ENVIRONMENTAL AND SOCIAL IMPACT BRIEF[1]

Project:	*Termo Norte* Thermoelectric Power Project
Project Number:	BR-0395
Country:	Brazil
Sponsors:	El Paso Energy International *("El Paso Energy")* CS Participações Ltda. *("CS")*
Project Total Costs:	Approximately US$243 million
Department:	Private Sector Department (PRI)
Project Team:	John Cahillane, Leandro Alves, Robert Montgomery, Ernesto Monter
Date:	July 8, 2002

I. INTRODUCTION

1.1 The Project entails the construction and operation of the Termo Norte Thermoelectric Power Project (the "Project"). The Project will have a generating capacity of 340 MW and is referred to as the Phase II of the existing 64 MW Termo Norte Power Plant (Phase I), which has been in operation since September 2000. The Project is located adjacent to the Phase I site in the municipality of Porto Velho, state of Rondônia, Brazil.

1.2 The Project will provide power to the isolated system serving the Northern states of Acre and Rondônia. The electricity produced will be sold under a 20 year Power Purchase Agreement ("PPA") to the state owned electricity utility *Centrais Elétricas do Norte do Brasil S.A*, ("Eletronorte"). Eletronorte in turn will sell the energy to the respective state distribution companies, namely: *Centrais Elétricas de Rondônia S.A.* ("Ceron"), and *Companhia de Eletricidade do Acre S.A.* ("Eletroacre").

1.3 *Termo Norte Energia Ltda*. ("Termo Norte" or "the Project Company") is a company that belongs to the consortium made up of *El Paso Energy Corporation* ("*El Paso Energy*") and the *CS Participações Ltda* Group. El Paso Energy has developed energy infrastructure projects in Argentina, Australia, Chile, China, Czech Republic, Hungary, Indonesia, Mexico, Pakistan, Peru and the United States, equivalent to a total generating capacity of more than 7,000 MW. In Brazil, El Paso Energy has an extensive portfolio of projects in operation, under construction, or the later stages of development, including the 400 MW plant in Manaus and the gas-fired 480 MW generating plant under construction in Araucária, in the state of Paraná. The CS Group is a privately owned company with experience in the distribution of natural gas, as a result of experience acquired over the last few years when it had interests, through GASPART, in seven natural gas companies.

[1] "This Environmental and Social Impact Brief (ESIB) is being made available to the public in accordance with the Bank's policy on information disclosure. The ESIB has been prepared based primarily upon information provided by the project sponsors and does not represent either the Bank's approval of the project or verification of the ESIB's completeness or accuracy. The Bank, as part of its due-diligence on the feasibility of the project, will assess the environmental and social aspects. This assessment will be presented in the project Environmental and Social Impact Report, prepared by the Bank, and will be made available to the public prior to consideration of the project by the Bank's Board of Executive Directors."

1.4 The Project cost is estimated at US$ 230 million. The Sponsors' financial plan envisages equity of US$ 46 million, an IDB Loan of US$128 million, consisting of an A Loan of US$56 million and a B Loan of US$72 million, and a loan from BNDES of US$ 56 million.

II. PROJECT DESCRIPTION

A. Site Location

2.1 Phase II of the *Termo Norte Thermoelectric Power Project* will be located in the municipality of Porto Velho at Km 7.5 on the BR-364 highway (direction of Cuiabá) in the state of Rondônia, Brazil (See Figure 1). Phase II is being constructed on a site with an area of 300,677 m^2 located in a rural area. The Project area is adjacent to the existing Phase I *Termo Norte* 64 MW capacity power plant and is bounded by the *Porto Parque Club* to the northeast, by the Eletronorte Substation to the south and by Highway BR-364 to the southeast.

B. Project Components and Facilities

2.2 The 64 MW Phase I Plant, which is not part of the Project, was constructed under an EPC Contract with Wartsila and commenced operations in September 2000. Phase I and Phase II will share some facilities, including water and fuel treatment systems and a transmission line connecting the site to Eletronorte's transmission system.

2.3 The Project is being constructed in three stages (modular construction) in accordance with the concept of progressive generation. Upon completion of the third stage, Phase II will operate in combined cycle mode at a rated generating capacity of 345 MW. Considering internal consumption for the operation of auxiliary items of equipment, foreseen as being 5 MWh, the three-stage project will supply the Rondônia system with 340 MWh. The final configuration of the generating plant will include a combustion turbo-generator, three heat-recovery boilers and the fourth group turbo-generator, the latter constituting a condensation turbine, which will allow the plant to generate 345 MW at a combined cycle mode using natural gas as fuel. Diesel will be used as the principal fuel until the end of 2004 when the completion of the 540-km *Urucu* Pipeline Project will enter into operation and thus natural gas will be available at the area.

2.4 Phase II is being implemented in three stages, namely:

- 1st stage (operating since September 2001): consists of one diesel oil turbine and associated generator operating in basic cycle mode generating 77,980 kW.
- 2nd stage (operating since June 2002): consists of two diesel oil turbines and associated generators operating in ordinary cycle mode generating 155,960 kW.
- 3rd stage (will start operations in July 2003): consists of three diesel oil/ gas turbines, operating in combined cycle mode, with one steam turbine.

2.5 The construction of the combined-cycle thermoelectric generating plant basically consists of the following activities: civil engineering work, laying of foundations, buildings and surfacing; mechanical construction work, installation and assembly of items of equipment, pipe welding and tests on equipment that will operate under pressure; electrical systems construction work, installation of transformers, safety switches, installation of cables and assembly of operational instrumentation and the interconnection

of all systems. The layout of the plant was designed to facilitate its construction in three distinct stages, considering an installation sequence that first involves combustion turbo-generation equipment, followed by heat recovery boilers and then the group steam turbo-generator.

2.6 *Technology*.- The combined operation cycle involves the combustion turbines, the heat-recovery boilers and the condensation turbine. The General Electric PG7121 (EA) turbine, designed for a heavy-duty operational cycle, includes a "Dual Fuel" combustor, designed for the burning of natural gas or light fuel oil, employing a combustion technology that produces low NO_x emissions with the injection of water or steam. The compressor that equips the combustion turbine is of the axial-flow kind and is designed with a noise suppressor (silencer) at the point of air intake, in order to reduce noise levels.

2.7 *Auxiliary Systems*.- Auxiliary systems including a water cooling system, diesel oil and natural gas systems, water treatment system, liquid effluent treatment system, boiler chemical products dosage system, fire protection system, ventilation and air conditioning system, compressed air system and others complement the main equipment installed at the generating plant. Water and fuel treatment and a transmission line connecting the site to Eletronorte's transmission system are shared facilities.

2.8 *Fuel*.- Initially the Project will use diesel as the principal fuel. Diesel oil will be stored in two tanks with a total holding capacity of 7,300 m^3, this being equivalent to four days consumption by the plant. Both Phase I and Phase II will operate on natural gas upon completion of the 540-km *Urucu* Pipeline Project expected to enter into operation at the end of 2004. A pressure regulation and measurement center will be installed at the site, together with piping carrying a supply of natural gas to the combustion turbines, emergency valves, a filter system and a fuel pre-heating system.

2.9 *Water requirements*.- During the first phase, water will be extracted from underground wells. With respect to the second and third operational phases of the plant, these wells will be complemented by an aqueduct that will take water from the river *Candeias* at an expected rate of 0.1231 m^3/sec at a point located at a distance of 11 km from the generating plant. The proposed aqueduct route will follow the transmission line corridor that extends from the Samuel Hydroelecttric Plant to the Porto Velho Substation.

