

INTER-AMERICAN DEVELOPMENT BANK



Mexico

***BAJIO POWER PROJECT
(ME-0225)***

ENVIRONMENTAL AND SOCIAL IMPACT REPORT

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January 2000

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1.0 INTRODUCTION

- 1.1 The *Bajío* Power Project (“Project”) is composed of the development, design, construction, operation, and maintenance of a dual fuel (primary fuel of natural gas and secondary fuel of diesel) 600 MW combined cycle power plant in central Mexico. About 495 MW of the electricity will be sold to the *Comision Federal de Electricidad* (“CFE” – Federal Electricity Commission) under a 25-year Power Purchase Agreement (PPA). Surplus power will be made available for others. The power sold to CFE will be transmitted in accordance with the PPA; the power sold to the third parties will be transmitted according to an Interconnection and Transmission Agreement that will be executed on or prior to the Commercial Operation Date (COD).
- 1.2 The *Bajío* Project was conceived by the CFE as part of CFE’s Independent Power Producer (IPP) program. On March 4, 1999, the CFE awarded the Project through an international bidding process to InterGen (the “Sponsors” hereafter), who will finance, construct, and develop the Project. Jointly owned by Bechtel Enterprises Holdings and Shell Generating Ltd., InterGen is one of the major greenfield energy developers in the world. InterGen, through its affiliates, develops, owns, and operates power plants and related fuel assets, as well as electricity infrastructure worldwide. Bechtel Power Corporation, or one of its affiliates, will be the Engineering, Procurement and Construction (EPC) Contractor for the *Bajío* Project, who will provide design, engineering, procurement, and construction services on a lump sum, turnkey basis in accordance with an EPC Agreement with the Sponsors
- 1.3 The sponsor has requested financial assistance from the Inter-American Development Bank (IADB) and the U.S. Export Import Bank (US Exim).

2.0 PROJECT DESCRIPTION

2.1 Project Location

- 2.1 The Project will include a Power Plant, a Sewage Treatment Plant (STP), an aqueduct, and an access road. The Project will be located in the area of *San Luis de la Paz* (see Figure 2-1), about 280 kilometers (km) northwest of Mexico City. The Project site is contained within a high altitude plains region generally referred to as the *Bajío* region, at an elevation of about 1,984 meters (m) above sea level. More specifically, the site is about 12 km southwest of the town of *San Luis de la Paz*. The *Bajío* power plant will be constructed on a greenfield site provided by the CFE.
- 2.2 The power plant site is situated southwest of the intersection of Highway 57 and Highway 110. The site is rectangular in shape with a total area of about 18.5 hectares. A transmission line, located at a distance of about 200 m to the west, runs parallel to the western boundary of the site. A small, old water canal adjoins the eastern property line. Access to the site is provided via dirt roads off Highway 57.
- 2.3 The STP will be constructed at the southeast corner of a municipality-owned property that is located just outside of the western limits of the town of *San Luis de La Paz*. The STP site is about 12 km northeast of the power plant site (see Figure 2-2). The STP will occupy an area of about 7,200 m².

- 2.4 The aqueduct (including the treated municipal waste water pipeline and the Project wastewater return pipeline to the STP) will be installed within a 15-m wide right-of-way. The total length of the aqueduct will be approximately 13 km . The first segment of the aqueduct leaving the power plant site will be constructed within the same right-of-way as the access road. The aqueduct will turn north and follow the direction of Highway 57 until it reaches a dirt road about a kilometer north of Highway 110. The aqueduct will then turn east and follow this municipal road until it terminates at the STP.
- 2.5 The access road to the power plant will be constructed within a 15-m wide right-of-way from the 83-km location off Highway 57. Total length of the access road will be 3 km, and will be a new road but with controlled access only to the power plant.

2.2 Project Components and Facilities

Power Plant

- 2.6 The *Bajío* Project will include a dual-fuel (natural gas and diesel) combined cycle power plant, although the Project will operated almost entirely on gas (i.e., PPA states maximum diesel usage is 15 days total per year and maximum of 10 days continuous). Electricity will be generated at 13.8 kV in the combustion turbine generators (CTGs) and 17 kV in the steam turbine generator (STG), and stepped up to an existing CFE grid at 230 kV. Nominal output of the power plant will be 600 MW.
- 2.7 The power plant will include three F-class frame-type (General Electric 7FA) CTGs with air-cooled condensers, each feeding exhaust gas to its respective heat recovery steam generator (HRSG). Steam from the HRSGs will be fed to a STG. Gas produced by combustion of the natural gas will be released to the atmosphere through the HRSG stacks. The primary emissions from natural gas firing will be nitrogen dioxide (NO₂), carbon monoxide (CO), and particulate matter (PM). During diesel firing, which is limited to a maximum of 10 continuous days and 15 days in a year, emissions of sulfur dioxide (SO₂) and particulate material (PM) will also occur. In order to minimize emissions of NO_x during natural gas firing, the Project will include a dry low-NO_x (DLN) design.
- 2.8 Because air-cooled condensers will be used for the power plant, a significant volume of water will not be required during plant operation. The cooling water used in the power plant will be treated municipal waste water from the Sewage Treatment Plant (STP) which will be designed and built associated with this Project (see details below under Water Supply).
- 2.9 A concrete curbing around the fuel oil storage tank and dikes around the sulfuric acid tank and caustic tank will be constructed to control potential spills. The dikes around the storage tanks will be treated with a concrete protective coating and will be sized to contain 110 percent of the volume of the individual tanks. A normally closed and locked drain valve will be provided to prevent release of rainwater. Curbed enclosures will be provided for collection of boiler feedwater treatment chemicals and water pretreatment chemicals. Storm water will be drained to a neutralization system or a depressed area to allow the use of a portable sump pump to remove water. Main and auxiliary oil-filled transformers will be installed on rock-filled pits.
- 2.10 The collection sumps at the power plant will be of concrete construction and the wastewater within the plant will be conveyed in piping or concrete trenches. Aboveground tanks that will

hold wastewater or contain chemicals will be provided with secondary containment provisions using concrete construction.

- 2.11 Parking spaces and driveways within the power plant will be paved with asphalt concrete. The remainder of the site will be landscaped. The entire power plant will be enclosed with a fence along its perimeters. The EPC Contractor plans to create a 10-m wide “environmental barrier” (i.e. green belt) inside the fence line.

Fuel Supply

- 2.12 Natural gas will be the primary fuel for the *Bajío* Project. The natural gas will be supplied by CFE for the 495 MW electricity sold to CFE, with the balance of the fuel requirements supplied either by CFE or directly by *Petroleos Mexicanos* (“Pemex”). Natural gas will be supplied by the *Queretaro-San Luis Potosi* pipeline which is located adjoining the Project site. The natural gas will be delivered to the power plant through a new 50-m long branch line that will be constructed within a 15-m wide right-of-way. The diameter of the new pipeline will be 356 mm (14 inches).
- 2.13 Low-sulfur diesel fuel will be used as a backup fuel in the event of emergency. Diesel firing will be limited to no more than 15 days per year and 10 continuous days. The diesel fuel will be trucked to the power plant and stored in a 21,000-m³ capacity aboveground carbon-steel tank. The size of the tank has been determined on the basis that the backup fuel will be available for a continuous diesel-firing period of 10 days. The characteristics of the diesel fuel includes 0.5 and 0.01 percent by weight maximum of sulfur and ash content, respectively.

Water Supply

- 2.14 Since water is a scarce resource in the *Bajío* region, the *Comision Nacional del Agua* (“CNA” – National Water Commission) has determined that no new ground water well permits should be granted to any industry operating within the area. As such, prior to the bidding, CFE entered negotiations with the *Junta de Agua Potable y Alcantarillado de San Luis de la Paz* (“JAPASP”(drinking water and sewer authority) for providing treated municipal wastewater for the *Bajío* Project. Subsequent to bid award, the Sponsors commenced contract negotiations with JAPASP for supply of raw sewage water for plant operation. While JAPASP will be responsible for bringing raw sewage to the STP, the Project Company will build and operate the STP.
- 2.15 In the original bid, the STP would be constructed in the *Los Cerritos* area adjacent to the power plant. The IADB and JAPASP asked the Sponsors to consider changing the location of the Project STP from the power plant site to the *El Bailon* area, which is located just outside of the town of *San Luis de la Paz*. The idea was to utilize this STP as the first stage in the municipality’s plan for waste water collection and treatment. Currently, the municipality of *San Luis de La Paz* discharges its raw sewage without any treatment to four separate points. JAPASP entirely independent of CFE’s plans for the *Bajío* Project and motivated by the impending regulations of the Mexico government, has developed plans for building a wastewater treatment plant for the municipality in the *El Bailon* area and to re-route all of the town’s sewage flow to the *El Bailon* Collector. Thus, the proposed STP can be built on a municipality-owned 10-hectare land that has been designated as the site for construction of future wastewater treatment facilities (i.e., expansions of the STP). The new site location was accepted by the Sponsors and has been approved by the CFE.
- 2.16 Raw sewage will be pumped by a lift station from the *El Bailon* Collector and sent to a concrete-lined collection basin at the STP for treatment. The treated sewage (gray water) will be delivered

to the power plant via a buried carbon steel and/or asbestos cement pipeline that will be constructed within a 10-m wide right-of-way (Figure 2-2). The gray water will be stored in a below-grade concrete clearwell at the power plant. The diameter of the gray water pipeline will be 305 mm (10 inches). Excess gray water that is not delivered to the power plant will flow to the JAPASP concrete-lined receiving pond that will be located adjacent to the new STP. The receiving pond will be constructed by the Sponsors but will be owned and operated by JAPASP.

- 2.17 In terms of potable water, the Sponsors will not withdraw water from any groundwater sources during construction or operation. The Sponsors will purchase potable water from the local vendors who will deliver bottled water to the power plant by truck. The Sponsors estimate that the power plant will be staffed with a maximum of 80 employees during operation. Assuming each person will consume up to 0.05 m³ per day, the daily amount of potable water needed during operation will be about 4 m³.

Sewage Treatment Plant

- 2.18 The STP will be a secondary treatment plant that consists of an extended aeration basin, activated sludge treatment system. The STP will be designed to process a design flow rate of 125 m³/hour of raw sewage in two 50 percent capacity process trains. The treatment process will be operated to achieve high biological oxygen demand (BOD) removal, nitrification, and partial densification.
- 2.19 The maximum makeup water needed for steam generation under normal power plant operating conditions will be about 57.1 m³/hour when natural gas is being fired. Under emergency conditions when diesel oil is fired, up to about 111.4 m³/hour of water will be required for controlling the emission of NO_x.
- 2.20 The raw sewage will be collected in the JAPASP municipal collection basin (located adjacent to the STP) and pumped with non-clog pumps to the STP. The pumped sewage will be pretreated through a degritting system and a hydrosieve fine screen. The pretreated sewage, along with the return sludge from the secondary clarifier, will flow to two aeration tanks/basins for biological treatment. Aeration will be accomplished membrane-type fine bubble diffusers. The aeration capacity can be varied as required, depending on BOD loading and minimum mixing requirements. Sodium hydroxide solution will be fed to the basins to maintain proper alkalinity levels to support nitrification. The mixed liquor will flow by gravity from the aeration basins to the clarifiers. The clarified effluent will flow by gravity to a chlorine contact chamber and, finally, to a treated sewage clearwell. The gray water will then be pumped to the power plant, as required for makeup water.
- 2.21 The Sponsors will analyze the quality of the raw sewage water before it enters the STP and the effluent before it leaves the power plant in order to ensure that effluent is in compliance with the Mexican standard (NOM-002-ECOL-1996) that regulate wastewater discharges to the municipal sewage system. In terms of the power plant effluent, JAPASP will have the option of blending all or a portion of the effluent with the town's raw sewage water or with the excess treated (gray) water. JAPASP will then discharge the blended water for designated use at its own discretion.
- 2.22 About 0.4 kilograms (kg) of sludge will be generated for every kilogram of BOD at the STP. The sludge from the clarifiers will be pre-thickened in a screen-type thickener and aerobically digested in a single digester. The digested sludge will be directed to a belt filter press where it can be dewatered. The Project Company will sample and test the nature of the dried sludge. If the test results indicate that the dried sludge is not hazardous, the sludge will be collected by front-end loaders, loaded in trucks, and will either be given to JAPASP (who intends to sell it to

fertilizer plants), or trucked to and disposed of in a local licensed landfill. If the test results indicate that the dried sludge is hazardous, the Project Company will have the responsibility for disposal of the sludge in an authorized offsite hazardous waste disposal facility.

- 2.23 The sludge-handling and dewatering processes at the STP will naturally generate filtrate. This filtrate will be combined in the collection sump and returned back to the STP inflow for treatment.
- 2.24 Solid wastes that will be generated at the STP will include paper, carton, plastics, glass, and food wastes. The Sponsors plan to separate these wastes prior to disposal. Other solid wastes such as exhausted resins from the de-mineralization system of the STP will be generated. These wastes are non-hazardous and may be recycled or disposed of. The sludge and residual solids from the STP that are not deemed hazardous will be disposed of at a site approved by the municipal authorities.
- 2.25 The Project Company will operate the STP in accordance with the Water Environment Federation Manual of Practice (MOP) 11 – Operation of Municipal Wastewater Treatment Plants.

Wastewater Discharge

- 2.26 The power plant will generate effluent from various sources such as wash water, RO reject, regeneration of demineralization system, and quenched HRSG blowdown. The power plant will not discharge its wastewater directly to a natural receiving water body. The wastewater produced during operation (which is described for the various power plant processes in Section 5.2 of this report) will be collected in a common concrete sump at the plant. The wastewater will be combined with the excess gray water that is not used at the power plant and then pumped through a dedicated pipeline (separate from the gray water pipeline) back to the JAPASP receiving pond. This receiving pond will be located outside of the STP boundary. The diameter of the return water conduit will be 183 mm (6 inches). The return water conduit will be constructed within the same 10 meter right-of-way as for the gray water pipeline
- 2.27 The Sponsors have analyzed the following three different modes of plant operation:
- Case 1 – Annual average, natural gas firing without evaporative coolers in service
 - Case 2 – Winter design with oil firing of the combustion turbines
 - Case 3 – Summer design with natural gas firing and evaporative coolers in service
- 2.28 For each of the modes of plant operations mentioned above, the water balances estimated by the Sponsors are shown below:

| Case | Makeup Water Requirements | Power Plant Effluent |
|-------------|----------------------------------|-----------------------------|
| 1 | 25.2 m ³ /hour | 18.5 m ³ /hour |
| 2 | 111.4 m ³ /hour | 34.1 m ³ /hour |
| 3 | 57.1 m ³ /hour | 28.0 m ³ /hour |

- 2.29 As previously stated, the power plant wastewater effluent will comply with the Mexican standard (NOM-002-ECOL-1996) and JAPASP will have the option of blending all or a portion of the effluent with the town's raw sewage water or with the excess treated (gray) water, and will then discharge the blended water for designated use at its own discretion. JAPASP has indicated that would like to use the power plant effluent for irrigation or other appropriate purposes. The Project Company has informed JAPASP that at certain times the power plant effluent may have

concentrations of certain constituents (i.e., total dissolved solids, sodium, and chloride) that may exceed U.S. recommended limits for certain irrigation uses. JAPASP has indicated that it would seek to dilute the effluent in order to make it useful for irrigation.

