluorine.)

[3] The effluent should result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution takes place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.

TABLE 3-3
Land Uses and Noise Levels - Brazilian Standards and World Bank Standards

Land Use	Brazilian Noise Level dB(A) (day time) [1]	Brazilian Noise Level dB(A) (night time) [1]	World Bank Noise Level dB(A) (day time) [2]	World Bank Noise Level dB(A) (night time) [2]
Rural areas (farms)	40	35	NA	NA
Area strictly urban residential or hospital or schools	50	45	55	45
Mixed zone, predominantly residential	55	50	55	45
Mixed zone, commercial and business	60	55	70	70
Mixed zone, predominantly recreational	65	55	NA	NA
Area predominantly industrial	70	60	70	70

Source: 1) Brazilian Norm NBR10151

2) World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants, July 1998

TABLE 5-1
Comparison of Maximum (NO_x) Impacts for Phase I and Phase II with Brazilian and World Bank Ambient Air Quality Standards and Guidelines

Pollutant	Averaging Time	Maximum Modeled Results		Brazilian Primary Standard[1]	Brazilian Secondary Standard[2]	World Bank Guidelines[3]
		Phase II	Phase I and II			
		($\mu g/m^3$)				
Nitrogen Dioxide	1-hour	63	310	320	190	ND
	24-hour	9	64	ND	ND	150
	Annual Average	4	31	100	100	100

Sources:

[1]CONAMA Resolution 003/90. Primary standards are concentrations, which, if exceeded, could impact human health.

[2]CONAMA Resolution 003/90. Secondary standards are concentrations, which if not exceeded, cause the minimum adverse impact on human health, flora and flora, materials, and the general environment.

[3]World Bank Pollution Prevention and Abatement Handbook, *Thermal Power: Guidelines for New Plants*, July 1998.

ND – not defined

TABLE 5-2
ISCST – Worst-Case Maximum Concentrations for SO_2, CO, PM at Ground Level

Pollutant	Concentrations in µg/m^3 and Respective Operating Scenarios		AQS (Brazilian Primary Limits – CONAMA Res. 03/90) in µg/m^3)
SO_2	60.6 – 24 hours 19.7 – annual (2 years)	Emissions for TN 1 engines and TN 2 turbines in CC, LFO, 100% Load	365 – 24 hours 80 – annual
CO	70.8 – 1 hour 30.7 – 8 hours	Emissions for TN 1 and TN 2 turbines in CC, NG TN 1 full load, TN 2 70%, no water injection	40,000 – 1 hour 10,000 – 8 hours
PM	3.8 – 24 hours 1.3 – annual (2 years)	Emissions for TN 1 and TN 2 turbines in CC, LFO, full load	240 – 24 hours 80 – annual
World Bank Guidelines [1]	150 – 24 hours 80 – annual	NR NR	230 – 24 hours 80 – annual average

[1]World Bank Pollution Prevention and Abatement Handbook, *Thermal Power: Guidelines for New Plants*, July 1998.
NR – not regulated

TABLE 5-3
Decommissioned Units – Rondônia

#	Type	MW	Owned by	Service Area	Status
28	Caterpillar engines	40.0	Eletronorte	Porto Velho	Decommissioned
3	GMT (Fiat) engines	7.5	Eletronorte	Porto Velho	Decommissioned
1	GE LM2500 turbine	35.3	Eletronorte	Porto Velho	cold-reserve (Rio Madeira)
3	GE LM6000 turbine	54.0	Eletronorte	Porto Velho	cold-reserve (Rio Madeira)
	Diesel Engines	10.0	CERON	Guajará-Mirim	production replaced (possible cold reserve)

TABLE 5-4
Decommissioned Units – Rondônia-Acre Transmission Connection

#	Type	MW	Owned by	Service Area	Status
15	Diesel Engines	12.6	Eletronorte	Rio Branco I	production may be replaced (possible cold reserve)
15	Diesel Engines	22.1	Eletronorte	Rio Branco II	production may be replaced (possible cold reserve)
21	Caterpillar engines	40.0	Eletronorte	Barro Vermelho	production may be replaced (possible cold reserve)

TABLE 6-1
Status of Environmental and Social Compensation Program

Termo Norte II
Environmental Compensation Programs
Status as of November 30, 2002