2.10 The water necessary for heat exchange in the condenser and for supplying all the other cooling systems will be supplied using a closed system, which utilizes a seven-cell cooling tower. The cooling water system basically consists of a cooling tower, pumps for circulating water and a system for the dosage of chemical products used in treating the water. The cooling tower is of the kind that uses an air flow induced by ventilator fans. The air going into the base of the tower runs against the direction of flow of the water and, after exchanging heat with the water is discharged into the atmosphere at high speed.

2.11 *Water treatment*.- Three separate water treatment systems will operate at the plant providing: (i) water for basic services, (ii) drinking water, and (iii) demineralized water. The demineralization process will be made up of three stages: ion removal, polishing and regeneration. The untreated water passes through pressure filters for the removal of solid particles in suspension. In the mixed beds, the cation and anion tracer units work alternately, removing these two kinds of ions, producing pure water, without mineral content, suitable for plant processes.

2.12 The liquid effluent generated by the heat recovery unit may be classified into two categories: chemical effluent and wastewater contaminated with oil. The chemical blowdown from the heat recovery boiler is sent to a drain, by means of a collection tank and, from this point, to the cooling tower. Effluents produced sporadically (e.g. effluent resulting from washing resins in the water demineralization system) will be collected in the non-continuous wastewater lagoon via a pipeline. The effluent collected in the non-continuous wastewater lagoon will be gradually drained off to the neutralization lagoon after undergoing treatment in order to obtain a pH of between 6.0 and 9.0. Oily wastewater, produced at various points within the unit (e.g. the oil pump, transformer, turbine generator and air compressor) will be treated in an oily wastewater lagoon, from and then by an API oil separator. The effluent from the API separator will be transferred to the neutralization lagoon by the force of gravity. Sanitary wastewater will be treated through the use of septic tanks and anaerobic filters, constructed in accordance with the technical standards established by the "*Associação Brasileira de Normas Técnicas - ABNT* " (Brazilian Technical Standards Association). After treatment, this wastewater will be discharged into the "*igarapé* " Velho, which traverses the property.

C. Project Workforce

2.13 The different stages in the construction of the generating plant will require the employment of approximately 700 workers at the peak of construction, principally destined for carrying out civil engineering activities. Considering the size and proximity of the city of Porto Velho, it is foreseen that most of this workforce will be hired locally. Thirty to forty permanent jobs will be created for the operation of the plant.

D. Project Schedule and Costs

2.14 Stage 1 and Stage 2 are operating since November 2001 and June 2002 respectively. Construction of Stage 3 is underway and will conclude by July 2003, representing the completion of Phase II.

2.15 The Project cost is estimated at US$ 230 million.

E. Project Alternative Analysis

2.16 A staged Project (progressive generation in a modular construction) was selected based on the immediate needs for electricity in the region. Modular generation offers the advantages of adding generating capacity to the system in batches as required by demand. The turbines have the capability of using both diesel and natural gas as fuel. Diesel will be used as the principal fuel until the end of 2004 when the completion of the 540-km *Urucu* Pipeline Project will enter into operation and thus natural gas will be available at the area. Upon completion of Phase II, the Project will operate in a combined cycle mode, which increases generation efficiency when compared to simple combustion cycle.

2.17 A site selection study was conducted using the following criteria: proximity to an electrical network, water availability, compatible municipal zoning, geological, hydrogeological and geomorphological characteristics, and air pollution dispersion capacity. The study was conducted based on field work, consultation with different agencies and the review of secondary sources of data. In addition, the selected site for the construction of the Termo Norte Thermoelectric Generating Plant took into consideration the areas assessed in a study of alternatives carried out in 1994 by

Eletronorte S.A, SEDAM and Petrobrás S.A. technical personnel - "*Aproveitamento do Gás Natural da Bacia do Solimões – UTE Caiari – Estudos Locacionais*" (Use of Solimões Basin Natural Gas - Caiari Thermoelectric Generating Plant - Site Location Study).

2.18 Four alternatives were evaluated, the site adjacent to Phase I being the most suitable area based on its location near a existing substation and a transmission line, land use, proximity to a river and it location outside the urban area.

III. INSTITUTIONAL FRAMEWORK

A. Institutional

3.1 The National Electric Energy Agency ("ANEEL") is the independent regulatory body for the electricity sector. Its primary role is to regulate and supervise the production, transmission and distribution of electricity in accordance with the policies and directives of the Government of Brazil ("GOB"). The isolated regions are loosely regulated by ANEEL but are essentially controlled and operated by Eletronorte. The National Oil Agency ("ANP") is responsible for the implementation of the federal oil and gas policy contained in the Federal Law no. 9,478/1997, regulation and enforcement of oil and gas activities.

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

3.3 Within the state of Rondônia, the State Environmental Policy Council ("*Conselho Estadual de Política Ambiental*" –"*CONSEPA*") is the state council for environmental protection responsible for policy making. The State Environmental Development Secretariat ("*Secretaria Estadual de Desenvolvimento Ambiental*" –"*SEDAM*") is the state environmental agency, responsible for coordinating and executing the environmental policy dictated by CONSEPA.

3.4 SEDAM is the executive technical agency which coordinates the actions of the taken by the "*Fundo Especial de Proteção Ambiental*" – "*FEPRAM*" (Special Environmental Protection Fund), the "*Fundo Especial de Desenvolvimento Ambiental*" – "*FEDARO*" (Special Environmental Development Fund) and the "*Fundo Especial de Reposição Florestal*" – "*FEREF* " (Special Forest Replanting Fund) within the State Environmental Development System of Rondônia ("*Sistema Estadual de Desenvolvimento Ambiental de Rondônia*" –" *SEDAR* ").

3.5 At the Municipal level, the Rondônia Municipal Authority is responsible for land use planning and for municipal policies and legislation. Municipal legislation and regulations cannot be less stringent than federal and state standards.

3.6 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 (DRTs). Stiff penalties, including construction embargo, may apply for non-compliance. State and municipal authorities have no jurisdiction over labor matters.

B. Legal

3.7 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. The new market model opened generation and trading businesses to competition, while transmission and distribution continued as regulated activities.

3.8 The relevant legislation that regulate the provision of electricity are articles 175 and 121 of the Federal Constitution which regulates the public provision of electricity; Federal Law 8.987/95, which establishes the regime of concession and permit for public services; 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 included amendments to all the above legislation, as part of the government's reform to introduce greater competition and transparency in the generation of electricity.

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

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

3.11 The legislation regarding environmental impact assessment was created by Federal Law 6.938/81 and by the Federal Decree 88.351/83. Its application became effective subsequent to the issue of the CONAMA 001/86 Resolution, which established the basic criteria for requesting Environmental Impact Assessment (EIA) studies as a prerequisite to obtaining licenses for projects with potential environmental impacts. The environmental permitting system requires that three licenses (permits) be obtained by all potentially polluting activities: Preliminary License ("*Licença Prévia*" *or* "*LP*"), Installation License ("*Licença de Instalação" or "LI*"), and Operating License ("*Licença de Operação*" *or "LO*"). For projects listed in CONAMA 001/86 (including power plants with nominal capacity above 10 MW), an Environmental Impact Assessment (EIA) is required. The CONAMA Resolution 001/86 defines the basic content of the EIA and establishes the public participation requirements. CONAMA Resolution 09/87 regulates the public hearing process associated with the EIA process. The LP is granted based upon governmental approval of the project EIA and the RIMA ("*Relatório de Impacto Ambiental*", which is a summary of the EIA). The LI is granted based upon governmental approval of a project-specific Environmental and Social Management Plan ESMP ("*Projeto Básico Ambiental*" or "*PBA*") and represents the governmental authorization to start the 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.