Wastes

- 2.30 Wastes that will be generated during plant operation will include small quantities of oil, demineralizer regeneration wastes, residual solids, sludge, and solid wastes. The oily wastes will be processed through an oil/water separator. Demineralizer regeneration wastes will be neutralized in fiberglass-reinforced plastic tanks prior to discharge. Sumps will be used to collect regeneration wastes from the mixed-bed demineralizers. Significant amounts of solid wastes will not be generated at the power plant. Domestic waste will be collected by an independent waste management contractor and disposed of in an approved municipal dump site in *San Luis de la Paz*.

Work Force

- 2.31 The EPC Contractor has estimated that the average number of workers needed during the 2-year construction period would be about 500, with an estimated maximum number of workers of about 750. The *Energía Azteca VIII, S. de R.L. de C.V.* (the “Project Company” hereafter), an affiliate of InterGen, will operate the Project on a continuous basis (i.e., 24 hours a day, 365 days a year). The Project Company has also estimated that up to 80 employees (including technicians, administrative personnel, etc.) will be required for the operation and maintenance of the Project. The EPC Contractor and its subcontractor (*Degremont de Mexico*) will have the responsibilities for design and construction of the STP. The Project Company will operate the STP

2.3 Schedule and Costs

- 2.32 Construction is planned to start in early 2000. Commercial operations are scheduled for January 2002. The total costs for the Project are estimated to be about \$409 million US dollars.

2.4 Project Analysis of Alternatives

- 2.33 During the development stage of the *Bajío* Project, the CFE considered several alternative factors, including site location, fuel supply, and a no-action alternative. A summary of the analysis of alternatives is presented in the following sections.

Siting Alternatives

- 2.34 A preliminary study was performed for screening potential sites in either the State of *Queretaro* or the State of *Guanajuato*. The methodology used in the study included regional definition of exclusion areas, identification of candidate and potential sites and evaluation of candidate sites. Eight criteria were used to identify technical, economic, social, and environmental concerns for each of the sites considered. The site screening criteria were: areas under ecology protection, mountain areas, volcanic activity zones, seismic region, flooding zones, urban centers, historic value zones, and special tourist attraction zones.
- 2.35 Using these criteria, a number of locations were considered as potential sites for the power plant. These included the *National Park El Cimatario* site, the *San Juan del Rio* site, the *Queretaro* site, and the *San Luis de la Paz* site. These potential sites were further analyzed on the basis of the technical and environmental consideration listed below:

| Technical Considerations | Environmental Considerations |
|--|--|
| <ul style="list-style-type: none"> • Fuel supply • Water supply • Interconnection to the national electric system | <ul style="list-style-type: none"> • Climate • Soil characteristics • Underground hydrology • Vegetation • Fauna • Zoning • Air quality |

- 2.36 Based on these environmental and technical considerations, three candidate sites (the *Las Delicias* Site in *Guanajuato*; the *La Lira* Site in *Queretaro*; and the *Lagunilla* site in *Queretaro*) were selected for final consideration. A number of factors were considered in the analysis of the candidate sites. These factors (in order of importance) included: fuel and water supply; interconnection to the national electric system; physical and geographical characteristics; environmental aspects; and, costs of investment and operation. CFE's final analysis indicates that the *Las Delicias* (currently named as *Bajío*) site would be the best choice for power production in the central region of Mexico.
- 2.37 Recognizing that water is a scarce resource in most of Mexico and much of the country suffers from inadequate water treatment capabilities, the Mexico federal government has embarked on a program of combining sewage treatment plants with IPP plants. For the *Bajío* Project, the local municipal water utility (JAPASP) has committed to supplying adequate raw sewage water for 25 years.
- 2.38 According to the CFE, the *Bajío* region was selected for the power plant in order to provide a major generation source for the area's existing and growing electric power demand and to stabilize the regional transmission system. The *Bajío* region is a net importer of electricity and this facility is expected to ease transmission constraints in the area. The CFE plans to build a substation on the adjoining 14.1-hectare property that will serve as the interconnection point of the plant with the national grid. Although the *Bajío* Project is strategically located adjacent to the existing natural gas fuel supply line and an established electric transmission system, the high elevation of the region has imposed a degrading effect on the project's generation output. As such, unlike the northeastern region of Mexico where there is a high level of competition for industrial customers, it is not likely that there will be a significant number of additional generators seeking to penetrate the *Bajío* industrial customer market.

No-Action Alternative

- 2.39 Given the existing and growing electric power demand, and considering that the *Bajío* region is a net importer of electricity, the no-action alternative will eventually cause further transmission constraints to the already existing ones, and probably make it impossible to satisfy power demand, resulting in power shortages. If the *Bajío* Project is not built, the demand for electricity as well as the need to stabilize the regional transmission system would still remain. This need would have to be satisfied by other means, which may impose more environmental and social impacts than would result from the alternative (*Bajío*) chosen.

3.0 INSTITUTIONAL AND LEGAL FRAMEWORK

3.1 Institutional Framework

3.1.1 Power Sector

- 3.1 The *Secretaría de Energía* (“Ministry of Energy”) is responsible for developing Mexico’s energy policy. The Ministry of Energy is also in charge of approving the exploration and development of natural energy resources, as well as auditing the operation of industry-related entities.
- 3.2 The *Comision Federal de Electricidad* (“CFE” – Federal Electricity Commission) was established in 1939 and is in charge of supplying electricity in Mexico. CFE owns and operates most of the generation plants that connect to the CFE grid in Mexico. CFE has held a monopoly for the generation, transmission, and distribution of electricity in the past.
- 3.3 The *Comisión Reguladora de Energía* (“CRE – Energy Regulatory Commission) is responsible for regulating the construction, operation, and ownership of power generation and the transportation, storage, and distribution systems for natural gas. CRE was created in 1994 as a technical branch of the Ministry of Energy. Being independent from CFE, CRE’s mission is to foster productive investment and efficient markets to benefit the end users by regulating natural and legal monopolies in the natural gas and power industries in Mexico. The CRE is responsible for issuing the permits necessary to allow private participation in the Mexican energy generation sector.

3.1.2 Environmental Sector

Federal Authorities

- 3.4 The *Secretaría Medio Ambiente, Recursos Naturales y Pesca* (“SEMARNAP” – Environment, Natural Resources, and Fisheries Secretary) was created in 1994 to centralize and streamline federal policy-making relating to natural resource management and environmental protection in an effort to achieve sustainable development. SEMARNAP regulates a broader spectrum of environmental protection issues including formulating the national environmental policies, issuing *Normas Oficiales Mexicanas* (“NOM” –Official Mexican Standards), evaluating EIAs managing the use of national waters, setting conditions for wastewater discharges into national waters and organizing projects for the improvement of national dams and establishing, in coordination with other agencies and entities, economic instruments for the protection, restoration and conservation of the environment, among other activities.
- 3.5 There are three decentralized organizations under the SEMARNAP:
- The *Procuraduría Federal de Protección al Ambiente* (“PROFEPA” – Office of Attorney General for Protection of Environment) is the primary federal agency authorized to enforce environmental laws in Mexico, including the regulations for the management and disposal of hazardous and industrial waste, air emission, and water pollution. All projects involving electricity generation such as the *Bajío* Project and all high-risk activities (such as hazardous wastes) are under the federal jurisdiction through the PROFEPA.
 - The *Comisión Nacional del Agua* (“CNA” – National Water Commission) is responsible for issuing permits for water withdrawal from and discharge to federally chartered bodies of water (such as rivers and lakes).

- The *Instituto Nacional de Ecología* (“INE” – National Institute of Ecology) is responsible for the development of environmental policies and regulations, and the issuance of permits and licenses, including review and authorization of a project EIA.

Local Authorities

- 3.6 Non-federal issues and environmental matters are under the jurisdiction of the respective states and municipalities. The policies of the states and municipalities must meet or exceed federal requirements. The state and local governments are responsible only for land use licensing, construction permitting, and regulation of solid waste disposal.
- 3.7 The Ecology Secretariat of the State of *Guanajuato* is responsible for issuing environmental permits for all state facilities of non-federal jurisdiction and for the non-hazardous solid waste management and disposal within the state. JAPASP regulates drinking water supply as well as wastewater treatment and recycling within the Municipality of *San Luis de la Paz*.
- 3.1.3 Health and Safety
- 3.8 Article 123 of the Mexican Constitution states that all citizens have a right to work in a manner that is dignified and socially useful and requires all employers to implement those measures which are necessary to ensure workplace safety and hygiene and to prevent employee accidents and illnesses. The occupational health and safety provisions of Article 123 are implemented under the General Health Law (“*Ley General de Salud*”), the Federal Labor Law (“*Ley Federal del Trabajo*”) and, more specifically, the Federal Regulations of Safety, Hygiene, and Work Environment (“*Reglamento Federal de Seguridad e Higiene y Medio Ambiente en el Trabajo*”).
- 3.9 The Health Secretariat shares its jurisdiction over the workplace with the *Secretaría de Trabajo y Previsión Social* (“STPS” – Labor Secretariat). The Labor Law establishes general provisions governing workplace conditions and expands the responsibilities of employers in order to ensure workplace health and safety. The Labor Law also provides for compensation to both temporary and permanent workers for any disability arising from occupational hazards.

3.2 Legal Framework

3.2.1 Power Sector

- 3.10 The legal framework for private generation of electricity in Mexico is still being developed. The Public Electric Energy Service Law (“*Ley del Servicio Público de Energía Eléctrica*” or “Electricity Law”), in effect since 1975, states that the State, as a general rule in accordance with the Mexico Constitution, has the exclusive authority to generate, transport, distribute, and supply electricity for the purpose of rendering a public service. The Electricity Law was amended in 1992. Key modification enacted in 1992 excluded the following activities from the definition of “public service”:
- Generation of electricity for self consumption, cogeneration, or small production
 - Generation of electricity by IPPs for sale to the CFE under long-term contracts
 - Generation of electricity for export
 - Importation of electricity by individuals exclusively for their own use
 - Generation of electricity for emergency purposes to cover shortfalls

- 3.11 The Regulations of the Electricity Law (*“Reglamento de la Ley del Servicio Público de Energía Eléctrica”*), in effect since 1993, establish the requirements for generation of electricity by private producers as well as the requirements to issue permits for self-generation to satisfy the power needs of the power plant owners. In 1995, the Electricity Law granted the CRE, among others, the authority to issue and revoke permits for self-generation, and to authorize the transfer of the rights derived from such permits. Recent resolutions by the CRE have complemented the regulatory framework to private cogeneration and self-generation activities. Such advances include the approval of contract models for interconnection, transmission and sale of surplus electricity to the CFE (January 23 and February 11, 1998), as well as the development of the methodology for establishing power transmission charges (May 15, 1998).
- 3.2.2 Environmental, Health and Safety Regulatory Requirements
- 3.12 Passed in 1998, the General Law of Ecological Equilibrium and Protection of the Environment (*“LGEEPA” – Ley General del Equilibrio Ecológico y Protección al Ambiente* or “Ecology Law”) establishes the overall framework for industrial requirements and associated fines and penalties for noncompliance. In 1996, the Ecology Law was revised to simplify procedures, improve enforcement, and clarify responsibilities for specific federal, state and municipal jurisdictions.
- 3.13 The legal framework for the Mexican federal EIA legislation is under the Ecology Law (LGEEPA) and its associated regulations. The General Directorate of Ecological Zoning and Environmental Impact (*“Dirección General de Ordenamiento Ecológico e Impacto Ambiental”*) of INE is responsible for carrying out the federal EIA evaluation. The Ecology Law and the associated Regulations of Environmental Impact (*“Reglamento de la Ley del Equilibrio Ecológico y Protección al Ambiente en Materia de Impacto Ambiental”*) require that an EIA for certain projects be prepared and approved by the INE. Depending upon the project, there are three levels of EIA: general, intermediate, or specific (most detailed). Upon issuing an authorization for the EIA, the INE usually establishes specific conditions that must be met by the project during construction, operation, and abandonment. These conditions commonly establish requirements for mitigating environmental impacts of the project.
- 3.14 Associated with the Ecology Law and related regulations, more than 250 environmental standards (NOMs) have been established to regulate areas in air emission, wastewater discharge, hazardous waste, health and safety, etc. In addition to the laws mentioned above (such as the Ecology Law, the General Health Law, and the Federal Labor Law), an agreement establishing the ecological criteria (CE-OESE-002/88) must be completed in the selection and preparation of sites for the installation of conventional steam generating plants. Moreover, key environmental, health and safety regulatory requirements pertinent to the *Bajío* Project are listed in Table 3.1.
- 3.15 In addition to meeting the applicable Mexican environmental requirements indicated above, the *Bajío* Project will be designed and operated to comply with applicable guidelines set forth in the World Bank Pollution Prevention and Abatement Handbook, Thermal Power-Guidelines for New Plants (July 1998) and the Environmental Procedures and Guidelines of the Ex-Im Bank (April 1998).
- 3.16 Tables 3-2 through 3-6 present the applicable standards for air emissions, wastewater discharge and noise for the Project.