	Institution	Total Cost R$	Total Spent R$	% Completion	% Remaining
Cancer Hospital	ARECCON	250,000.00	250,000.00	100.00%	0.00%
Community Water Program	Rio Terra	45,956.30	45,956.30	100.00%	0.00%
Promotion of sustainable forest exploration	OSR	19,090.00	19,090.00	100.00%	0.00%
SOS Youth	Funpro	322,499.70	322,499.70	100.00%	0.00%
Lot	Celdase	94,998.00	94,998.00	100.00%	0.00%
Support to the Small Business Program	Acrecid	70,704.00	68,204.00	96.46%	3.54%
Marcelinas Sisters	Casa de Saúde Irmãs Marcelinas	250,000.00	112,373.51	44.95%	55.05%
Support to PEMA	SEDAM	60,000.00	51,583.60	85.97%	14.03%
NUCOF/SEDAM	SEDAM	190,000.00	190,000.00	100.00%	0.00%
Support to PANMP	SEMA	317,845.00	83,698.87	26.33%	73.67%
Restoration of Cilliary Vegetation at the Samuel Hydroelectric Power Plant	EMATER	120,000.00	36,855.89	30.71%	69.29%
Environmnental Education Program at Conservation Areas (Mujica Nava, Três Irmãos, Parque Guajará Mirim e Serra dos Reis)	SEDAM	120,000.00	33,818.79	28.18%	71.82%
Pacaas Novos Sustainable Exploration Area	SEDAM	67,500.00	67,284.94	99.68%	0.32%
Cautário Sustainable Exploration Area	ECOPORÉ - Ação Ecológica Guaporé	16,815.00	15,920.38	94.68%	5.32%
Serra dos Reis State Park	STPC	134,000.00	53,635.94	40.03%	59.97%

TABLE 6 -1

Status of Environmental and Social Compensation Program

Termo Norte II **Environmental Compensation Programs** **Status as of November 30, 2002**					
	Engenharia de Projetos Ltda				
Aquariquara Sustainable Exploration Area	SEDAM	60,350.00	53,999.10	89.48%	10.52%
Rio Machado/Rio Preto/Jacundá Sustainable Exploration Área	SEDAM	72,410.00	60,610.00	83.70%	16.30%
Rio Jaci Paraná Sustainable Exploration Área	SEDAM	81,352.00	81,162.00	99.77%	0.23%
Guajará Mirim State Park	SEDAM	101,604.00	100,828.94	99.24%	0.76%
Três Irmãos Ecological Conservation Area	SEDAM	120,000.00	120,000.00	100.00%	0.00%
Samuel Ecological Station	SEDAM	61,500.00	61,500.00	100.00%	0.00%
Sustainable Management of the Cautário River Resex	SEDAM	72,155.00	4,516.00	6.26%	93.74%
State of Rondônia Latex Workers Organization	OSR	75,987.00	40,542.00	53.35%	46.65%
TOTAL GERAL		**2,724,766.00**	**1,969,077.96**	**72.27%**	**27.73%**

Table 6.2

Annotated Outline of the Spill Prevention and Counter Control Plan used by one of the fuel transport companies

1.0. INTRODUÇÃO
2.0. TERMINOLOGIA
    2.1. Emergência
    2.2. Tipos de Emergência
    2.3. Área de Abrangência
3.0. PROCEDIMENTOS E ATRIBUIÇÕES
    3.1. Responsabilidades e Atribuições dos Envolvidos no PET
        3.1.1. Transportador
        3.1.2. Coordenador do PET/BR
        3.1.3. Assessoria Técnica
        3.1.4. Apoio Local
    3.2. Comunicação Interna e Externa
        3.2.1. Comunicação Interna
        3.2.2. Comunicação Externa
    3.3. COORDENAÇÃO DE EMERGÊNCIA
    3.4. Fluxograma de Comunicação
    3.5. Procedimentos e Atribuições por Cenário Acidental
CENÁRIO I – Vazamento de carro tanque em operação de carga ou descarga
CENÁRIO II – Incêndio no tanque e/ou cavalo mecânico
CENÁRIO III – Acidente durante o trajeto
4.0. GERENCIAMENTO DO PLANO DE EMERGÊNCIA
    4.1. Distribuição
    4.2. Treinamento
    4.3. Exercícios Simulados
    4.4. Avaliação dos Exercícios Simulados
    4.5. Segurança nos Exercícios Simulados
ANEXO I – Lista de Acionamento
ANEXO II – Cronograma de Execução
ANEXO III - Organização para Controle de Emergência (PVH)
ANEXO IV - Organização para Controle de Emergência (MT)
ANEXO V - Organização para Controle de Emergência (AC)
ANEXO VI – Relatório de Acidente