3.12 State Law nº 547, dated 30/12/93, regulated by Decree nº 7.903/97, establishes that environmental licensing is to be analyzed by SEDAM. SEDAM is responsible for analyzing the Environmental Impact Assessment (EIA) and its respective Environmental Impact Report (which preparation and processing should also be in accordance with State Law nº 890/00) and eventually granting the environmental license(s).

3.13 The Brazilian environmental legislation includes a large variety of laws, decrees and directives of different types issued by the federal, state and municipal agencies. Resolution 003/90 provides a general framework to the states and municipal governments, which in turn can establish more stringent air quality standards. Article 40 of State Decree n° 7903/97 deals with issues related to air pollution, establishing requirements regarding use, pollution prevention and control of air quality in the state of Rondônia. The state is thereby divided into six areas - "*Regiões de Controle de Qualidade do Ar" – "RCQA "* (Air Quality Control Regions), it being the case that RCQA 1 corresponds to the area that includes Porto Velho, Guajará-Mirim, Nova Mamoré, *Candeias* do Jamari and Jamari. The applicable air quality standards for the Project are those established by CONAMA Resolution 003/90 (See Table 1). Other federal legislation that may relate to the Project includes noise, including maximum limits for noise in industrial, commercial or leisure areas (see Table 2); water management, including water quality standards, and standards for wastewater and effluent discharges; waste management; fauna and flora and forest management; and exploitation of mineral resources, including extraction of stones, clay, gravel and sand and other materials for construction works.

3.14 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 innumerous sections and provisions to guarantee this objective, including the use of individual safety equipment (EPI). Subsequently, the Ministry of Labor issued Administrative Rule no. 3,214/1978 with detailed provisions in these matters, known as NRs ("*Normas Regulamentadoras*"). Programs for medical

control of occupational health (Administrative Rule no. 8/1996) should take the NR provisions under consideration.

3.15 The main legislation regarding health and safety are: (a) Workers Code ("*Consolidação das Leis do Trabalho*"–"*CLT*") and its regulations ("*Normas Regulamentadoras*" - "*NRs*"); and (b) International Conventions of the International Labor Organization – ILO. NR 05 and article 163 of the *CLT* define that every company must create and operate an Internal Accident Prevention Commission ("*Comissão Interna de Prevenção de Acidentes*" – "*CIPA*"). NR 07 and 09, respectively, define requirements for the Workers Health and Medical Program ("*Programa de Controle Médico e Saúde Ocupacional*"- "*PCMSO*") and the Environmental Risks Prevention Program ("*Programa de Prevenção de Riscos Ambientais*" – "*PPRA*").

3.16 Industrial growth and development in the municipality of Porto Velho is regulated through the "*Lei Orgânica*" (Organic Law), promulgated on 26/06/90, with specific observance of the Municipal Law nº 1224, dated 20/10/95 and the land use complementary Law nº 97 ("*Lei de Parcelamento, Uso e Ocupação do Solo*"), dated 29/12/99.

C. Project Compliance

3.17 An Environmental Impact Assessment (EIA) for the Phase II was prepared in September 2000. The Project EIA was approved by SEDAM, Rondônia environmental agency and an installation license (LI) was granted in April 2001 for the three stages of the Project. Operational licenses have been granted following the modular construction of the project. As such, the LO for the 1st stage was granted in September 2001, followed by the LO for the 2nd stage in June 2002.

3.18 Public disclosure of the EIA was done on in the beginning of 2001. In January 2001, SEDAM delivered copies of the EIA to IBAMA (the national environmental agency) and to the municipality of Rondônia.

3.19 The land use permit ("*Certidão de Uso do Solo*") was issued by Porto Velho city hall. The land use permit authorizes the location of the Project adjacent to Phase I of the Termo Norte Thermoelectric Generating Plant (64 MW) and the PV-1 Substation.

IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 The environmental and social conditions associated with the construction and operation of Phase II of the Termo Norte Generating Plant are described in accordance with two differentiated areas. An Area Directly Affected (ADA) by the undertaking, corresponding to the area of land that is to be effectively occupied by the Project (i.e. construction of the plant), and an Area of Direct Influence (ADI), which is the area affected by air emissions, noise emissions and the discharge of liquid effluents, corresponding approximately to a 2 km radius around the plant and a greater area affected indirectly by the transport of fuel and an unlikely occurrence of a major spill.

A. Environmental

4.2 *Meteorology and Climate.*- Climate at the project area is highly influenced by its latitude close to the equator, the affect of the Amazon forest and that of the Andes mountain range. The region is subject to a rainy tropical climate, with an average temperature, during the coldest month of the year, of more than 18°C, and more than 25° C in the warmest month of the year. Seasonal variation in the climate is represented by a well-defined dry period, from October and throughout the winter, and a rainy period during the months of spring and summer. During the dry season, there is an average total rainfall of 38.8 mm in June in the city of Porto Velho. The predominant wind direction is from the south (S), the second most predominant direction is from the southeast (SE) and, in third place, are winds from the northwest (NW). The average velocity of these winds ranges between 2.5 m/sec. and 3.1 m/sec.

4.3 *Geology* - The region of Porto Velho consists of Tertiary-Quaternary alluvial sediments, overlying bedrock Middle and Lower Proterozoic in age that forms part of one of the oldest geotectonic plates on the planet, known as the Guaporé Craton. This craton, together with that of the Guianas, constituted the continental shields that shaped the Amazon depression. The region is stable, immune to the effects of seismic movements or volcanic eruptions. The soil in the area is classified as dystrophic red-yellow latosol (LLD16 0-2%), that has been subjected to weathering processes, made up of minerals derived from clay, kaolinite, gypsite, amorphous minerals and oxides of iron and aluminum. The soil in question has good drainage characteristics, favoring the development of root systems, as well as a high degree of resistance to erosion. At the proposed aqueduct route, 4 km from the Project site, sand covering a stretch of approximately 600 meters is exploited for construction purposes.

4.4 A quaternary alluvial forms a rampart along the banks of the rivers Madeira, Jamari and Candeia, appearing in the form of beaches within the area of direct influence of the river Madeira. These sediments exhibit a simple geological profile, consisting of basal clays, sands and gravel, occasionally mineralized gold, and some peat. This unit is particularly important from a hydrogeological point of view, as aquifers form in pockets of sandy conglomerations, providing the entire groundwater supply of the city of Porto Velho and adjacent areas. During the drier months of the year, from June to October, extensive beaches appear that are principally made up of fine sand and silt, very representative of the hydrological dynamic that is active in these river basins.

4.5 *Hidrogeology*.- The sedimentary land present in the basins of the rivers Madeira and *Candeias* have the best groundwater reserves in the area covered by the Porto Velho Sheet. Due to the structural characteristics of these basins, the Holocene sediments are associated with rivers that meander to a varying degree (the most outstanding being the rivers *Candeias* and Garças), and of composite configuration (the case of the river Madeira, which dominates the drainage network of the region). Showing the same deposition characteristics and without significant changes in their lithological features, it is possible to say that these alluvial sediments function as large-scale hydrogeological units, without very great differences in conditions regarding the occurrence, accumulation, movement and quality of their groundwater. In general, specific groundwater flow rates are considered to be satisfactory, varying from 0.70 to a little more than 20 m³/hr/m. In the case of the total predominance of silty-clayey facies, specific non-evident flow rates are of around 5 m³/hr/m, it being common under these conditions for many wells to be considered dry. At Km 17 on the BR-364 highway, the flow rate from a well lined with four-inch diameter tubing and reaching a depth of 66 m, attains 10 m³/hr where the specific flow rate nearby is that of 1.25 m³/hr/m. With regard

to the site where it is foreseen that Phase II of the Termo Norte Thermoelectric Generating Plant will be built, located at Km 7.5 of the BR-364 highway, the flow rate is 3 m³/hr and the specific flow rate is that of 1.2 m³/hr/m.