3.3 Project Environmental and Permitting Status

- 3.17 The principal approvals, permits, and authorizations required for the *Bajío* Project are:
- INE's approval of the Project EIA and the Risk Study,
 - CRE's authorization for construction of the Project, and
 - Approval of land use and construction by the local authorities
- 3.18 In January 1999, the *Universidad Nacional Autonoma de Mexico* ("UNAM" – Engineering Institute of the National Autonomous University of Mexico) prepared a General Level environmental impact assessment (EIA) ("*Manifiesto de Impacto Ambiental - General*" or "MIA") and a Risk Study ("*Estudio de Riesgo*") for the *Bajío* Project. UNAM on behalf of the CFE submitted those reports to the *Instituto Nacional de Ecologia* ("INE" – National Institute of Ecology) on February 16, 1999 and the MIA was made available to the public at this time. On July 7, 1999, the INE approved these studies and granted an authorization for the Project. The INE authorization sets forth 64 conditions related to the construction, operation, and abandonment of the Project. These conditions require the Sponsors to comply with the Mexican national environmental standards as well as Project-specific conditions. On August 5, 1999, the CFE requested a transfer of the INE authorization to the Sponsors.
- 3.19 The *Bajío* Project has been modified since the MIA was originally prepared. In comparison to the description of the Project contained in the MIA, major modifications in Project features that differ from those presented in the MIA include the following:
- Increase in generation capacity from 450 MW to 600 MW,
 - Increase in the number of gas turbine from two to three,
 - Relocation of the Project STP to the *El Bailon* area,
 - Increase in gas supply from 2,285,000 m³/day to 2,800,000 m³/day, and
 - Increase the size of the gray water supply pipeline from 5 to 12 inches in diameter.
- 3.20 Because of the modifications, the Sponsors filed an update to the original MIA to the INE on September 28, 1999. The Sponsors requested the INE to review the proposed updates to the Project and to reconsider some of the conditions stipulated in the previous authorization. On November 15, 1999, the INE issued a new authorization to the Sponsors with modified conditions for the Project.
- 3.21 Since June 1999, both the IADB and the Ex-Im Bank have requested the Sponsors to provide detailed information and additional studies on the following:
- Air modeling reflecting the current design of the Project,
 - Written evidences of JAPASP's agreement for providing the municipal raw sewage water (quantity and quality) for the *Bajío* power plant as well as JAPASP's agreement to accept the power plant wastewater for discharge to the municipal grid,
 - Characteristics of raw sewage water and power plant wastewater as well as water balances,
 - Noise modeling and mitigation measures, and
 - Information on employment and income characteristics of the residents in the *Los Cerritos* area and in the *Chichimeca Jonaz Misión*.
- 3.22 To address the modifications of the Project and the requests made by both the IADB and the Ex-Im Bank, the Sponsors conducted supplemental environmental studies between September and December 1999. These studies include dispersion modeling, assessments of air quality impacts,

revisions of the noise level contours, calculations of the water balances, and estimates of the characteristics of wastewater and blended water for discharge. During the week of September 26, 1999, the Sponsors conducted a survey of the workers from the *Chichimeca Jonaz Misión*, regarding the nature, extent, and location of employment. The Sponsors also compiled the profiles of the residents in the *Los Cerritos* area.

- 3.23 The sponsor implemented a Public Consultation and Disclosure Plan in September 1999, which included making the EIA available to the local public and the performance of public hearings in October 1999 (see Section 7 for details).
- 3.24 On June 2, 1999, the CRE granted the *Bajío* Project an independent power producer permit. The Institute of National Archaeology and History (“INAH”) issued a notice on October 11, 1999, stating that the power plant site does not contain any archaeological ruins or objects, based on a review of existing records and site visit performed by the INAH in September 30, 1999. Subsequently, the Sponsors have contacted the INAH and received similar approval for the right-of-way of the proposed access road and for the STP site. The Sponsors also received both a construction permit and a land use permit from the Municipality of *San Luis de la Paz* on October 6, 1999.

4.0 ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 Environmental

Land Use

- 4.1 The power plant site and its surrounding areas are open fields for growth of agricultural produce and for animal grazing. Agricultural activities such as growing corn and vegetables at the site have been suspended for some time. Currently, there are no paved roads, structures, or other improvements within the site boundaries. There is an electric power line and a natural gas pipeline running parallel to the west fringe of the site at distances of about 200 m and 50 m, respectively. The power plant site is predominantly flat. There are two small hills (known as the “*Los Cerritos*”) that are situated just north of the site. These hills are covered with thorny bushes. The only vegetation observed within the power plant by the Sponsors in July 1999 consisted predominantly of grass and three isolated trees on the east portion of the site. The areas immediately surrounding the Project site are currently used as pastureland. A total of ten residences are located within a 1-km radius from the power plant site. Most of these residences are located to the north. The closest housing is approximately 240 m to the east. A small primary school with 15 students is located about 650 m north of the site. Access to the site is provided via Highway 57 through various narrow dirt roads that run between the land parcels.
- 4.2 The STP site is a portion of a land owned by the Municipality of *San Luis de la Paz*. The STP site is surrounded by agricultural fields and is currently not in use. A small campus of the UNAM is located to the northwest of the STP site. JAPASP has designated this location as the site for building future municipal sewage collectors and treatment facilities. Although JAPASP has improved its municipal sewage infrastructure to divert its raw sewage discharge from the existing discharge points to the *El Bailon* area, JAPASP has decided to delay this conversion until the construction of the new STP is completed in Year 2002.

Meteorology and Air Quality

- 4.3 The Project area is located in a semi-arid region characterized by hot summers with frequent rain, and cooler but dry winters. Based on the data from several monitoring stations in the region, the average monthly temperature ranges from 13.8 degrees Celsius (°C) in winter to 19.8°C in summer. The highest temperatures are typically recorded in the period from April through July. The minimum average temperature ranges from 9.4°C to 15.8°C, with December being the coldest month.
- 4.4 Extreme temperatures cover a much larger range than the averages, with very hot conditions occurring in summer, and temperatures below freezing occurring in winter. Total rainfall ranges from about 336 to 560 mm per year, and is concentrated in the rainy season from June to September.
- 4.5 Wind data are available from the airport at *Queretaro*, as well as from periodic observations at other stations. The *Queretaro* airport is located about 60 km from the Project site. Winds at the Project site are primarily from the northeast with speeds from about 1 to 3 meters per second (m/s). However, interviews with local residents indicate that periods of high wind speed may occur during the dry season, causing significant amounts of windblown dust.
- 4.6 A baseline air-quality sampling program was conducted by UNAM in January 1999. As verified during the site visit, the Project area is very remote and rural in nature. Major stationary sources of air pollution are not located in the Project area, and baseline levels are expected to reflect the rural setting. Sampling was conducted for NO_x, the pollutant of most significant concern for gas turbines.
- 4.7 An initial monitoring program obtained hourly average samples at the crossroads of Highway 57 and Highway 110. The closest source of significant emissions to the Project site is Highway 57. This sampling program indicated an hourly average value of NO₂ of about 0.01 parts per million (ppm), or about 21 micrograms per cubic meter (µg/m³).
- 4.8 Subsequent sampling (144 samples per week) was performed over three 1-week periods (August 19 through 25; September 16 through 22; and October 15 through 21) at three sites in the Project region (*San Luis de la Paz* Road Crossing at Highway 57; *San Luis de la Paz*; and *Covadonga*). The hourly average value from this sampling was 0.0053 ppm, or 11 µg/m³.
- 4.9 No sampling data exist for other pollutants. However, given the lack of major stationary sources in the area and observations during the site visit, it is expected that baseline levels are low. The environmental assessment prepared for CFE suggests baseline levels of SO₂ and particulate matter of about 25 and 20 µg/m³ for a 24-hour average. Based on the experience in other rural areas, these values are reasonable.
- 4.10 The existing conditions are well within Mexican ambient air quality standards. The Mexican standards are comparable to the standards of the United States Environmental Protection Agency (USEPA). Based on the comparison of the above standards with sampled and anticipated levels of air pollutants, the Project site has been determined to have good air quality.
- 4.11 The World Bank's Pollution Prevention and Abatement Handbook includes air quality guideline levels from several sources such as the World Health Organization and European Union. The existing air quality in the Project region meets all of these guideline levels. The Project region's air quality is not considered degraded, according to the World Bank guidelines.

Hydrology

- 4.12 The Project is located within a hydrological region known as the *Lerma-Santiago* Region. Within this region, the *Laja River* watershed and the sub-basin *Laja River - Peñuelitas* total an area of about 12,811 square kilometers (km²). The Lerma-Santiago region is bounded to the north by *Tamuín* basin C and the *Santa María Alto River* sub-basin of the *Pánuco* Region. There are no rivers or major streams within a 15-km radius from the site. Only intermittent surface drainages, arroyos, and several small man-made ponds are present, which contain water seasonally. The power plant site is located within an internally-draining basin. Local streams do not discharge their waters into the sea, lakes, or main regional rivers. During the rainy season, the runoff created by rainfall within the close system mostly evaporates. Because some of the streams direct their runoffs towards the low-lying areas such as the *Pozo Blanco* and *Laguna Seca* west of *San Luis de La Paz*, swamp lands are created during the rainy seasons.
- 4.13 Major groundwater resources are present in the region and are used extensively for agricultural, municipal, and domestic purposes. Information available from the INEGI (1983) and data compiled by the CNA indicate that some aquifers in the region are capable of producing up to 360 m³/hour of good-quality groundwater. Based on the 1983 regional data (UNAM, 1999), the groundwater levels within a 25-km radius from the site ranged from about 50 to 80 m below the ground surface. The water quality produced by the existing wells in the area was characterized as being “fresh to tolerable” in the MIA (UNAM). Since 1983, there have been large-scale declines in groundwater levels of 50 m or more in some areas within a 7-km radius from the site. The groundwater level declines have been caused by withdrawing groundwater from the aquifers at higher rates than the natural recharge rate.
- 4.14 According to the published reports (INEGI), the groundwater exploited in the region is of relative good quality, with tolerable total dissolved solids suitable for drinking purposes. However, the CNA has determined that well water is not authorized for industrial uses within the area around *San Luis de La Paz*. The Project site is located within the Valley of *San Luis de La Paz - Dolores Hidalgo* low lands of an internally-draining watershed. The valley is comprised mostly of non-consolidated alluvial and lacustrine deposits. Reportedly, the water table of the main aquifer in this valley is between about 5 and 90 m below ground surface. The local municipality has installed 6 to 7 active wells in the northern part of the town. According to JAPASP, the present volume of groundwater used by the municipality represents approximately 5% of the production of regional wells. The results of a physical-chemical analysis of the ground water performed by others (*Proyectos Antares, S.A. de C.V.*) indicated salinity values ranging from under 300 ppm to a little over 500 ppm. In the region, groundwater has been used mostly for agricultural, industrial, and domestic consumption (drinking water purposes).
- 4.15 The groundwater and hydrogeologic conditions beneath the Project site have not been thoroughly characterized. According to the information provided by the Sponsors, the CFE installed a well at the power site to a depth of about 300 m below grade. Reportedly, the CFE found only low-yielding water bearing zones in this well. However, no well logs, stratigraphic information, or geophysical logs of the CFE well have been provided. Nonetheless, based on the agricultural characteristics of the site vicinity and the existing groundwater supply wells noted above, it should be assumed that important groundwater resources may be present beneath the site.
- 4.16 Even though it may be possible to develop groundwater supplies within the site area, the Sponsors plan to use municipal sewage water as the source of process water for the power plant. This decision is also because of CNA’s restriction against groundwater use for industrial purposes. The Sponsors also plan to purchase and import potable water for domestic purposes.

The water will be delivered to the power plant by tanker trucks from a local water supply company.

Flora

- 4.17 The Project area is located within the *Floristic* Province of the Plateau, which extends from *Chihuahua and Coahuila to Jalisco and Michoacán* in the States of *Mexico, Tlaxcala, and Puebla*. The *Floristic* Province is characterized by prevailing vegetation composed of thickets and thorny forest as well as pasturelands. Natural vegetation is scattered throughout the area. According to UNAM (1999) and INEGI, thorny thickets along with other kinds of vegetation were reported in the area. However, the Sponsors indicated that the different types of vegetation recorded by the INEGI could not be recognized. The thorny thicket found in the area was an open community with scarce herbaceous stratum, which was located in altitudes varying from about 1,985 to 2,300 m above sea level.
- 4.18 The power plant site is covered by up to 86% pasturelands and 14% thorny thickets. The pasturelands occupy a portion of the land used primarily for irrigated agriculture. The thorny thicket portion is part of a continuous area of thick growth over the *Los Cerritos*. Some specimens of isolated pettifoeger (*Acacia Farnesiana*) were found in the area, an evidence of the thicket that existed in the area prior to the development of agriculture. The species present at the terrain include *Brachiaria*, *Bouteloua*, and *Muhlenbergia*. Some isolated specimens of *Acacia Farnesiana* were observed at the site boundaries. There are pasturelands west from *San Luis de la Paz* which were devoted to the growing of bovine and equine livestock. The main grass species is *Brachiaria Meziana*.
- 4.19 Oak forests (*Quercus*) are vegetal communities quite characteristic of Mexican hilly areas. The remainders of the oak forests that were previously mapped by INEGI (1973) in the northern and eastern sides of the *Quijay* hills do not exist any more. ERM reported that some temporary surface water bodies in the area include species such as *Klemna gibba* (water lentil) and *Marsilea Mexicana* (water fern).

Fauna

- 4.20 The wildlife found in the Project area (UNAM, 1999), includes insects, amphibians and reptiles, birds, mammals, and fish. Because such wildlife is typical of semi-arid environments and cultivated areas, the original ecosystem has already been altered. Specific use for the reported fauna was not noted, except for occasional utilization of rabbit (*Sylvilagus Audubonii*) for food and ornamental use of the hide.
- 4.21 The species subject to conservation as listed in Table 4-1 were recorded in the Project area. The power plant site is used for animal grazing. There are no endangered, threatened, or rare species that are subject to special protection under NOM-059-ECOL-1994 at the site.

Geology and Seismicity

- 4.22 The Project area is located in the Physiographic Province of the Tectonic basins, which is characterized by the presence of basaltic flows, volcanoes, and lakes. The mountains were formed by rhyolites and andesites topped by basalt and the valleys were filled with fluvial material eroded from the mountain ranges.

- 4.23 Volcanic and sedimentary rocks outcrop in the region of the *Laguna Seca* basin. The ages of the formation range from Triassic-Jurassic to Quaternary. The oldest formations in the Project area are composed of Triassic-Jurassic-aged schist outcropping at a hill known as the *El Guajolote* south of the Project site. The top of the *El Guajolote* hill is at an elevation of about 2,400 m above sea level.
- 4.24 Cretaceous-aged limestone of the *El Doctor* formation outcrops the *Mineral de Pozos* area south of *San Luis de la Paz*. The *El Doctor* formation is comprised of gray limestone with interbedded layers of red and ochre limonite. Tertiary-aged andesite rocks lie discordantly on the Cretaceous-aged calcareous rocks to the southwest of *Mineral de Pozos* and on the southern portion of the *El Guajolote* hill west of *San José Iturbide*. These volcanic rocks are dark gray and reddish, tilted and compact, and partially weathered. The outcrops are reduced, covered by the thick Middle-Superior Tertiary volcanic and sedimentary deposits.
- 4.25 Tertiary-Quaternary fluvial and predominantly lacustrine deposits fill the wide valleys in the western portion of the *Laguna Seca* area. These deposits are comprised of sandstone and relatively cemented conglomerates, in transition to interbedded light-gray-colored silt and clay, in almost horizontal, well stratified thin layers.
- 4.26 A detailed evaluation of the geologic hazards at the site is not available. Typical geological hazards that should be evaluated include issues such as surface faulting, subsidence of the land due to groundwater withdrawal and seismic shaking, liquefaction during strong ground motion events, etc. According to the Sponsors, the EPC Contractor has commissioned a geotechnical investigation at the STP site and along the pipeline corridor. The results of these investigations are not available for review at this time. According to the CFE, the power plant and STP sites are located within a seismic zone with intermediate seismic risk (Zone B) and ground peak acceleration is not expected to exceed 0.25g.

Noise

- 4.27 The Sponsors contracted for a brief initial survey of the background noise levels at the power plant site for the Sponsors on August 3, 1999, and obtained subsequent readings on September 30, 1999. The purpose of the noise survey was to measure the existing sound level at the power plant site prior to its construction. ERM has indicated that the procedures described in NOM-081-ECOL-1994 were followed during the noise surveying.
- 4.28 A total of 5 measuring locations, including nearby residences, were selected around the site. A Lucas Instruments sound level meter (Model CEL-254) was used for the measurements. The sound level meter was located at a height of 1.2 m above the ground level. A total of 35 readings were obtained at each measuring point at intervals of 5 seconds. The sound level meter was calibrated before each new measuring point and at the conclusion of the survey. Based on the limited baseline noise measurements, the sound level exceeded 50% of the measurement period (L_{50}) is the most appropriate descriptor of the existing ambient noise level. The background noise levels (L_{50}) were calculated in accordance with the equations provided in NOM-081-ECOL-1994.
- 4.29 The results of the noise survey indicate that the average ambient noise levels at the residential locations near the power plant during the late afternoon and early evening hours were about 40 dBA. The primary source of noise was Highway 57 located 3 km to the east of the site.

Agriculture

- 4.30 *San Luis de La Paz* is the leading producer of asparagus in the State of *Guanajuato* with 4,206 hectares, and the third leading producer of alfalfa with 249,374 hectares. Other important products cultivated in the municipality include beans (5,782 hectares), broccoli (6,964 hectares), green chili (10,146 hectares), and garlic (1,401 hectares). The power plant site does not have any agricultural activities; sheep grazing is the only activity at the present time.

Archeology and Cultural Heritages

- 4.31 The power plant site and its surrounding areas are free of remains of archeological importance. No significant cultural resources are known to exist at the Project site.

Transportation

- 4.32 Highway 57 and Highway 110 are the primary transportation routes in the Project area. Access to the power plant site is provided via dirt roads at the present time.

Visual Resources

- 4.33 The power plant site is located in a generally flat area. Agricultural and grazing activities around the power plant site can be observed from many locations, including Highway 57 (about 3 km to the east). The site location is shielded from direct view in some directions at the *Los Cerritos* hills.

4.2 Social-Economic

Location and Setting

- 4.34 The ethnic origin of the Project area is the territorial setting of the *Chichimeca*. The *Chichimeca* people are located predominantly in the community called "*Misión de Chichimecas*". The *Chichimeca* population is about 3,000. The *Misión* is located in *Sierra Gorda*, approximately 2 km north of the town of *San Luis de la Paz* and about 13 km from the power plant site.
- 4.35 Historically, the town of *San Luis de la Paz* has a rich tradition and pride in its people, churches, and the beauty of its landscape. The municipality of *San Luis de la Paz* is divided into two main areas by Highway 57. The power plant site is located south of the area locally known as *Los Cerritos*. The land near the power plant site does not have recreation areas, historical monuments, or prehistoric cultural assets.

Demographics and Indigenous People

- 4.36 *Guanajuato* has a population of 440,568. The municipality of *San Luis de la Paz* reports a total population of 90,441, with approximately 50,000 residents in the municipal capital. The average age of the municipality's inhabitants is under 17 years old. Only 3,818 people are over 65.
- 4.37 Within the *San Luis de la Paz* municipality, there are approximately 500 human settlements, with 309 (about 61%) with a population of less than 50 people. With the exception of the municipal capital, the remaining settlements have populations of less than 1,000. There are 15,394 dwellings in the municipality containing an average of six persons per household. About 11,355 houses have piped water supply, 8,148 are connected to sewers, and 11,755 have electricity supply. *Los Cerritos*, the area adjacent to where the Project is located, has approximately a dozen homes and a population of less than 50 people. Public services are limited to electricity.

As is common in rural areas, drinking water comes from wells, sanitary wastes are disposed of to cesspools or pits, and solid wastes are burned or buried.

- 4.38 The people who identify themselves as *Chichimecas* are located in a village inhabited by approximately 3,000 people in 433 dwellings called *Misión de Chichimecas I and II* which is located a few kilometers to the east of San Luis de la Paz. The mission's lands are an *ejido*, which are protected and cannot be sold. It is traversed by the *Victoria-Real de Pozos* Highway, and is located within the geographical area of *Sierra Gorda* within the municipality of *San Luis de la Paz*. It is estimated that around 2,000 of the inhabitants speak the *Chichimeca* idiom, but that all speak Spanish outside the mission. From a welfare standpoint, the *Chichimecas* are very poor, although the state provides basic medical and educational services. Culturally, they are threatened by loss of traditional values due to a paucity of economic resources to support cultural institutions.
- 4.39 The principal economic activity of the *Chichimecas* is farming, both on *ejido* lands and as day-laborers on lands elsewhere in the vicinity. Approximately 2,000 members of the mission work as *jornaleros* for outside landowners, who employ them for various periods of time, depending on seasonal factors. Their daily wages range from 45 to 60 pesos (*Mexicanos*) per day, as compared to the average wage of 60 pesos per day for non-mission agricultural laborers.
- 4.40 Recognizing the importance of assessing the impact of the Project on indigenous peoples, the Sponsors had prepared two studies of the *Chichimecas* and the *Misión Jonaz*. The first study, entitled "Social Impact of the InterGen Power Plant in the *Chichimeca Jonaz Misión in San Luis de la Paz, Guanajuato, Mexico*" and prepared by the Sponsors in September 1999, consists of a compilation of demographic, socio-cultural and survey information (including excellent maps and photographs) about the mission, as well as a preliminary assessment of socio-economic effects of the Project. This report was based upon field work, quantitative and qualitative research, and interviews with local, state and national government agencies concerned with indigenous peoples. It provides details about the location, land tenure status, history and culture, health care and community infrastructure, and income and economic characteristics of the *Chichimecas* and the *Misión*.
- 4.41 The second report, entitled "An Assessment of the Potential Environmental and Socioeconomic Effects of InterGen's *Azteca VIII Power Plant on the Chichimeca Jonaz Misión in San Luis de La Paz, Guanajuato, Mexico* (Update)" and prepared by InterGen in October 1999, provides a more detailed analysis of potential environmental and social effects of the Project together with an outline of the impact mitigation strategy the Sponsors propose to follow. The supplementary study updates and expands on information regarding employment practices and welfare conditions among *Misión* residents, providing additional insights into the relationship of the Project to the *Chichimeca* community.

Economic Activity

- 4.42 *San Luis de la Paz* was a rich mining location. With the decline of the mining activity, it has shifted its economic activity to light industry and commerce, while specialty crop agriculture and cattle raising predominate in rural areas. There are no recent detailed statistical data available on employment and occupations in the *San Luis de la Paz* municipality, but aggregated statewide data from the 1999 edition of Statistical Yearbook of the State of *Guanajuato* (*Anuario Estadístico del Estado de Guanajuato*, edición 1999) by INEGI provide some indication of economic conditions in the Project region. The economy in the State of *Guanajuato* is heavily agricultural, as revealed by a comparison of the composition of the state's sectoral economic

output with that of the entire nation. In 1996, *Guanajuato* accounted for 3.38% of the nation's Gross Domestic Product (GDP), but it provided a larger percentage (4.83%) of the nation's agricultural output. In the areas of mining, manufacturing, public utilities, commerce, and public and private services, on the other hand, the state's percentage shares were less than the overall 3.38% share of the national GDP. Only in the areas of construction and transportation (apart from agriculture) did *Guanajuato* produce relatively larger proportions of output than the state's overall share of the national GDP (4.07% and 4.47%, respectively).

- 4.43 Of interest to the analysis of the potential impacts of the *Bajío* Project on the residents of the area is an appraisal of the ability of the area to supply skilled construction labor and building materials. The construction sector registered 584 licensed construction establishments statewide in 1998, employing a total of 10,376 workers. The average wage in that year was about 20,684 pesos per worker. However, most of the construction work (about 89%) was performed by small operators. Eight to nine percent of the establishments were classified as "micro" (annual value of production less than 4.12 million pesos), and they employed 70% of the construction workforce. There were only eight "gigantic" establishments (greater than 41.7 million pesos per year). A total of 892 workers were employed. The main areas of activity were construction of houses, buildings, and highways.
- 4.44 With respect to manufacturing activity, *Guanajuato* is oriented mainly towards processing of foodstuffs (cereals and animal products), and manufacturing of textiles, chemicals, and mineral products. Wood and paper products, basic metal products and machinery and electrical equipment accounted for less than one-fourth (24.4%) of the value of total manufacturing output in 1996.
- 4.45 The foregoing data suggest that the proposed power plant would have to rely to a considerable extent on non-local sources (i.e., workers and suppliers from outside *Guanajuato* State) for its manpower and materials requirements.

Agriculture

- 4.46 As stated previously, *San Luis de la Paz* is the first in asparagus production and third in alfalfa production in Mexico. Other important products cultivated in the municipality include beans, broccoli, green chili, and garlic.

Cattle

- 4.47 In terms of value contribution to Gross State Product, cattle raising is not a major contributor to the economy of *Guanajuato*, but it and other agricultural activities employ a significant percentage of the workforce. *San Luis de la Paz* has the third largest cattle population in the state (41,843 head). It is second in ovine population (41,467 head), and first in domestic fowl population (2,544,264 head).

Industry

- 4.48 In *San Luis de la Paz*, there are dress manufacturing workshops where acrylic fiber, wool and cotton are widely used. There are also dehydrators of farming products, wine and brandy distillers, soap and craftsmanship factories, and mineral working on a small scale.

Commerce

- 4.49 There are 1,723 employees working in the municipality of *San Luis de la Paz* at 944 commercial establishments (not including public or private personal services) such as drugstores, stationary shops, paint shops, hardware stores, ice shops, furniture shops, clothing and shoe stores, grocery stores, among others. There are two public markets, one slaughterhouse, and a receiving center of basic foodstuffs. Street vendors are numerous and are principally located in the Town Hall Square. There are also 33 stores for low-income families.

Tourism

- 4.50 Tourism is not an important economic activity in this municipality. In *San Luis de la Paz*, the 1996 economic census listed 109 transient rooms distributed among one three-star hotel (with 28 rooms) and four "other" establishments with 81 rooms classified as guest rooms, *cabañas*, or extensions to private domiciles.

5.0 ENVIRONMENTAL AND SOCIAL IMPACTS

- 5.1 As with any project of this type, the *Bajío* Project will have both positive and negative impacts on the physical, biological, and human environment. Potential negative impacts associated with the construction and operation phases of the Project are presented in sections 5.1 and 5.2 respectively. Potential positive impacts (benefits) associated with the Project are presented in Section 5.3. The proposed mitigation measures for these Project impacts are discussed in Section 6.

5.1 Construction Phase

- 5.2 Construction of the *Bajío* Project is estimated to extend over two years. Primary potential negative impacts during construction include: 1) changes in topography due to site preparation and excavation; 2) generation of dust, waste, and wastewater, etc; 3) increases in noise and traffic level and 4) indirect social impacts relating to demands on employment, lodging, eating, public safety, and health services due to an influx of jobseekers attracted by the Project. These construction-related impacts have been evaluated and are considered mitigable.

5.1.1 Environmental

Soils and Geological Features

- 5.3 The Sponsors plan to incorporate a drainage system to protect the power plant site from potential flooding in a 1-in-10-year storm event. With this provision for controlling heavy rainfall, significant impacts of flooding due to the assumed storm event are not expected.
- 5.4 Construction activities can potentially alter the soil physical make-up by either compacting the soils or by changing the surface topography. The potential for such impacts on soils largely depends upon the management and practices of the construction site and activities. Assuming that the EPC Contractor will implement the mitigation measures to protect surficial materials during construction (see Section 6.1), the impacts on soils and geological features due to construction of the Project are considered minimal.
- 5.5 The Sponsors and the EPC Contractor will design and construct the Project in accordance with the CFE Seismic Code (i.e., following the criteria of "Zone B, Class A Structures" for the Project). Significant environmental impacts on the proposed structures resulting from potential

seismic activities are not expected. However, additional studies for determining site-specific ground motion characteristics (see Section 8) would be beneficial in assessing various levels of seismic risk for the Project.

Air Quality

- 5.6 During construction of the power plant, temporary impacts to air quality will occur from exhaust emissions from vehicles and construction equipment, and from fugitive dust. Construction activities that may result in fugitive dust emissions include the following:
- earthmoving operations during site clearing and grading;
 - construction vehicle movements over cleared land;
 - stockpiling of earth and materials; and
 - blow-off and spillage from vehicles during import of construction materials and export of surplus materials from the site.
- 5.7 The receptors that are sensitive to dust emissions are those located at a close distance to the construction boundary. The available information indicates that such potential receptors would include a property (with a family of 9 persons) at a distance of about 240 m to the east, a second property (with a family of 6 persons) at a distance of about 390 m to the southeast, and a third property (with one family of about 15 persons) at a distance of about 500 m to the north. Fugitive dust emissions are variable in nature and are primarily influenced by the moisture of the material and wind speed. Wind speed in the project area averages about 1 to 3 meters per second (m/s), although stronger wind speeds are expected to occur frequently. At speeds greater than 3 m/s, significant fugitive dust may be generated. Given that construction activities will be spread over the site, that the distances to the nearby residences are relatively high, and that the Sponsors and the EPC Contractor plan to implement measures to minimize dust emissions (see Section 6), fugitive dust during construction is not expected to have significant impacts on ambient air quality.
- 5.8 Because there are no residential dwellings along the alignment of the access road, the impact of dust emissions from construction of the access road on sensitive receptors is considered to be minimal. Furthermore, the primary transport activity on the access road will be the movement of construction workers and materials. The Sponsors plan to pave the existing dirt road. Once upgraded, the dust that may be generated from the dirt road would be minimized.