4.6 *Hydrology*.- The Area of Indirect Influence of the undertaking corresponds to the sub-basin of the lower river *Candeias*, that has an approximate area of 7,961 km^2. The river *Candeias* is one of the main tributaries flowing into the left bank of the river Jamari, which in turn, flows into the river Madeira. The hydrological pattern which governs conditions in the sub-basin of the river *Candeias* is basically determined by a period of high water levels, associated with the rainy season (from December to April), and another of low water levels that corresponds to the dry season (from May to September). The waters of the river *Candeias* are greenish in color, with a pH of around 6.6, a relatively high level of solids in suspension and a low degree of turbidity. Its average flow rate during the dry months of the year is that of 45 m^3/sec., whereas this may increase to 800 m^3/sec. during the rainy season. Small "*igarapés*" complement the river system in the vicinity of the undertaking, with such names as Periquitos, Tênis Clube, Bate-Estaca and Grande. The site of the undertaking is strategically positioned at a point which separates the waters of the "*igarapé*" Periquitos to the north and the "*igarapé*" Tênis Clube to the south. The "*igarapé*" Periquitos, with a length of approximately 9 km, constitutes second-order drainage and flows directly into the left bank of the river *Candeias*, at a point located around 8 km downstream from the municipality of *Candeias* do Jamari. The "*igarapé*" Tênis Clube, with a length of approximately 6 km, receiving the water generated by Phase I of the Termo Norte Thermoelectric Generating Plant (64 MW), by means of a fourth-order drainage channel named "*igarapé*" Velho, constitutes third-order drainage and its waters flow into the left bank of the river Garças, in the vicinity of the Porto Velho Industrial District. The river Garças, in turn, constitutes second-order drainage and flows into the left bank of the river *Candeias* at a point approximately 6 km upstream from the city of *Candeias* do Jamari.

4.7 *Geomorphology* Surface relief features are flat with small depressions caused by surface drainage, most notably the "*igarapé*" Velho, which rises near the site of the project g, dissecting the detritic-lateritic covering of the South Amazon Low Plateau, where tabular surface features are to be found that are gently undulating in nature. The bed of this drainage channel has carved out an open valley in the shape of a "V",which is not particularly deep, with differences in elevation varying from 5 to 10 meters. The elevated topography reduces the risk of flooding.

4.8 *Flora and Fauna* – The natural forest at the site has been significantly degraded, resulting in the scarce presence of wild animals and birds as a result of the intense anthropogenic activity that exists in the region surrounding the site. Only a few isolated pockets of degraded forest, brushwood and abandoned pasture that give rise to "*sapezais*" grassland remain in the region. The lack of substantial natural vegetation acts has affected nesting sites, shelter and plant food for bird species. Consequently, there is low diversity and density of bird species at the site. It should be emphasized that the Project site is located adjacent to the BR-364 highway near leisure areas, as well as the Eletronorte Transmission Line PV-1 Substation, all factors that have a disturbing effect on the local fauna. No species were identified that were either endemic or under threat of extinction.

4.9 *Aquatic Ecosystem* The aquatic environment near the Project exceeds the limits of limnological standards with regard to the biological productivity of naturally occurring waters, being thus characterized as having "Meso-Saprobic" features. From the

qualitative and quantitative point of view, both the macro and micro biota are below normal productivity standards. The riverbed and riverbanks near the proposed intake structure have been degraded as a result of the untreated discharge of sewage and other types of effluent from the town of *Candeias* do Jamari and dredging activities in the riverbed for the exploitation of sand for construction activities.

4.10 In stretches of the middle and lower *Candeias*, unfavorable conditions with regard to water quality, principally due to high levels of particulate materials in suspension, have had an effect on the migratory movements of shoals that use this part of the river which, in turn, has had a negative influence on fishing activities in the region. The diversity of species in the Area Directly Affected by the project has been significantly reduced due to the low flow rate of the "igarapé" which exists at the site and the fact that the riverbank vegetation along the length of this watercourse has undergone some degree of alteration, thus inhibiting the proliferation of certain fish species.

B. Social-Economic

4.11 Considering the Western Amazon region as a whole, Porto Velho is positioned as a regional center located between Manaus (Amazonas), Rio Branco (Acre) and Cuiabá (Mato Grosso) having, respectively, as its principal means of access the Madeira Waterway and the BR-364 highway (RIBEIRO, 1998). Besides being the political-administrative center of the state, it also has the function of a sub-regional nucleus. Thus it is an urban center that concentrates the political and economic decisions of the State.

4.12 In 1991, Porto Velho retained approximately 43.6% of the urban population of the state and showed an annual growth rate of its population of 7.2% per annum. Highway BR-364 and the implementation of programs for maintaining agricultural workers in the field, together with gold prospecting along the Madeira River and mineral exploitation fostered a demographic explosion during the last three decades. With regard to the spatial distribution of population, the majority is located along the BR-364 corridor, where the main urban centers of the state are to be found. Average demographic density in the state is that of 5.16 inhabitants per square kilometer.

4.13 There are small rural properties near the Project site, leisure areas including the Bank Workers Club, the AABB Club and Porto Velho Tennis Club and abandoned gravel pit excavations that have been used for the disposal of domestic waste.

4.14 The northeastern sector of the Project area is identified as an area taken over by landless families, which occupy the land for rural purposes. This stretch of land is outside the Project boundary near the access to the BR-364 highway and under the Eletronorte transmission line running in the direction of access to the Cidade Jardim district/ northeastern sector of the Marcos Freire district.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

5.1 Phase II of the Termo Norte Power Plant Project is located adjacent to the Phase I site at an area which has been prepared for the Phase II expansion. As such, civil works involving earth moving, construction of access roads and site leveling was completed at the time of construction of Phase I, and thus the environmental and social impacts associated with these activities are expected to be minimal. As the Proposed Project is

located at an existing substation, no transmission lines will be constructed. The land occupation in the area surrounding the site is relatively low and the nearest receptors are located at a distance of around 500 meters. The principal impact of the Project is associated with the air emissions and resulting air quality while firing diesel. However, both air quality and emissions will comply with Brazilian standards and the World Bank guidelines for New Thermal Power Plants included in the Pollution Prevention and Abatement Handbook. Furthermore, upon the completion of the *Urucu* pipeline, both Phase I and Phase II will switch to the use of natural gas and air emissions will be reduced significantly.

A. Construction Phase

5.2 *Water Quality Associated with the Structure for Extracting Water from the River Candeias*.- The construction of the intake water structure and the opening up of trenches for the aqueduct will increase temporarily the concentration of suspended solids in the *Candeias* River. Piles of soil along the length of the excavations of the aqueduct have the potential to be carried away by heavy rain, thus contributing to the silting up of waterways. Oil and lubricants spills, as well as inadequate waste disposal may also affect the *Candeias* River. Impacts on the estuarine fauna could result from changes in water quality and sedimentation.

5.3 *Air Quality*. During the construction of the 3rd stage of Phase II, excavation works and the circulation of trucks and machines at the site will generate airborne dust with a predominant component of particulate material (essentially soil). In addition construction related traffic on the BR-364 highway will increase air emissions from vehicle motors.