Water Quality

- 5.9 Because there are no surface water bodies in the immediate vicinity of the power plant and the access road, the impacts on surface water during construction are minimal. Because the reported depth to water table at the power plant site was greater than 300 m from the ground surface, significant impacts on groundwater resources during construction are not expected.
- 5.10 The STP site is surrounded by agricultural fields and has intermittent surface waters. Therefore, there is a potential impact on surface water and groundwater at the STP site. It is likely that natural drainage may be slightly altered and/or interfered as a result of clearance activities and upgrading of the existing dirt road. This may lead to an increased sediment load into the existing drainage courses; however, considering that the STP site is relatively level and the Project region has a relatively low rainfall, the potential for increasing sediment load into the drainage paths would be small. There is some potential for water infiltration during rainstorms.

Flora and Fauna

- 5.11 Reportedly, the Project site and the immediate surrounding areas have little ecological value. Construction of the Project will not result in loss of flora and species of fauna that are subject to conservation regulations. Because the construction activities will be limited to the Project site, disturbances to regional flora and fauna beyond the limits of the project sites are not likely. Therefore, no significant impacts on offsite flora and fauna are anticipated.

Noise

- 5.12 Operation of heavy machinery and equipment during construction will cause an increase in noise level in the Project area. Routine construction noise is likely to be audible at houses in the nearby *Los Cerritos* area. Because the increase in noise level due to construction activities is temporary, the impact is not expected to be significant as long as reasonable measures (such as mufflers on all motorized vehicles, limitations on noisy nighttime work, etc.) are taken to control construction noise. During construction of lineal facilities (e.g., pipelines and access roads), an increase in a local noise environment will also occur. Such increases will last from a few days to a few weeks only at any one location and thus will not cause permanent or extended adverse noise effects.

Traffic Conditions

- 5.13 The potential impacts on traffic conditions during construction are expected to take place during the short period of peak construction. The EPC Contractor plans to carry out the construction work in three shifts: 08:00 to 16:00 hours; 16:00 to 24:00 hours; and 24:00 to 08:00 hours. The Sponsors have estimated the numbers of heavy goods vehicles and construction workers required during construction of the Project. It appears that there will be some, although likely limited, impact on the traffic conditions on local roads. The Sponsors and the EPC Contractor will implement measures during construction (see Section 6) to minimize the potential negative impacts.

Archeological, Historic and Cultural Heritages

- 5.14 The EHSA report and other available information (i.e. the INAH Letter, dated October 11, 1999) do not identify any archaeological, historic, or cultural remains on the Project site. However, the Sponsors have not ruled out the possibility that remains of archaeological, historic, or cultural importance might be encountered during construction. As such, the Sponsors and the EPC Contractor have developed a plan to address this issue (see Section 6). Assuming that the EPC Contractor will implement the mitigation measures during construction, there will be no significant impacts on known or potential archaeological, historic or cultural resources.

Occupational Health and Safety

- 5.15 Occupational hazards will exist during construction of the plant. The critical safety issues during construction include: transportation of equipment and materials to and within the site; handling and storage of materials on site; crane and other heavy equipment operation; work on scaffolding, platforms and other work at height; hot work such as welding; excavations and trenching; confined space work; working with and around electrical, hydraulic and other energized systems; and potential for fires, explosions, spills and other emergencies. Occupational health concerns during construction include exposure to chemicals (e.g., fuels, degreasers, welding fumes) and dusts (e.g., silica); exposure to noise and radiation; exposure to extreme temperatures; and general

sanitary conditions, including toilet facilities, showers, food preparation and eating facilities, and drinking water provisions. The EPC Contractor has developed a Construction Environmental Control Plan (CECP), an Environmental, Safety and Health Execution Plan, and an Environmental Management Plan for the Project (see Section 6 for details) which summarize the environmental, health and safety measures that will be implemented during construction.

5.1.2 Social

- 5.16 An analysis of potential impacts on *San Luis de la Paz* resulting from construction of the power plant demonstrates that there will be no direct negative social impacts. However, it is likely that the Project will stimulate an influx of itinerant job seekers and other transients attracted to the area in hope of finding work or other income opportunities. These persons could impose a burden on households and public safety and other community service providers in their search for shelter, food, and other necessities that they may not have the money to pay for. See below for a further description of these potential impacts.
- 5.17 As part of the construction phase, numerous service and product procurement opportunities will be created. The EPC Contractor will seek out local suppliers and include them on a list of potential bidders. Appropriate notification of *San Luis de la Paz* officials will be made concerning the specific contracting opportunities. Local businesses will benefit from construction-related spending, which could encourage expansion of operation and employment to accommodate the increased demands. This may, however, attract further immigration to the community. However, as construction activities wind down, the expanded operation will have to be cut back as demand declines, thus imposing a transitory negative impact on local economy.
- 5.18 No settlements, whether legal or illegal, have been recorded within the site perimeter. Sporadic grazing of sheep and goats occurs in certain areas at the site. These practices would be displaced by the construction of the power plant, but no significant impacts are expected because there is ample land beyond the site for grazing. There has been no intensive agriculture in the general vicinity of the Project site for several years due to wells having dried up.
- 5.19 There will be no unmitigable social impacts on the land adjacent to the site (e.g., *Los Cerritos*) during construction. The EPC Contractor, through its various construction plans, will take steps to minimize and/or mitigate the impacts (e.g., dust control measures, noise control measures, nighttime visual effects, etc.) on adjacent neighbors. The access road to the power plant, which will be used during construction and operation, does not pass or bisect the *Los Cerritos* area. The Sponsors will take mitigating measures (see Section 6) in connection with ameliorating the foregoing impacts on the physical environment.

Worker Hiring

- 5.20 An indirect socioeconomic impact on *San Luis de la Paz* during construction, will be the number and source of the work force to be employed during the construction period. Since each construction stage will have varying work force requirements (i.e., by number and skill), the potential socioeconomic impact of those workers on the municipality will also vary during construction. The EPC Contractor has determined the labor requirements for the Project and furthermore has estimated the likely number of workers residing within daily commuting distance who could be hired (Table 5-1). Top priority will be given to maximizing the number of local hires, but limits are imposed by the skills available among the local labor force. It should be noted that the “daily commuting distance” (or “local area” as indicated in Table 5-1) is referenced by the Sponsors as the radius of one to one and one-half hours of driving time (each way) from

the Project site, assuming uniform road conditions. As shown in Table 5-1, the EPC Contractor plans to utilize 70% of the work force from the local hires in the first half of Year 2000 (first and second quarters). The local hires will become 60% for the remainder of Year 2000. For Year 2001, the percentages of local hires will be between 50% and 60%.

- 5.21 The EPC Contractor has determined that the ratio of skilled vs. unskilled workers in the composition of work crews ranges from 40% to 60% in the civil areas, and 45% to 55% in some of the electrical and mechanical areas. The current plans, subject to ratification of the collective bargaining agreement with the *Sindicato Unico de Trabajadores Electricos de la Republica Mexicana* ("Sole Syndicate of Electrical Workers of the Mexican Republic –SUTERM"), are to recruit the unskilled labor locally. Under the agreement, SUTERM would have final authority for qualifying workers to be hired. Also, some possible pre-hire training programs are being planned for the mechanical, piping, and electrical areas in order to upgrade skills for those workers who will be recruited as helpers (*ayudantes*). The initial civil phase will include a significantly higher percentage of local hires, given the nature of the work and the availability of general construction workers in the area. A breakdown of the quarterly construction phase hiring projected by the EPC Contractor is presented in Table 5-1.
- 5.22 Based on the studies conducted by the EPC Contractor, it is expected that the Contractor will be able to attract some skilled as well as unskilled labor from *San Luis de la Paz*, with the remainder coming from surrounding areas like *San José Iturbide*, *Dolores Hidalgo*, *Queretaro*, and *San Luis Potosí*. The EPC Contractor has developed a multi-point strategy to optimize hiring of locals, including collaboration with local labor and civic authorities to inform the public and identify recruiting candidates, utilizing job bank services in neighboring municipalities, and coordinating with SUTERM. This program has already been put into action.

Housing

- 5.23 Given the projected high content of local hires (i.e., workers living within daily commuting distance) anticipated for the civil construction portion of the Project and the availability of labor both within *San Luis de la Paz* and the surrounding areas (70% local hire as shown in Table 5-1), the first six months of Year 2000 should not require provision of new worker housing for the Project. However, some existing transient lodging will need to be found outside the immediate *San Luis de la Paz* area to accommodate the relatively small number of non-local hires that will be recruited during the first six months. *San Luis de la Paz* does not have adequate hotel facilities for the numbers of skilled craftsmen that would be relocating to the area. Local authorities have offered to initiate an effort to obtain rooms to rent to non-local construction workers, but the total amount of transient room space in *San Luis de la Paz* will not be known until early Year 2000. For that reason, the EPC Contractor and SUTERM will seek housing in towns within commuting distance of the site (e.g., *San José Iturbide*, *Dolores Hidalgo*, *Queretaro*, *San Luis Potosí* and other towns). A combination of existing public transportation and the use of dedicated buses will be used to transport workers from these towns. For this purpose, the CFE and SUTERM have offered to provide the names of transportation companies with proven safety records that have been used on previous large construction projects.
- 5.24 Towards the end of the near-term (6 to 9 months) civil construction period, the EPC Contractor and SUTERM will determine whether regional housing facilities are adequate to accommodate the higher numbers of non-local workers that will be on the job in late Year 2000 (40% non-local work force) and the first half of Year 2001 (45% non-local work force). If they do not appear to be adequate, the Sponsors are prepared to explore such options as constructing a work camp near the Project site, and/or supporting expansion of the existing housing in nearby communities.

Chichimeca Jonaz Misión

- 5.25 While the construction of the Project will not have a direct negative impact on the *Chichimeca* community, there is some potential for an adverse indirect effect on the cultural values of the *Chichimeca Jonaz Misión*, especially related to the operations of the Project (see paragraph 5.92 for a complete description related to this issue).

5.2 Operation Phase

- 5.26 The principal negative impacts associated with operations and maintenance of the power plant include: effects on air quality; impacts due to increase in noise level; impacts from wastewater discharge; and impacts on local population. These impacts have been evaluated as described in the following sections. The Sponsors and the Project Company have prepared mitigation measures (see Section 6) to address and mitigate these impacts.

Impacts on Air Quality Associated with Plant Operations

- 5.27 During operation, the primary sources of air pollutants will be the turbine stacks. Use of dry cooling will eliminate particulate matter emissions associated with cooling towers. The Mexican Government regulates both stack emissions and ambient concentrations. Similarly, the World Bank and the Ex-Im Bank have both emissions standards. Table 5-2 presents the proposed Project emission rates (for each turbine) compared to the Mexican, World Bank and Ex-Im Bank emissions standards. The proposed design maximum emission rates will comply with the Mexican, World Bank, and Ex-Im Bank emission standards.
- 5.28 The Sponsors propose to control SO₂ by using natural gas as the primary fuel and by limiting the sulfur content of the diesel fuel to 0.5 percent by weight. Use of 0.5 percent sulfur fuel would reduce actual SO₂ emissions to about 7.5 tons per day, in compliance with the standards. The use of diesel fuel is to be used only in emergencies (i.e., maximum of 15 days per year, maximum of 10 continuous days).
- 5.29 While the data provided by the Sponsors list a design SO₂ limit of 2,000 milligrams per cubic meter (mg/m³) for both natural gas and diesel, SO₂ emissions for natural gas are expected to be much lower. The emissions of NO_x during gas firing will be controlled by low-NO_x combustor design to a level of 25 ppm. In addition, water injection is proposed for periods when using diesel fuel to reduce emissions to a level of 55 ppm.

Dispersion Model

- 5.30 Increases in concentration from a proposed source are typically estimated using dispersion models. Dispersion models require source information, emission estimates, meteorological data and receptor locations.
- 5.31 Source information consists of stack height, stack diameter, exit temperature, exit flow rate and information regarding the dimensions of nearby structures. The stack characteristics play a major role in determining the plume characteristics, such as the final plume height. The dimensions of nearby structures determine whether or not building wake effects will lead to plume downwash. Project operation includes three stacks of 40 m height and 6.1 m diameter.

- 5.32 Regarding emissions information, the Sponsors provided estimates of emissions for both natural gas and diesel fuel combustion. These estimates are based on performance data provided by the turbine supplier (General Electric). These values are representative of operation at 50% to 100% load conditions. In addition to the criteria pollutants (pollutants for which there are ambient standards), use of diesel fuel may result in emissions of metals. Based on the USEPA “Compilation of Air Pollutant Emission Factors, AP-42”, these may include arsenic, cadmium and chromium. However, the ash content of the proposed fuel is relatively low, and these emissions are not anticipated to be significant.
- 5.33 Meteorological data are not available in the immediate site vicinity. Data are available for the *Queretaro* airport located about 60 km from the site. However, there is uncertainty about the applicability of these data to the Project site. In addition, the data does not include observations during the nighttime hours. Therefore, dispersion modeling was based on an assumed set of worst-case meteorological conditions. These conditions are recommended by the USEPA for cases where actual hourly data are not available and cover a wide range of wind speed, wind direction and atmospheric stability conditions. While the worst-case hourly data set can provide conservative short-term predictions, it is helpful to also evaluate predicted impacts based on observed hourly data, even in the case where the data set is somewhat remote from the actual Project location. For this purpose, the Sponsors have used the data from *Leon*, Mexico. Both the worst-case and the *Leon* data sets were used for the modeling.
- 5.34 The models produce predictions of concentration at specific locations, known as receptors. The receptor coverage used in the dispersion modeling consisted of a grid, centered on the proposed power plant, extending out to 10 km. A grid spacing of 100-m was used. This grid spacing is adequate to ensure that the point of maximum impact has been included in the modeling.
- 5.35 The USEPA Industrial Source Complex (ISC) dispersion model was used to estimate ambient air quality based upon the Project data (i.e., source, emissions, meteorology, and receptor data). ISC is a Gaussian dispersion model designed to estimate the impact of point and area sources such as power plants. Based on model validation studies, ISC is expected to produce conservative estimates of concentration increases. The model assumes that atmospheric conditions are constant (steady state) over each hourly period for which impacts are simulated, and includes algorithms to simulate plume rise, plume dispersion and transport, and plume impaction on areas of elevated terrain.
- 5.36 Potential impacts of plume downwash were considered by using the USEPA Building Profile Input Program (BPIP). The primary structures that may lead to plume downwash are the air cooling condensers and the HRSG structures.
- 5.37 Each discrete combination of wind speed, wind direction and atmospheric stability was simulated for the worst-case short-term impact in order to produce a prediction of the one-hour average concentration increase at each receptor point. For longer averaging periods, impacts were estimated by applying ratios suggested by the USEPA. For example, the 24-hour average is estimated by multiplying the one-hour average by a factor of 0.4. These factors are designed to simulate the persistence of any given meteorological condition. The annual average concentration increases were estimated by applying the USEPA factor of 0.08 to the one-hour maximum. The eight-hour concentrations were assumed to be equal to the one-hour concentrations (i.e., assuming eight-hour persistence of the worst-case meteorological conditions).
- 5.38 The *Leon* data set is sequential in nature. That is, the data is provided in the form of hourly

average conditions. The ISCST model predicts a concentration increase for each hour and then averages these predictions for each selected averaging period (e.g., 24-hour, annual, etc.).

Dispersion Model Results

- 5.39 The one-hour maximum impacts were predicted to occur at a location 150 m downwind of the stacks. The maximum concentration results from building downwash under high wind speed (15 m/s), neutral stability conditions. Given the lack of actual meteorological data for the site, the possible occurrence of such high wind speed conditions for very short-term periods (i.e., one-hour) can not be ruled out. However, the magnitude of the model predictions decreases as wind speed decreases, as shown in Table 5-2 for NO_x . A similar pattern exists for other pollutants. Model values are also greatly reduced for directions not subject to building downwash. It should be noted that the available observations indicate that the worst-case wind speed of 15 m/s occurs very rarely (on the order of 2 to 20 hours per year). The probability of this condition occurring at the same time as high levels of emissions from the power plant (such as diesel fuel use) is considered to be very low.
- 5.40 The actual magnitude of the concentration increase for NO_2 will depend on the conversion of NO to NO_2 . The emissions from the turbine are primarily in the form of NO, with only a fraction directly emitted as NO_2 . The amount of conversion of NO to NO_2 depends upon several variables, including the amount of ozone available to react with the NO to form NO_2 . The USEPA refers to this conversion as being “Ozone limited”. While ozone levels are expected to be relatively low in the Project area, no data exists to determine a site-specific conversion ratio. However, significant research has been done specific to the rate of NO to NO_2 conversion in power plant plumes shows that conversion rates in cases where impacts occur close to the stack (so that plume travel time is short) are less than 0.5 (e.g., 50 percent). The conversion rates reported in the literature for short-term time periods range from 0.1 to 0.5. For annual averages, the literature shows that the NO to NO_2 conversion reaches equilibrium at a conversion ranging from 0.75 to 1.0. This is consistent with the USEPA guidelines on the use of Applied Ratios for NO to NO_2 conversion. Based on this, an NO to NO_2 conversion rate of 0.5 was used for one- and 24-hour averaging periods, and a rate of 1.0 was used for annual averages. These assumptions are conservative and will result in over predictions of impact.
- 5.41 Table 5-2 presents the results of the modeling for both natural gas and diesel fuel based on the worst-case data and the *Leon* data set. Isopleth figures of the worst-case concentration increases are presented in Figure 5-1 to 5-5.
- 5.42 The screening modeling using the worst-case data predicts a maximum one-hour concentration increase of NO_x of $682 \mu\text{g}/\text{m}^3$ for natural gas and $1,312 \mu\text{g}/\text{m}^3$ under diesel oil firing, for a wind speed of 15 m/s. Based on a conversion rate of 50 percent, the NO_2 concentration increases under gas and oil would be $341 \mu\text{g}/\text{m}^3$ and $656 \mu\text{g}/\text{m}^3$. Under a 10 m/s wind speed with a 50 percent conversion rate, the predicted increase for gas would be $306 \mu\text{g}/\text{m}^3$ for gas and $503 \mu\text{g}/\text{m}^3$ for diesel. The *Leon* data predict a maximum one-hour increase of $395 \mu\text{g}/\text{m}^3$ for gas and $490 \mu\text{g}/\text{m}^3$ for diesel.
- 5.43 The predicted concentrations under the worst-case meteorological conditions with diesel firing would exceed the one-hour Mexican standard. However, in order for a violation to occur, the adverse meteorological conditions would need to coincide with the combustion of diesel fuel. As discussed above, the probability of these conditions coinciding is not considered significant.

When more probable conditions are considered, the Project is expected to comply with the Mexican short term standard.

- 5.44 For predicting 24-hour increases, the assumption of a 15-m/s wind speed persisting for over 9 out of 24 hours (the 0.4 persistence factor) is unreasonable, based on a review of the *Queretaro* and *Leon* data. The assumption of a 10 m/s wind speed can not be ruled out, so this meteorological condition was assumed for the 24-hour concentration prediction. The one-hour concentration increase of NO_x under a 10 m/s condition is predicted by the screening model to be 611 µg/m³ under natural gas and 1,007 µg/m³ under diesel firing. Applying a 50 percent conversion factor and the USEPA factor of 0.4 (to convert a one-hour value to a 24-hour value) yields predicted NO₂ concentration increases of 122 µg/m³ for natural gas and 201 µg/m³ for diesel. The 24-hour values predicted using the *Leon* data set and a 50% conversion rate are 51 µg/m³ for gas and 78 µg/m³ for diesel.
- 5.45 Annual average concentrations from the worse-case data set were predicted based on an assumption of 100 percent conversion to NO₂ and average wind speed conditions of 5 m/s. This is expected to be conservative, as the annual average wind speeds in the area appear to be 1 to 3 m/s. The screening modeling predicts concentration increases of 0.3 µg/m³ for natural gas. Continuous firing of diesel for a one-year period is not proposed, and no annual average was calculated. The annual average from the *Leon* data predicts an increase of 6.6 µg/m³.
- 5.46 Emissions of SO₂ will only be significant over the short-term periods when diesel oil is fired. Using the same time averaging ratios as for NO₂, 24-hour SO₂ concentration increases for diesel fuel will be 825 µg/m³. The *Leon* data predicts an increase of 319 µg/m³. Thus, while the conservative worst-case data set predicts an exceedance of the Mexican standard, the use of the sequential data predicts compliance with the standard.
- 5.47 The ambient standards for CO apply only for short-term periods. The one-hour concentration was predicted using the same methods and assumptions as for NO_x. As a conservative assumption, the 1-hour and 8-hour concentration increases were assumed to be the same. The predicted increase is 193 µg/m³ for natural gas and 231 µg/m³ for diesel. The *Leon* data predicts an increase of 173 µg/m³ for natural gas and 207 µg/m³ for diesel fuel. These results predict compliance with the ambient standards.
- 5.48 All particulate emissions from the turbines were assumed to be in the form of PM₁₀. Twenty-four hour average concentration values were predicted using the same approach as for NO₂. The 24-hour concentration increase is 34 µg/m³ for natural gas and 56 µg/m³ for diesel. The annual average increase for natural gas is predicted to be 0.3 µg/m³. The modeling results predict compliance with the ambient standards.

Conclusions on Dispersion Modeling

- 5.49 The dispersion modeling predicts that the *Bajio* Project will comply with the Mexican ambient air quality standards for all pollutants under natural gas firing. However, the predicted 1-hour NO_x concentration will be over 85% of the standard, under the worst-case conditions. These conditions will occur on a rare basis in the Project area. During diesel fuel firing, a violation of the Mexican one-hour nitrogen dioxide standard is not expected, but can not be entirely ruled out. The worst-case data set predicts that the Project would also violate the 24-hour SO₂ standard during diesel firing. However, modeling with the *Leon* data predicts compliance with the

standard. The results represent reasonably conservative predictions of Project impacts to ambient air quality.

Uncertainties Associated with Modeling

- 5.50 The impact on air quality has been assessed using dispersion modeling in accordance with accepted scientific practices. The results indicate that the proposed Project will not lead to a violation of any applicable standards when firing natural gas. A violation of the short-term NO₂ standard is predicted during diesel fuel firing. Sources of uncertainties in dispersion models include the following, and are further discussed below:
- The basis of the model,
 - Source input data such as emission rates and stack parameters,
 - Meteorological data,
 - Background air quality data, and
 - Receptor locations.
- 5.51 The ISCST model is a Gaussian dispersion model determined by the USEPA to be a “Guideline Model”. As such it has received extensive peer review and application in the scientific community. ISCST is considered appropriate for the Project and has been applied in a manner consistent with current standards of scientific practice. Gaussian models are known to be conservative. That is, the models overpredict impacts in most cases. The USEPA studies have indicated this overprediction, when correlated in both space and time, to be from a factor of 2 to 10.
- 5.52 Source data may also induce uncertainty. In the case of the *Bajío* power plant, the Sponsors have provided source and emissions data, based on available facility design and information from similar facilities. Based on our experience, these data are reasonable. The percent conversion of NO to NO₂ has been estimated to be 50 percent. The range of conversion rates over short transport times has been reported to be 10 to 50 percent, thus adding to the conservative nature of the predictions.
- 5.53 Meteorological data are available from the *Queretaro* airport. However, the data may not be representative of the Project area, and there are significant data gaps. Because of these uncertainties, the Sponsors have chosen to base the modeling analysis on an assumed worst-case data set. This data set covers several combinations of atmospheric stability and wind speed, over a 360-degree wind direction range. Use of such a worst-case data set is considered conservative, and will add to the likelihood that the predictions represent overestimates. The Sponsors have also conducted modeling using the data from *Leon*, Mexico. While the data are not directly representative of site conditions, they are representative of regional flow patterns and are appropriate for use in modeling.
- 5.54 In order to predict total concentrations for comparison to standards and guidelines, model predicted concentrations must be added to the existing background levels. In the case of NO_x, SO₂, and CO, background levels have been estimated by sampling for NO₂ and by a review of the literature for other pollutants.
- 5.55 Receptors are those points where the model produces predictions of impacts. If the receptor grid has a very coarse spacing, the point of maximum impact may be missed. The Sponsors have

examined a detailed receptor grid with a 100-m spacing. This grid provides a high degree of certainty that the point of maximum model or estimated impact has been included.

Power Plant Wastewater

- 5.56 The Project will generate three types of wastewater discharges: industrial wastewater from the power plant processes, sanitary sewage from power plant personnel, and storm water. Further descriptions of the major waste streams are provided below.
- 5.57 **Demineralizer Regeneration Wastes.** The demineralizer regeneration process will include backwashing, regeneration with acid and caustic, and rinsing. This process is intermittent and the wastewater flows can be either acidic or caustic. These wastes will be drained into the chemical waste sump, and then pumped into a neutralization tank. The water in the tanks will be recirculated through a mixing system so that the contents of the tank will be completely neutralized. After the water has been mixed, the pH-value will be measured and either acid or caustic will be added to correct the pH-value to acceptable levels. These chemicals will be added in the recirculation line of waste neutralization pumps. The chemicals will be drawn from the acid and caustic injection skid of the demineralized water system. After the pH-value has been adjusted, the recirculating pumps will pump the neutralized water to the wastewater collection sump.
- 5.58 **Reverse-Osmosis Rejection Water.** The RO reject water, approximately 15 percent of the total feedwater that will be neutralized in line, will flow to a settling tank (to allow silica that may have precipitated to settle), and then to the combined wastewater collection sump. Settled silica will be transferred to the makeup water system sludge dewatering system.
- 5.59 **Gravity and Pressure Filter Backwash Water.** Filters will be backwashed as necessary. The frequency of intermittent backwashing will normally be once every 24 hours. These wastes will flow from the filtration units into a backwash waste collection sump and recycled upstream of the clarifier.
- 5.60 **Clarifier Sludge.** The sludge will be treated in the dewatering system consisting of a gravity thickener and a filter/belt press. The dried sludge will be tested to determine its analytical nature. If the test results indicate that the sludge is not a hazardous material, it will be trucked to an offsite licensed landfill for disposal. The filtrate will be recycled upstream of the clarifier. If the test results indicate that the dried sludge is hazardous in nature, it will be disposed of in an offsite, authorized hazardous waste facility.
- 5.61 **Plant Wash Water and Oil/water Separation.** Plant wash water from equipment that could potentially be contaminated with oil will be collected and drained into an oily water sewer system. Oil/water sumps will be provided for each CTG and an additional sump will be provided for the fuel pump and the storage and unloading area. Oily water from the STG will be routed to one of the oil/water sumps. These wastes will be pumped to, and treated in, a packaged oil/water separator. Recovered oil will be trucked on an intermittent basis to a suitable offsite licensed facility for disposal. Oil-free water will be drained or pumped to the wastewater collection sump.
- 5.62 **HRSG Blowdown.** Boiler blowdown from each HRSG will be cooled in a closed cooling water system and then collected in the local sumps. The quenched water will be pumped to the wastewater collection sump.

- 5.63 Sewage. Sewage from the various buildings of the power plant will be drained to a septic tank and then by gravity to an on-site leaching field.
- 5.64 CTG Chemical Cleaning. The CTG will be periodically washed with a chemical cleaning solution. The cleaning wastes will be drained into local sumps. The sumps will have a capacity to hold approximately two batches of cleaning waste. The solution will be collected from the sumps and trucked to an offsite licensed hazardous waste disposal facility.