5.4 *Noise Levels*.- Noise levels at the Project site will temporarily increase as a result of construction equipment and related machinery. Construction related activities will generate noise emissions of no more than 90 dB(A) measured at a distance of 7 meters from the source. Considering that the distance of the nearest receptor is 500 meters from the site, there will be no harmful effects on receptors located in the area surrounding the plant. Near the end of construction, noise levels will increase due to the performance tests associated with the commissioning of the plant. In addition, construction related noise will generate some inconvenience to the fauna.

5.5 *Flora and Fauna*.- As more than one-third of the site where Phase II is being constructed was cleared during construction of Phase I, no major impacts on flora and associated fauna are envisioned. The remaining vegetation (predominantly made up of grasses, mainly "*sapé*" and a few individual specimens of "*babaçu*") will be cleared.

5.6 *Health and Safety* The impacts on the occupational health and safety are typical of medium scale construction projects. No adverse health conditions or critical worker safety conditions are expected during the completion of the construction of the 3rd stage.

5.7 *Social impacts from the Project workforce*: The Project construction has not and will not lead to a large mobilization of people or an increased demand on the existing infrastructure. Completion of construction will involve a maximum of 720 workers during approximately a one-month period. No construction campsites are anticipated and Porto Velho should absorb temporary housing requirements for non-local workers. Social conflicts and increased infrastructure demands are not anticipated.

5.8 *Construction related traffic*.- It is foreseen that during completion of Phase II approximately 10 heavy vehicles will be circulating every hour on roads near the access of the Plant.

5.9 *Resettlement*: No relocation, indemnification or resettlement is anticipated.

B. Operation Phase

5.10 The principal negative impacts associated with the Project operation are related to air and noise emissions, water supply, wastewater disposal and traffic associated with fuel supply activities before the *Urucu* pipeline is completed.

5.11 *Ambient Air Quality*.- After undergoing a heat exchange process in the heat-recovery boiler, the combustion gases from each of the combustion turbines, will be expelled through three stacks, one serving each of the heat-recovery boilers, the heights of which have been determined using good engineering practices (GEP) with a view to facilitate the dispersion of air emissions.

5.12 Air quality modeling was conducted during the preparation of the EIA to estimate Project-related air quality impacts using the Industrial Source Complex (ISC) model. The ISC is a steady-state bi-Gaussian model and is the most commonly used model for assessing downwind concentration from power plants. The ISC has two forms differentiated by the averaging time to be used. The ISC short-term (ISCST) model considers hourly time periods up to 24 hours. The ISCST3 version was used, in order to determine ground-level concentrations of particulate material and sulfur dioxide (for a 24-hour period and annual averages), nitrogen dioxide (for a 1-hour period, 24-hour period and annual averages), and carbon monoxide (for a 1-hour period and 8-hour period). The stacks physical parameters (location, height, diameter and temperature of gases leaving stack), and the emissions rates for each pollutant, as well as the flow rate of gases leaving each stack were used according to each stage of implementation of the project. The simulations were carried out considering a period of two years. The grid defined for calculation of pollutant concentrations at ground level includes 225 receptors that are distributed in a cartesian system, within a square area with sides of 20,000 meters, in the center of which is the emissions source (i.e. stacks). Winds hourly information and atmospheric stability, among other parameters, were programmed into the model to predict pollution transport.

5.13 The air modeling scenarios considered the contribution of Phase I, which was in operation using diesel oil as fuel during the preparation of the EIA. The Termo Norte Thermoelectric Generating Plant is located in a region where there are no significant elevations in the surface relief, with only the existence of such physical barriers as low-rise buildings. Therefore, the least favorable conditions for the dispersion of pollutants were adopted for the purposes of making simulations, that is, the surface relief was assumed to be flat and without any barriers that may interfere to a significant extent, with the transport of pollutants. The modeling analysis includes the following scenarios:

- Scenario 1 - 1st stage: one diesel oil turbine, operating in ordinary cycle mode, with water injection. Air emissions will be via a by-pass stack;
- Scenario 2 - 2nd stage: two diesel oil turbines, operating in ordinary cycle mode, with water injection. Air emissions will be via two by-pass stacks;
- Scenario 3 - 3rd stage: three diesel oil turbines, operating in combined cycle mode, with one steam turbine. Air emissions will be via three main stacks; and

?? Scenario 4 - 3rd stage: three natural gas turbines, operating in combined cycle mode, with one steam turbine. Air emissions will be via three main stacks.

5.14 The results of the simulations identified that the principal potential environmental impact will be during the operation of the 3rd stage of Phase II, namely, the operation of three turbines using diesel oil as fuel (See Table 3). A maximum nitrogen dioxide (NO_2) ground-level concentration of 177.73 µg/m^3 over a period of 1-hour should occur 500 meters to the south of the emissions source. This concentration corresponds to 55% of the 320 µg/m^3 air quality standard established by CONAMA federal legislation. In regards to sulfur dioxide (SO_2), a maximum of 12.60 µg/m^3 24-hours average concentration will occur 4 km to the north and 1 km to the east from the stacks during the same 3rd stage of Phase II. The 12.60 µg/m^3 concentration is well below the 200 µg/m^3 CONAMA air quality standard and the 150 µg/m^3 on the limits set forth in the World Bank "Pollution Prevention and Abatement Handbook". The operation of three turbines using diesel will last less than a semester as the Project plant will fire natural gas upon availability (expected at the end of year 2003). The use of natural gas will reduce the 1-hr NO_2 concentrations to 157.18 µg/m^3 (at the same maximum expected point) while SO_2 emissions will be negligible.

5.15 *Noise*.- A combined-cycle generating plant includes several sources of noise emissions. The most important of these are those generated by the combustion turbines, compressors, generator and condenser and cooling towers. The generating units used in Phase I are alternative engines manufactured by Wartsila. This kind of equipment produces high noise levels, with a predominance of low frequencies in the range of 31.5 to 125 Hz. Due to its wavelength, this sound is widely propagated, reaching considerable distances. Background levels are reported in the order of 53 dB(A) inside the property boundaries. Phase II will use gas and steam group generators rather than engine-driven units. The gas and steam groups systems produce noise levels with components of a higher frequency (i.e. 125 Hz and above) and consequently, due to its narrower wavelength, the noise produced will be attenuated to a greater extent by the building and by aerial attenuation (higher frequency noise have a more marked fall in sound level).

5.16 A noise study was conducted to evaluate the noise contribution from Phase II. Based on the results obtained from the study, the Project will have a minimal contribution on the existing levels of noise (i.e. noise levels from Phase I) at the property boundary. The principal contribution of noise from the power plant (both Phase I and Phase II) will be the effects of the noise produced by the Phase I diesel units.

5.17 *Water discharge*.- The power plant will generate effluents from various sources, but mainly from the heat recovery unit as blowdown, effluent resulting from washing resins in the water demineralization system and wastewater contaminated with oil. Effluents will be channeled to a treatment system before being discharged at an estimated rate of 30 m^3/hr (approximately 8.3 l/sec) into the *Candeias* river. Sanitary wastewater will be treated through the use of septic tanks and anaerobic filters and discharged into the "*Igarapé*" Velho River, which traverses the property. All effluents that enter rivers will be in compliance with the discharge standards established by the legislation in force.

5.18 *Water extraction*.- The plant will operate with a closed water cooling system. Water losses will be replaced using water from the *Candeias* river at an expected rate of 0.1231 m^3/sec. Water extraction will not impact the availability of water in the *Candeias* river, which has an average flow rate of 45 m^3/sec during the dry season.

5.19 *Solid waste*.- Operation of the thermoelectric generating plant will result in the production of sanitary waste and to a lesser extent, Class II normal office solid waste, as well as the Class I waste (oil and oily sludge from effluent treatment systems and chemical product packaging). As such, the only solid waste materials classified as hazardous that will be produced by the generating plant will be the oil separated out in the effluent treatment system and materials contaminated with oil.