Wastewater Discharge

- 5.65 Collection sumps within the power plant and the STP will be constructed of reinforced concrete to prevent seepage. Wastewater will be conveyed either in piping or in concrete trenches. Above-ground tanks at the power plant that hold wastewater or contain chemicals will be provided with secondary containment structures. These secondary containment structures will be made of reinforced concrete and be curbed to contain 110 percent of the volume in the tanks they are designed to contain. Above-ground tanks at the STP that contain chemicals will be provided with similar secondary containment concrete structures. The Project Company's operational procedures require that any leakage or spillage from these tanks is immediately cleaned up and the cause for the leakage or spillage is immediately corrected.
- 5.66 Water balances were calculated by the Sponsors for the following three different modes of power plant operation:
- Case 1 – Annual average, natural gas firing without evaporative coolers in service,
 - Case 2 – Winter design with oil firing of the combustion turbines, and
 - Case 3 – Summer design with natural gas firing and evaporative coolers in service.
- 5.67 Table 5-3 was constructed using the flows assumed for each case listed above and a total raw sewage flow rate of 324 m³/hour. Table 5-4 summarizes the estimated chemical concentrations and water quality parameter values for raw sewage, gray water, and power plant wastewater. The estimated values of water quality were provided for the three operational modes of the power plant as listed above. Table 5-4 lists various effluent limitations imposed by NOM-002-ECOL-1996, the World Bank Guidelines, and the Ex-Im Bank Guidelines for gray water (Ex-Im Bank Table 1) and for power plant wastewater (Ex-Im Bank Table 6), respectively. Table 5-5 presents the results of a separate estimate of wastewater quality characteristics prepared by the EPC Contractor using different methodology and different assumptions than were used to prepare Table 5-4.
- 5.68 Table 5-6 contains estimated characteristics of blended power plant wastewater and excess treated sewage (gray water) in the JAPASP receiving pond. Table 5-6 also includes estimates of the water quality constituents in the blended power plant wastewater and excess raw sewage stream. In all cases, the expected typical concentrations in the raw sewage, gray water, and power plant wastewater were used for the water quality estimates as shown in Table 5-6. For the gray water/power plant wastewater blend, it was assumed that all of the power plant wastewater was blended with all of the excess gray water available. Likewise, for the raw sewage/power plant wastewater blend, it was assumed that all of the power plant wastewater was blended with all of the excess raw sewage available.
- 5.69 Based on the estimated wastewater characteristics listed in Table 5-4 and Table 5-5, the STP effluent (excess gray water) would comply with NOM-002-ECOL-1996 and the applicable Ex-Im Bank Guidelines. Also, based on the estimated wastewater characteristics listed in Table 5-4,

Table 5-5 and Table 5-6, the power plant wastewater discharge would comply with NOM-002-ECOL-1996 and the applicable Ex-Im Guidelines (i.e., Table 6 of Ex-Im Bank 1998 Guidelines).

- 5.70 The power plant wastewater would comply with the World Bank Guidelines, except for iron and zinc under the hypothetical maximum conditions analyzed by the Sponsors and the EPC Contractor. The World Bank Guidelines require that both iron and zinc concentrations be below 1.0 milligrams per liter (mg/l). In the case of iron, the power plant effluent will meet the guidelines for typical concentrations of iron in the raw sewage, but not for the maximum concentrations expected. The Sponsors have estimated that the maximum iron concentration in the power plant effluent will be 1.3 mg/l for Case 1 and Case 3, and 1.9 mg/l for Case 2 (Table 5-4). The EPC Contractor has estimated that the maximum iron concentration in the power plant effluent will be 2.8 mg/l for Case 1 and Case 3, and 2.9 mg/l for Case 2 (Table 5-5). It should be noted that the iron concentration appears to be attributable to the water supply source, in that the raw sewage water has an estimated iron concentration of 5 mg/l. In the case of zinc, the Sponsors have estimated that the concentration of zinc in power plant effluent will meet the guidelines for typical concentrations of zinc in the raw sewage for all gas-fired operation, but not for the typical concentration for oil-fired operation. For oil-fired operation, the zinc concentrations in the power plant effluent will typically be 1.6 mg/l with a maximum of 2.2 mg/l. The maximum zinc concentration in the power plant effluent for Case 3 is 1.2 mg/l. The estimates predicted by the EPC Contractor are similar for weekly and monthly average zinc concentrations. However, the instantaneous maximum value for zinc is 2.8 mg/l for all three cases.
- 5.71 According to the Sponsors, the power plant will not contribute any zinc to the wastewater and only very little iron (corrosion products in HRSG blowdown). The predicted exceedances are primarily due to evapo-concentration effects of the water treatment processes at the power plant. The World Bank does not differentiate between discharges to a receiving body of water or to a municipal sewer. Considering that the power plant discharge will be blended with either excess treated sewage or excess raw sewage, the estimated iron and zinc concentrations in the blended water will not cause a significant environmental impact compared to the raw sewage discharge by JAPASP.
- 5.72 Even though the applicable guidelines and regulations for most parameters would appear to be met by the blended gray water/wastewater and raw sewage/wastewater, it is also true that the Project will cause increases in concentrations of some constituents. As shown in Table 5-6, the power plant wastewater blends will have substantially higher concentrations of sodium, chloride, nitrate, phosphorus, sulfate, and total dissolved solids than the raw sewage. The expected concentrations of sodium, chloride, and total dissolved solids are higher than the concentration desirable for irrigation of many crops (i.e., suggested US criteria for irrigation purposes), although the levels comply with the applicable Mexican wastewater discharge requirements. Elevated nitrate and phosphorus may increase growth of algae and other vegetation. Considering that the Project will discharge to a municipal sewage system, the increased concentrations of these constituents may not cause a significant environmental impact. Nonetheless, if the blended wastewater and sewage is to be discharged by JAPASP from the *El Bailon* area for agricultural purposes, then there may be impacts to groundwater, surface water and agricultural resources. Also, if the JAPASP receiving pond (which receives the blended power plant wastewater in the *Bailon* Collector area) is not designed to preclude seepage, then there may be significant impacts to groundwater, surface water and agricultural resources.
- 5.73 Evaluating water quality as to suitability for agricultural irrigation is complex and depends on many factors, including evapo-transpiration rates, crop type, plant tolerance to individual chemical constituents, soil drainage characteristics, soil chemistry, soil moisture and temporal

variability of soil moisture. Nonetheless, as a generalization, an increase in the major dissolved ions that affect salinity and sodium adsorption ratio is not desirable for irrigation and may lead to long term impacts to agriculture. The Sponsors plan to routinely advise JAPASP of the power effluent water chemistry using the laboratory analyses of periodic effluent samples to be collected from the power plant effluent pipeline discharging into the JAPASP receiving pond located immediately adjacent to the STP.

- 5.74 The Sponsors will conduct a groundwater investigation at both the power plant and STP sites to establish the baseline information, which would include defining groundwater levels, hydraulic gradients, and groundwater chemistry. The Sponsors have indicated that they will implement a groundwater monitoring program at the power plant site, which would include groundwater sampling and analysis to detect potential impacts due to leaks, spills, or seepage.

Noise

- 5.75 The power plant will be operated 24 hours a day for 25 years. Noise emissions from plant operation will increase existing noise level in the Project area. The main sources of noise and design requirements from the power plant are listed in Table 5-9. The predicted noise levels resulting from plant operations are shown as noise contours in Figure 5-6.
- 5.76 A review of the noise contours indicates that the Mexican standards for operational noise will be met at all receptors during daytime (68 dBA) and nighttime (65 dBA). However, there are four households adjacent to the power plant that may experience noise levels of between 45 dBA and 50 dBA, and two other households that may experience noise levels of between 50 dBA and 65 dBA. Daytime noise levels at some of these properties are expected to be below the World Bank daytime criterion of 55 dBA. However, these six households would likely experience nighttime noise levels that are at or above the World Bank criterion of 45 dBA. An additional World Bank standard is that a new facility should not increase existing noise levels by 3 dBA or more. As such, two to four additional residences may be included in the noise impact area because their average noise environment could be increased by 3 dBA or more.
- 5.77 The Sponsors have informed the affected households of the potential noise impacts due to power plant operations. The Sponsors have committed to providing measures to mitigate the potential long-term noise impacts, as described in the Noise Mitigation Plan (see Section 6). The noise modeling and analyses performed by the Sponsors represent reasonable predictions of Project noise impacts. Assuming that the Sponsors' Noise Mitigation Plan will be executed, significant noise impacts due to plant operation should be mitigated.
- 5.78 Operational traffic, comprising mainly private cars for the plant personnel, is expected to be light. The need for heavy vehicles to visit the plant during operation is expected to be limited. Maintenance activities at the plant and along the lineal facilities (transmission line, water pipeline, and gas line) will rarely require the use of heavy vehicles or special equipment. Residents living close to the access road, if any, would be subject to some vehicle noise during daytime. The noise levels generated by the power plant during operation are expected to be in compliance with the Mexican regulations.

Hazardous and Solid Wastes

- 5.79 The areas around the storage tanks containing hazardous chemicals will be curbed or diked with concrete construction to collect any chemical spillage. A common, neutralization sump will be provided so the chemicals can be collected and removed for proper treatment or disposal. Certain

chemicals, such as sodium bisulfite and sodium hypochlorite, will be stored in individual, curbed areas. However, they will not be forwarded to the common neutralization sump. Cleanup for spills of these chemicals will occur locally within the respective curbing.

- 5.80 The Sponsors expect that the Project would generate primarily non-hazardous waste during the course of plant operation. The Sponsors plan to dispose of all of the non-hazardous wastes in an authorized and government regulated landfill.
- 5.81 The Project will generate sludge during the process at sewage treatment plant. In Mexico, the sludge generated from municipal sewage is listed as hazardous waste by default. It is incumbent upon the sludge generator to perform mandated tests in order to demonstrate to INE that the sludge is not hazardous in nature. The Sponsors plan to test the sludge for determining its analytical nature. Once the sludge has been de-listed, the Sponsors will dispose the sludge in an authorized landfill.
- 5.82 The Sponsors have investigated several regional landfills to determine the viability of disposing of its solid wastes. The Sponsors have located a relatively new, INE-authorized, lined landfill in *Queretaro* (about 60 km from the power plant). The Project Company has initiated negotiations with the licensed operator of this landfill, who is also an authorized transporter.
- 5.83 In the unlikely case that the sludge has any of the characteristics that make it a hazardous waste according to NOM-052-ECOL-1993, the sludge will likely be sent to a hazardous waste landfill owned by RIMSA (“*Residuos Industriales Multiquim*”). The RIMSA landfill is located in *Mina*, State of *Nuevo León*, about 600 km to the north of the power plant. The Sponsors plan to dispose of any other small volumes of hazardous wastes that may be generated by operation of the plant or equipment maintenance at the RIMSA facility. RIMSA is associated with the Chemical Waste Management that has been permitted by the INE for handling, treatment, and disposal of 35,000 tons of hazardous waste every month. According to RIMSA, it will have enough capacity to handle hazardous waste for the next 30 years.
- 5.84 Based upon the procedure identified by the Sponsors to handle hazardous chemicals and solid wastes and the plan prepared by the Sponsors to dispose of hazardous and non-hazardous materials, significant impacts on the environment are not expected.

Water Supply

- 5.85 The water consumed by the *Bajío* Project will be used primarily to meet four major power plant requirements during the operational phase: the requirement for the HRSG/steam cycle, the HRSG blow-down system, the plant wash water, and non-potable water domestic use. Because air-cooled condensers will be provided for the power plant, significant amounts of water will not be needed. As described in the earlier section of this report, raw sewage will be first treated in the STP, pumped as makeup water to the power plant, further treated using a micro-filtration system, and then demineralized in an RO/mixed-bed system for use as makeup water. As such, the impact on surface water abstraction will be minimal.
- 5.86 The cooling water system will use a mixture of ethylene glycol (20%) and demineralized water (80%). Only a small amount of water will be needed. The water needed for mixing will be provided from the demineralized water storage tank or condensate pump. As such, additional strains on the existing water resources in the site vicinity are not expected.

- 5.87 The Project Company will provide bottled water for drinking and self-contained emergency eyewash stations during operation. Once the power plant is fully commissioned, the facility should provide adequate support for the entire staff (up to 80 persons). As such, significant impacts on the community's existing water resources are not expected.

Traffic Conditions

- 5.88 The power plant will be operated 24 hours a day, 7 days a week with a maximum of 80 employees. Based upon the vehicular movements estimated by the Sponsors, a significant increase in road usage by the plant employees is not expected. Therefore, no noticeable impacts on traffic conditions are expected during operation.

Visual Impacts

- 5.89 The Project (the 40-m tall stacks in particular) will have a visual impact on the area, with particular significance to the properties that lie on the southwest side of the *Los Cerritos* Hills. However, the overall visual impact of the power station is not expected to be significant on the basis of the following facts:

- There are only a few households in the immediate vicinity of the power plant,
- The town of *San Luis de la Paz* is about 12 km from the power plant,
- The *Tinaja* Hill is situated in between the power plant and *San Luis de la Paz*,
- Highway 57 is located about 3 km to the east of the power plant, and
- The existing transmission lines are visible from Highway 57 and other locations.

Health & Safety

- 5.90 Given the characteristics of the power plant, the critical safety issues that will likely impact plant workers during operation include: transportation of equipment and materials to and within the site; handling and storage of materials on site; working with and around electrical, hydraulic and other energized systems; work around hot equipment and other hot work, such as welding; confined space work; pressurized vessel operation; and potential for fires, explosions, spills and other emergencies. Operation-related occupational health concerns include exposure to chemicals (e.g., fuels, degreasers, gases, welding fumes), dusts (e.g., silica) and plant wastes; exposure to noise and radiation; exposure to extreme temperatures; and general sanitary conditions. The Project Company intends to implement an operational Health and Safety System and to have a Contingency/emergency Plan (see Section 6 or details).

5.2.2 Social Impacts

- 5.91 No significant long term social impacts are expected during operation of the power plant, given the relatively remote location of the Project site and the small number of permanent workers required (under 100 individuals). It is noticed that the Project Company intends to staff the power plant to the greatest extent possible with local residents. As such, this strategy would minimize the need for additional community infrastructure.