5.20 *Soil and water contamination,*- The operation of the power plant requires various systems as water pre-treatment, demineralization of water, neutralization of boiler blowdown, treatment of oily effluents, among others. The effluents and solid waste materials produced will be channeled to neutralization and equalization tanks. If they are not properly constructed, these tanks could leak and the chemical compounds associated with the various systems could contaminate the soil and underground water.

5.21 *Diesel oil transport related traffic.*- The circulation of trucks transporting diesel oil during the initial stages of operation of the plant will impact traffic circulation in the vicinity of the plant and at the highway. It is foreseen that 53 tank-trucks per day will arrive to the Plant during the operation of the third stage (three turbines firing diesel). High traffic conditions are expected to occur during the 18 months after Project completion (June 2003) and the operation of the Urucu natural gas pipeline expected by the end of year 2004.

5.22 *Health and Safety*.- 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, fire prevention, among others. Although the chance for an accident is minimal, risk assessment and contingency planning will be considered along the project development.

C. Positive Impacts

5.23 An important positive impact of the Project is that the Plant is being constructed with a dual firing capability, which will allow the Project to use natural gas upon completion of the *Urucu* pipeline. The use of natural gas will result in a reduction of particulate matter, sulfur dioxide and nitrogen oxides emissions which are currently generated by Phase I and two stages of Phase II that are burning diesel.

5.24 The Project is expected to provide an average of 350 jobs during the remaining of construction, reaching peaks of 720 jobs, for a period of approximately one month. The requirement of workforce will generate a source of income to several local families and will enhance the local economy (local commerce and other economic activities). In addition, the completion of the Project will create indirect jobs and demand for services and equipment that might be provided by local or regional suppliers, also generating increase in tax revenues.

5.25 Phase II of the Termo Norte Project will add 340 MW of energy into the isolated grid system at a time of scarcity, thus reducing or avoiding shortages and enabling economic growth in the State of Rondônia. The additional power is expected to have a multiplying effect on the economy and will create more reliable electric power supply (less dependent on the weather such as hydroelectric power plants).

VI. ENVIRONMENTAL, SOCIAL AND HEALTH AND SAFETY MANAGEMENT

6.1 Construction impacts are temporary and will be mitigated with the use of standard construction techniques and environmental, health and safety management procedures. The prevention and mitigation measures established for each of the identified environmental impacts will be consolidated in an Environmental and Social Management Plan (ESMP), which will cover both the remaining construction activities and the modular operation of the Project. Trained personnel will be responsible for supervision of the compliance with the preventive and mitigation measures established for each stage of the Project. The ESMP will include monitoring programs including air emissions, ambient air quality, wastewater and noise. A contingency plan will be developed to deal with the risk of the operation of both Phase I and Phase II. A Spill Prevention and Counter Control Plan is currently in place with especial emphasis tank trucks fueling operations.

A. Mitigation Measures

Construction

6.2 *Water Quality Associated with the Structure for Extracting Water from the River Candeias*.- Construction of the aqueduct will be carried out in sections to reduce the amount of time that the trench remains open and reduce the resulting amounts of soil along the length of the aqueduct excavations.

6.3 *Air Quality*.- Vehicles transporting bulk materials will be covered. The construction site will be dampened when meteorological conditions warrant (high winds, low humidity, etc) and particularly during earth moving activities.

6.4 *Noise*.- Construction activities will be carried out in accordance with zoning restrictions to ensure that noise levels will not exceed maximum allowable limits, specially during night-time hours.

6.5 *Flora and Fauna*.- A Landscaping Project will be prepared to landscape the Project site with perennial foliage (with the use of species native to the region) attractive to bird species.

6.6 *Diesel oil transport related traffic*.- A traffic plan for heavy vehicles will be developed in conjunction with the Porto Velho Municipal authorities to restrict heavy vehicles circulation at specific times of the day and at some routes as applicable. The plan will define the activities to inform the public on the frequency of vehicle movements and routes, information to identify the tank trucks to the Project and a point of contact to submit claims for speeding or bad driving.

6.7 *Social impacts from the Project workforce*: The Project construction workforce will largely continue to be recruited from residents of Porto Velho, which have a large supply of skilled construction labor. Partnerships will be fostered between local bodies and the EPC, in such a way as to ensure that a local workforce continues to be hired. No accommodations for workers at the site are required and the existing public transportation combined with transportation provided by the EPC will facilitate the commute on a daily basis to the site.

Operation

6.8 *Ambient Air Quality*.- Emissions will be controlled at the combustion process with an excess volume of air. The addition of air to the fuel results in a significant improvement in the combustion, reducing the formation of oxides of nitrogen (NO_x), carbon monoxide (CO) and particulate materials, which are normally the result of incomplete combustion of fuels. In addition, during the first two stages, the addition of hot water will reduce emissions. Steam will be injected in the third phase.

6.9 The principal emission reductions will be achieved with the use of natural gas. The General Electric PG7121 (EA) turbine includes a "Dual Fuel" combustor, designed for the burning of natural gas or light fuel oil, employing a combustion technology that produces low NO_x emissions, with the injection of water or steam, and multi-stage type turbine which is coupled to the respective generator. A small amount of this steam will be used in the combustors of the combustion turbines, in order to control NO_x emissions. The steam will be injected in quantities proportional to the fuel used, thus allowing combustion to proceed under ideal conditions of temperature.

6.10 *Noise*.- The manufacturer has guaranteed that the sound pressure levels will not exceed 85 dBA, when measured at a distance of 1 (one) meter, in a horizontal plane, and 1.5 (one point five) meters, in a vertical plane, from the installation base line of the group combustion turbogenerator. The principal measures adopted include the (i) installation of silencers at the air inlets, which will achieve a degree of attenuation of between 9 and 30 dBA (125 to 8,000 Hz); (ii) installation of exhaust gas silencers equipped with a soot filter and water drainage, which can achieve a level of attenuation of 25 dB(A); and (iii) if further reduction is necessary, the installation of acoustic panels on ceilings construction of the powerhouse and external areas.

6.11 *Water quality*.- The chemical blowdown from the heat recovery boiler and the effluent resulting from washing resins in the water demineralization system will be neutralized in a lagoon. Oily wastewater, produced at various points within the Plant (e.g. the oil pump, transformer, turbine generator and air compressor) will be treated in an oily wastewater lagoon and then by an API oil separator. The effluent from the API separator will be transferred to the neutralization lagoon by force of gravity before its discharge to the *Candeias* River. Sanitary wastewater will be treated through the use of septic tanks and anaerobic filters, constructed in accordance with the technical standards established by the "*Associação Brasileira de Normas Técnicas - ABNT "* (Brazilian Technical Standards Association). Sanitary wastewater will be discharged into the "*igarapé*" Velho River. Effluents that enter both rivers will be in compliance with the discharge standards established by the Brazilian legislation.

6.12 *Water extraction*.- The plant will operate with a closed water cooling system. Water losses will be replaced using water from the *Candeias* river at an expected rate of 0.1231 m^3/sec. Water extraction will not impact the availability of water in the *Candeias* river, which has an average flow rate of 45 m^3/sec during the dry season.

6.13 *Solid Waste*.- Waste oil will be sent for re-refining at companies authorized and licensed for this kind of activity. Materials with oil on them will be temporarily stored on site, in facilities constructed in accordance with the standards established by the "*Associação Brasileira de Normas Técnicas - ABNT "* (Brazilian Technical Standards Association).

These materials will finally be disposed of at facilities that have been duly licensed for this kind of operation. The remaining waste materials, such as those from the office area and those produced by sweeping access roads, gardening, etc, constitute non-hazardous wastes and will be sent to the municipal landfill.

6.14 *Soil and water contamination*.- During the initial stages of operation of the Plant, diesel oil will be used as fuel. The tank farm will be situated in a paved area with secondary containment, in order to prevent contamination due to possible leaks or spills of diesel oil. To the untreated water from leaching into the soil, the effluent treatment system, particularly the neutralization and equalization tanks, will be built using reinforced concrete, prepared in such a way that the possibility of cracking is reduced to a minimum, thus preventing the process of corrosion of the iron part of the structure and, above all, guaranteeing the integrity of the tanks.

B. Monitoring Programs

6.15 The Project will implement the following monitoring programs: (a) Continuous Emission Monitoring for air pollutants, on each stack; (b) water quality analysis of the intake cooling water; and (c) wastewater analysis prior to discharge.

6.16 *Air Emissions*.- A system will be installed for monitoring air emissions in each one of the stacks. This system will be used to control levels of oxygen (O_2), carbon monoxide (CO), oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) in the exhaust gases, as well as the volume of gas flow and the discharge temperature.

6.17 *Ambient air quality*.- The EIA proposes to carry out an air quality monitoring campaign upon the completion and start of operations of each stage of Phase II. Monitoring will continue for a period of at least a year after the plant starts to operate using natural gas as a fuel, in order to check modeling predictions and confirm the anticipated environmental impacts. Once the monitoring campaigns are conducted, the data should be used to verify predictions of the atmospheric dispersion model, in order to determine the location of three (3) air quality monitoring stations.

6.18 *Noise*- A noise monitoring plan will be carried out before the plant comes into operation, immediately after the start up of the plant, and then repeated annually, in order to confirm the effectiveness of the level of acoustic protection implemented. The monitoring locations selected along the property boundary and at the nearest receptors.

6.19 *Water Quality Monitoring*.- Monitoring of the physical and chemical conditions of the river *Candeias* upstream and downstream from the point where water will be extracted for the plant and the point where the effluents that it generates will be discharged. An automatic station at a point of interest on the river *Candeias* might be installed for obtaining quantitative and qualitative information. The parameters to be monitored will be agreed in conjunction with SEDAM, since the monitoring station might be incorporated in the state environmental system.

6.20 *Groundwater Quality Monitoring (Aquifer)*.- At least three monitoring wells should be installed, one upstream and two downstream from the effluent treatment plant. These wells will monitor water quality every six months. Before the plant comes into full operation (completion of Phase II), information on the groundwater wells will be collected to complement the site baseline information.

C. Contingency Plans

6.21 Procedures have been developed to ensure the safe transfer of diesel oil from tank trucks. Operators have been trained, in such a way as to avoid the possibility of overflows. In the case of equipment malfunction, operators have been trained in spill containment and clean-up procedures, with a view to preventing contamination of the soil and bodies of water.

6.22 Fuel tanks are grouped in the tank farm. Tanks are checked periodically in order to ensure their integrity and verify that there is no damage resulting from collisions. Dikes to contain spills have been constructed around the tank farm.

6.23 Special procedures (e.g. check tank levels before and after loading and unloading operations, periodically test and inspect all instrumentation, valves and piping) have been implemented for loading and unloading operations to ensure the correct alignment of piping, valves, pumps and tanks. A rigid routine has been established in regards to opening the drainage valve of the containment area within the dike. A permit is required in writing by the head of operations. An audible and/or visual alarm will be installed in the area or industrial safety room indicating when the valve is open.

6.24 A Preliminary Risk Analysis (PRA) gas been conducted in order to identify the hazards associated with the operation of the Project. The PRA was based on the "*Análise Preliminar de Perigos - APP*" (Preliminary Hazard Analysis) recommended by CETESB /CETESB, 1999/, modified in order to incorporate the frequency and risk assessment. The PRA identified the severity and frequency of occurrence of potential accident scenarios, including the release of chemical and inflammable substances that can affect both Phase I and II and off-site areas. Based on the PRA, an Emergency Action Plan is being developed .

D. Environmental and Health and Safety Management

6.25 The Project will consolidate the reported Environmental, Health and Safety (EHS) Management System to ensure an effective implementation of the ESMP during the operation of the overall Project (Phase I and Phase II). The EHS Systems includes: (a) environmental, health and safety policies of the company; (b) responsibilities of the Project environmental, health and safety personnel; (c) training; (d) record-keeping of environmental, health and safety information; and (e) a program of inspections and audits.

VII. PUBLIC CONSULTATION

7.1 The Project EIA was finalized by the end of 2000 and presented to SEDAM for analysis. Public disclosure of the EIA was conducted in January 2001 as part of SEDAM's evaluation process. No public hearing was requested.

7.2 Termo Norte will conduct proper public consultation and information disclosure in accordance with Bank's policy. Public announcements will be posted by the Project Company, including press communications, informing on the status of the Project and the company's contact information to receive any kind of comments.

VIII. RECOMMENDATIONS

8.1 The Bank, as part of the due-diligence process, will analyze the environmental, social and health and safety aspects of the Project and prepare an Environmental and Social Impact Report (ESIR) for review and approval by the Bank's Committee on Environmental and Social Impacts (CESI). The environmental and social due-diligence will specifically include the components listed below.

1. An assessment of project compliance status with the applicable Brazilian (national, state and municipal) environmental, social, and health and safety regulatory requirements (e.g., laws, regulations, standards, permits, authorizations, applicable international treaties/conventions, etc.), project specific legal requirements (e.g., concession contract, etc.), and the Bank requirements. In particular, this will include compliance with the World Bank Guidelines for New Thermal Power Plants (Pollution Prevention and Abatement Handbook, 1998) and status of compliance with all required environmental authorizations and permits (Previous, Installation and Operation Licenses) and health and safety requirements for both the power plant and the transmission line.
2. An evaluation of the Project's direct and indirect environmental and social impacts to ensure that they have been thoroughly and properly identified and evaluated, including in particular the following: (a) an evaluation of the air emission mathematical dispersion models used to estimate ambient air quality impacts and any ambient air quality monitoring results; (b) confirmation that the Project will comply with the ambient air quality limits set forth in the World Bank Guidelines for New Thermal Power Plants (Pollution Prevention and Abatement Handbook, 1998), in particular upon Phase II completion while firing diesel; (c) operational noise impacts, in particular baseline levels and sound pressure levels generated by the Phase I and the noise contribution from the Project; (d) tank trucks traffic related traffic impacts during the use of diesel; (e) the use of the most adequate construction techniques and proposed environmental mitigation measures in particular construction under heavy rain or flooding conditions; (f) confirmation that the used oil is recycled by authorized companies; (g) evaluation of the industrial risk; and (g) liabilities and risks related to the operation of Phase I.
3. An evaluation of the proposed environmental and social mitigation measures in terms of their completeness, sufficiency of detail, cost, definition of responsibility, schedule and quality control. In particular the existing environmental management practices are currently implemented in Phase I and the two stages of Phase II.
4. An evaluation of the proposed environmental and social monitoring activities, in terms of their completeness, sufficiency of detail, cost, definition of responsibility, schedule and quality control. In particular, this will include: (a) the monitoring programs defined in the EIA; (b) monitoring programs imposed by SEDAM; (c) environmental, social and safety procedures to be requested to contractors and subcontractors during construction activities; (d) health and safety operation procedures, especially related to the unloading of diesel and maintenance of energized equipment.
5. An evaluation of the company's proposed supervision strategy to contractors and subcontractors to assure environmental performance of the local construction firms concluding the construction of Phase II.

6. An evaluation of the Termo Norte health and safety management system to ensure adequate health and safety plans and procedures are in place, including their technical adequacy given the potential project-specific health and safety issues, adequate level of training will be performed, and sufficient resources will be made available to ensure adequate implementation.
7. An evaluation to confirm adequate contingency plans (i.e., emergency and fire fighting plans, Spill Prevention and Counter Control Plan), including confirmation that all relevant environmental and industrial risks (fire, explosion) have been identified, proper procedures have been developed to ensure adequate implementation.
8. An evaluation of project-related information disclosure and public consultation requirements by the Government, and activities that have been performed and the proposed future actions to provide adequate ongoing information disclosure and public consultation with the local population.
9. An evaluation of the project supervision and evaluation procedures included in the environmental, health and safety management system to ensure proper implementation of the environmental, health and safety plans during construction and operation.
10. An evaluation of environmental, social and health and safety terms and conditions in relevant project legal documents (e.g., concession contract, construction contract, operations and maintenance contract, etc.), in terms of sufficiency, potential risks or liabilities and the insurance policies to cover indemnities to affected people in cases of spills, accidents and/or industrial risk associated contingencies.
11. An evaluation of existing and potential future environmental, social, or health and safety financial/credit risks and liabilities associated with the Phase I, the Project, the project site, the Project Company and environmental and social risks associated with the upstream supply chain of gas to the plant (*Urucu* gas fields and the pipeline under construction) as well as the proposed measures to minimize all risks.

8.2 The Project ESIR will include a summary of the proposed project, in terms of environmental, social, and health and safety aspects. The ESIR will also present the project team's recommendations related to environmental, social, and health and safety requirements for the project and the loan agreement.

FIGURE 1
Termo Norte Power Plant Location

TABLE 1

Air quality standards established by CONAMA Resolution nº 03, dated 28/06/90, and by state legislation in Decree 7903/97.

				STATE STANDARD	WORLD BANK GUIDELINES*(4*
		PRIMARY STANDARD (? g/m³)	**SECONDARY STANDARD (? g/m³)**	**Decree 7903/97 (? g/m³)**	
Total Particulates in Suspension	24 hours AGA	240(1) 80(2)	150(1) 60(2)	120(1) 40	230 80
Sulfur Dioxide	24 hours AAA	365 80(3)	100 40(3)	200(1) 60	150 80
Carbon Monoxide	1 hour 8 hours	40,000 (35ppm) 10,000 (9ppm)	40,000 (35ppm) 10,000 (9ppm)	40,000 (35ppm) (1) 10,000 (9ppm) (1)	Not defined
Ozone	1 hour	160(1)	160(1)	Not defined	Not defined
Smoke	24 hours AAA	150(1) 60(3)	100(1) 40(3)	Not defined	Not defined
Inhalable Particulates	24 hours AAA	150(1) 50(3)	150(1) 50(3)	Not defined	150 50
Nitrogen Dioxide	1 hour 24 hours AAA	320(1) Not defined 100(3)	190(1) Not defined 100(3)	Not defined	150 100
Photochemical Oxidants	1 hour 8 hours	Not defined	Not defined	120 (1) 60 (1)	Not defined

(1) should not be exceeded more than once a year.

(2) annual geometrical average.

(3) annual arithmetical average.

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

TABLE 2
Brazilian Noise Criteria

BASIC CRITERIA	*CORRECTION FACTORS*	
	Correction by zone (C_z)	Correction by time of the day (C_p)
45dB(A)	0 (hospital area) +10 (residential urban area) +20 (mixed commercial, administration, and business urban area) +25 (predominant industrial urban area)	0 (day period) –5 (night period)

Source: CONAMA Resolution 001/90 issued March 1990.

World Bank Ambient Noise Criteria

Maximum Allowable L_{eq} (hourly measurments) in dB(A)

Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: World Bank General Environmental Guideline (World Bank Pollution Prevention Handbook, July 1, 1998).

TABLE 3

Highest Ground-Level Concentrations of the Assessed Pollutants in µg/m^3 – Coordinates in Meters, and Air Quality Standards

				SCENÁRIO 2 – 1 by-pass stack and Phase I		Air Qua
		1998	1999	1998	1999	
TOTAL PARTICULATES IN SUSPENSION (TPS)	24 hours	0.56 (500; 2000)	0.48 (500; 2000)	0.57 (500; 2000)	0.49 (500; 2000)	
	Annual Average	0.043 (500; 2000)	0.038 (500; 2000)	0.04 (500; 2000)	0.04 (500; 2000)	
OXIDES OF NITROGEN (NOX)	1 hour	119.57 (500; 500)	121.69 (-500; 0)	119.57 (500; 500)	121.87 (-500; 0)	
	24 hours	22.30 (500; 2000)	19.06 (500; 2000)	22.38 (500; 2000)	19.16 (500; 2000)	
	Annual Average	1.69 (500; 2000)	1.49 (500; 2000)	1.72 (500; 2000)	1.51 (500; 2000)	
ANNUAL AVERAGE	0.26 (500; 2000)	0.30 (500; 2000)	0.34 (500; 2000)	0.29 (6000; -10000)		
CARBON MONOXIDE	1 hour	0..73 (-1000; -500)	0.82 (-1000; 1000)	1.44 (-1000; -500)	1.65 (-1000; 1000)	
	8 hours	0.25 (500; 2000)	0.16 (2000; 0)	0.50 (1000; 1000)	0.31 (2000; 0)	

(1) Air Quality Standards – State

(2) Air Quality Standards - CONAMA

** The more restrictive of federal and state standards*

(3) Air Quality Standards – CONAMA

World Bank Standards used in the absence of Brazilian standards

( ) Cartesian Coordinates of the expected impacts associated with the

TABLE 3 (continuation)

Highest Ground-Level Concentrations of the Assessed Pollutants, in µg/m^3 – Coordinates in Meters, and Air Quality Standard

						Air Qua
		1998	1999	1998	1999	
TOTAL PARTICULATES IN SUSPENSION (TPS)	24 hours	0.78 (500; 2000)	0.67 (500; 2000)	0.67 (500; 2000)	0.53 (500; 2000)	
	Annual Average	0.07 (500; 2000)	0.06 (2000; -2000)	0.06 (500; 2000)	0.05 (500; 2000)	
OXIDES OF NITROGEN (NOX)	1 hour	176.66 (-500; 0)	177.73 (-500; 0)	154.98 (-500; 0)	157.18 (-500; 0)	
	24 hours	27.14 (500; 2000)	21.92 (500; 2000)	25.36 (500; 2000)	20.27 (500; 2000)	
	Annual Average	2.24 (500; 2000)	1.89 (500; 2000)	2.03 (500; 2000)	1.74 (500; 2000)	
SULFUR DIOXIDE (SOX)	24 hours	10.08 (-1000; -2000)	12.60 (1000; 4000)	3.66 (500; 2000)	3.12 (500; -500)	
	Annual Average	0.85 (4000; -6000)	0.94 (1000; 2000)	0.27 (500; 2000)	0.24 (500; 2000)	
CARBON MONOXIDE	1 hour	5.35 (-500; 0)	5.47 (-500; 500)	2.08 (500; 1000)	5.19 (-500; 500)	
	8 hours	2.19 (500; 1000)	1.64 (0; 1000)	1.56 (500; 1000)	1.55 (0; 1000)	

(1) Air Quality Standards – State

(2) Air Quality Standards - CONAMA

** The more restrictive of federal and state standard*

(3) Air Quality Standards – CONAMA

World Bank Standards used in the absence of Brazilian standards

( ) Cartesian Coordinates of the expected impacts associated with the