Chichimeca Jonaz Misión

- 5.92 While the construction and operation of the Project will not have a direct negative impact on the *Chichimeca* community, there is some potential for an adverse indirect effect on the cultural

values of the *Chichimeca Jonaz Misión*. The Sponsors have committed to implementing actions to mitigate the adverse impacts. The issue is the *Chichimeca's* cultural identity, which is tied closely to their agrarian roots and life style. The benefits of modernization and industrialization in the surrounding community have not accrued significantly to the economic well-being of the *Misión*, while by the same token, they have eroded the inhabitants' traditional values. In their poverty, the residents are vulnerable to further erosion of their customs, arts, and beliefs. The conversion of the 18.5-hectare land from grazing to power plant uses is in itself a negligible reduction in the region's supply of agricultural lands (the *Chichimeca's* principal source of employment). However, the visibility of the Project and the prospect of further land being lost to industrial development (which is the long-term goal of the municipal and state governments) make for a disproportionately larger perception of the effect of the Project on the indigenous culture. For this reason, the Sponsors have acknowledged their responsibility to contribute their fair share to the effort to mitigate the problem and the Project Company is prepared to provide financial support for culture-strengthening projects to be undertaken by the *Chichimeca* community (see Section 6 for additional details). The Project Company would either provide funding to match grant proposals to the Directorate of Popular Culture and INE, or provide grants for special projects sponsored by the *Chichimeca*. The Project Company has suggested that the funding levels be based upon a set of pre-determined priorities established by an interagency coordinating committee (composed of representatives from the *Misión*, INI, and the Directorate of Popular Culture, for example).

5.3 Positive Impacts/Benefits

5.93 The following are the principal direct benefits from the *Bajío* Project:

- Add 600 MW of new generation capacity to the central region of Mexico, and thus together with the other projects included in CFE's expansion plan, is expected to be able to meet the increasing electric power demand in the region, provide competitively priced electricity, and by support the objective of the Government of Mexico for developing the open power market using a technology in an environmentally sound manner;
- Increase in local economy through the creation of jobs, procurement needs, and taxes; and
- Construction of a sewage treatment plant in *San Luis de la Paz*, which will treat approximately half of the municipality's current raw sewage flow, and will be the first stage/phase of the local municipality's plans for wastewater collection and treatment.

6.0 ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING

6.1 The Sponsors are committed to mitigating environmental and social impacts due to construction and operation of the *Bajío* Project. The mitigation measures proposed during construction and operation will be adopted by the Sponsors and the Project Company and imposed as conditions of contract on the EPC Contractor and any subcontractors employed to build or operate the power plant.

6.2 Section 6.1 describes the measures proposed by the Sponsors to mitigate construction and operation related environmental and social impacts. These mitigation measures are summarized in Table 6-1 and Table 6-2, respectively. Section 6.2 presents the programs proposed by the Sponsors to monitor the environmental and social aspects of the Project. Section 6.3 describes the measures proposed by the Sponsors to promote health and safety during construction and operation of the Project.

6.1 Mitigation Measures

6.1.1 Construction Phase

6.1.1.1 Environmental

Terrestrial Ecology

6.3 According to the Sponsors, the EPC Contractor will implement standard good practices to mitigate impacts on terrestrial ecology. The EPC Contractor will perform the following specific measures during the construction:

- Clear only the land needed for construction;
- Keep the loss of habitat to the minimum necessary;
- Protect habitats from dust generation and deposition;
- Protect habitats from disturbance by the construction workforce, such as by fencing off of unused areas, providing warning signs, and training workers;
- Provide engineered site drainage systems to collect, treat as required, and control the discharge of site run-off;
- Ensure that stockpiling of materials does not occur on any location where run-off could flow (or wind-blow) onto sensitive habitats, such as the thorny bushes;
- Provide adequate containment for control of spillage of fuel or other materials, as well as solid waste;
- Restrict vehicles and personnel from accessing areas not designated for construction to prevent accidental or unnecessary disturbance or compaction of the soil;
- Monitor and control spoils from construction activities and waste materials that are unsuitable for reuse on-site;
- Restore construction laydown areas an equivalent standard to their existing condition upon completion of construction; and
- Re-vegetate the land after construction.

Dust Emissions

6.4 The Sponsors plan to implement the measures listed below to reduce dust emissions.

- The contractor will select equipment designed to minimize dust emissions.
- The Contractor will carefully manage and minimize drop heights for material transfer activities.
- The Contractor will maintain on-site and access roads through mechanical means (sweeping or vacuuming) or spraying with water to reduce potential dust emissions.
- Construction activities will be monitored during periods of elevated wind speed. The site environmental coordinator will have the responsibility to limit construction activities if significant dust generation is observed.
- Soil and material stockpiles will be covered when not being actively worked.
- Active construction areas will be watered on a regular basis.
- Trucks transporting soil or materials will be covered.
- Vehicle speeds on construction roads will be limited to 30 km per hour.

Water Resources

6.5 The EPC Contractor will implement standard good practices to mitigate impacts on water resources, and specifically will perform the following measures during the construction:

- Develop a site drainage plan to ensure that if erosion of soils occurs during storm periods, particularly during the rainy season, minimal amounts of sediment will occur by reducing both the flow velocity and sediment load;
- Minimize the amount of land left bare of vegetation and re-vegetate any slopes as quickly as possible;
- Use a reduced slope angle for temporary stockpiles to protect the sites from erosion, and incorporate sediment traps in all constructed drainage ditches and natural drainages near the construction area;
- Establish onsite preventive measures to avoid significant impacts from spillage and disposal of liquid wastes and potentially hazardous or toxic wastes; and
- Develop and implement effective waste handling (e.g., sanitary, wastewater, solid waste, etc.), spill prevention, process systems monitoring and control measures and procedures to mitigate possible sources of contamination that could impact surface water or groundwater resources.

Noise

6.6 The Sponsors will implement standard good practices to control noise and to mitigate noise impacts. Specific measures during construction will include the following:

- Enforcement of vehicle speed limits (30 km per hour);
- Control of vehicle routing and restriction of heavy vehicle movements during nighttime hours;
- Placement of noisy equipment (e.g. temporary generators) away from nearby receptors;
- Construction of temporary noise barriers around particularly noisy equipment; and
- Restriction of noisy construction activities during nighttime hours.

Traffic

6.7 The EPC Contractor will implement standard good practices to mitigate traffic impacts, including the following specific measures during construction:

- Confirm abnormal load road movements with the local highway authorities;
- Adhere to prescribed routes for access to the site;
- Schedule movement to avoid peak hours on local roads and publish in advance the routing schedules to minimize possible disruption;
- Select haulage routes to minimize disruption to existing road users and congestion in urban areas;
- Consider staggering construction shifts to split arrival and departure times;
- Use contract buses and encourage car sharing for transportation of construction workers; and
- Use sheeting for all on-site heavy goods vehicles.

Protection of Potential Historical and Cultural Remains

6.8 Although no known historical or cultural impacts are foreseen, the EPC Contractor will

implement the following standard good practices during construction to mitigate impacts on potential archeological, historical and cultural remains:

- Immediately prior to construction, perform a walk-over field survey across the site to identify any visible surface evidence of remains;
- Protect the remains in-situ from construction activities if any archaeological remains are found;
- Relocate and re-schedule non-essential activities and employ protective measures, and notify appropriate authorities in a timely manner;
- Excavate the indicated area prior to the commencement of construction activities where identified remains cannot be protected;
- Record and remove vulnerable remains and features; and
- Submit any findings to the appropriate Mexican regulatory authority.

6.1.1.2 Social

- 6.9 The analysis of the impacts of the *Bajío* Project indicates that adverse social effects would mainly be an indirect nature, related to coping with an influx of non-project jobseekers and other transient workers to the *San Luis de la Paz* area attracted by the Project, maximizing employment opportunities for residents of the project region, providing housing for non-local hired construction personnel temporarily relocating to the area for the duration of their assignments, and assisting the *Chichimeca Jonaz Misión* to preserve its cultural values. Further descriptions of the mitigation measures proposed by the Sponsors are presented in the following sections.

Influx of Transients

- 6.10 As word of the Project spreads, many unemployed individuals in the region may travel to the Project site and remain (camp out) hoping to be hired. This is not an unusual condition and can create a burden on the local population. To minimize this impact, the Sponsors will place notices in local, state, and regional newspapers and other media explaining that workers will not be hired at the site, and that all personnel must be approved by SUTERM. Beyond this, local public safety agencies may occasionally require assistance dealing with disturbances caused by Project workers or transients during their off hours at places of entertainment. The security personnel of the Project would be made available to supplement the community's law enforcement resources. Similarly, the fire fighting personnel of the Project would be available to supplement the community's fire brigades, if necessary.

Maximization of Local Hiring

- 6.11 The EPC Contractor estimates that the majority of the construction work force can be recruited from residents of *San Luis de la Paz* and the nearby municipalities. Recognizing that SUTERM has the final authority to qualify workers to be hired for the Project, the EPC Contractor will work with SUTERM and other agencies to maximize employment opportunities for the residents in the region, including those from the *Chichimeca* community. In order to achieve the projected levels of local worker employment, the EPC Contractor will implement the steps below.
- The EPC Contractor will coordinate with SUTERM and identify available experienced construction craftworkers from prior projects in the region (e.g., *Sauz*, *Salamanca*, and *Villa de Reyes*).

- The EPC Contractor will pursue a recruiting campaign in *San Luis de la Paz* that relies on the local authorities to assist in collecting work histories of residents interested in working on the Project. The EPC Contractor has committed to the local authorities that this will be the first priority recruiting area, with secondary efforts to be carried out in surrounding towns of approximately the same size (40,000 to 50,000 residents) that are still considered commuting distance from the Project site. As part of the local recruitment drive, the EPC Contractor will coordinate special efforts to ensure that residents of *Los Cerritos* and *Estación Blanco* are given every opportunity to secure employment during construction.
 - The EPC Contractor will utilize job bank services offered by the Construction Chamber of Commerce in the areas of *Queretaro*, *San Luis Potosí*, and *Guanajuato*. The *Queretaro* office is the branch with the closest proximity to the Project site (60,000 residents) and can be considered as still being within commuting distance of the job.
- 6.12 The Sponsors have committed to the diagnostic/recruitment effort on an ongoing basis and expect to receive measurable results. The Sponsors also plan to continue the effort during the early period of Project construction.

Providing Housing for Non-Local Personnel

- 6.13 After the initial civil construction phase (6 to 9 months) nears completion, the EPC Contractor and SUTERM will determine whether regional housing is adequate to accommodate peak levels of non-local workers. If not, the two housing options described below will be explored.

Option #1 - Construction of Modular Work Camp

- 6.14 Under this option, the EPC Contractor would construct a temporary, modular work camp at a site within *San Luis de la Paz* municipality. The camp would be located either adjacent to the Project site or in some appropriate location along Highway 57. If a site adjacent to the Project site is selected, it would be on land purchased as a result of mitigating noise impacts for the affected receptors. This newly acquired area would represent ground that is not part of the plant's "footprint," but would offer sufficient area for construction of temporary (i.e., for the construction phase only) housing for workers. Only bachelor housing would be provided; no dependents would be permitted to accompany non-local workers to the facility.
- 6.15 The temporary housing at a work camp adjacent to the plant site would include all ancillary food services, health, emergency services, and other activities to support workers at the site. As a result, there will be no increase in demand on existing local social infrastructure. Once construction has been completed, the camp facilities would be dismantled and removed, and the ground would be restored to its former state.
- 6.16 If the work camp is not located adjacent to the Project site the final choice of sites would be made in cooperation with local authorities, and would be consistent with municipal land use zoning and other regulatory requirements that may exist. Under this "off-site" scenario, the Project would work with relevant municipal economic and housing development agencies to offset any potential socioeconomic impacts created by the new housing. This could include the following measures:
- Project support through the provision of in-kind services for fire, police, and other public safety and social service agencies to minimize the effects of additional residents (and transients) within the municipality;

- Participation in the development of housing that could be utilized when future economic and industrial development occurs within San Luis de la Paz municipality; and
- Execution of contracts with local businesses, government agencies, and other entities to support the construction worker camps and minimize any potential strain on community services or facilities.

Option #2 - Use of Existing Housing

- 6.17 If it is determined that the near-term housing scenario (i.e., using existing accommodations in the region) would be effective for peak construction periods, the Project will work with local officials to identify additional housing opportunities within the region. As in the case of Option #1, the Project Company and EPC Contractor would develop measures and plans to minimize any potential disruptions caused by project-related migration to the municipality. Potential support for local social service and public safety agencies would include those listed under Option #1.

Indirect Impacts on Chichimeca Jonaz Misión

- 6.18 The Sponsors and the Project Company are committed to working with members of the *Chichimeca Jonaz Misión* and appropriate government representatives to identify methods for supporting efforts to enhance cultural identity and increase economic opportunity through provision of a "Community Benefits Program." The proposed strategy is based on the following principles:
- Using existing organizations, institutions, and other established vehicles to assess needs and recommend program priorities;
 - Giving priority to programs that demonstrate sustainability of the *Chichimeca* culture, language, and other sociocultural needs; and
 - Giving priority to programs that enhance the *Chichimeca's* ability to leverage their cultural heritage for creating or achieving economic development opportunities.
- 6.19 The *Chichimecas* currently receive very small grants to maintain and enhance cultural identity and economic development opportunities from the General Directorate of Popular Culture, a federal agency that works closely with the local offices of the National Institute of Indigenous People (INI). Over the past decade, the *Chichimecas* have applied for 33 grants, of which they obtained 28. The average grant was for US\$250 per project. Additional government resources raised the funding level to approximately US\$1,000 per project. The project funding was awarded on the basis of appropriateness and support from local and state governments. Some of these projects include: popular arts, traditional medicine, social organization, and recovery of historical memory.
- 6.20 During the initial stage of construction, the Project Company will convene a meeting with representatives from the *Misión*, INI, and Directorate of Popular Culture to begin the process of developing grant proposals and establishing criteria and priorities for future funding. The Project's Community Liaison Officer (to be established as part of the ongoing Public Consultation and Disclosure Plan) will serve on this interagency coordinating committee.
- 6.21 The Project Company plans to participate financially by either providing funding to match grant proposals to the Directorate of Popular Culture and INI, or providing grants for special projects sponsored by the *Chichimecas*. The Project Company has committed an amount of US\$2,500 per year for the period of five years. The Project Company will evaluate future funding levels on the basis of the needs and priorities of the *Chichimecas* and the effectiveness of the programs.

6.1.2 Operation Phase

6.22 According to the Sponsors, the Project Company will implement standard good practices to mitigate potential impacts during operation of the power plant. Specific mitigation measures proposed by the Project Company are described below.

6.1.2.1 Environmental

Air Quality

6.23 During operation the primary emissions of concern are NO_x when burning gas, and NO_x, SO₂, and particulate material. The Project Company will implement the following measures to control air emissions within the applicable emission limits:

- Use of dry-low NO_x combustion technology in the gas turbines,
- Use of water injection to control NO_x during diesel fuel firing, and
- Use of natural gas as the primary fuel, and limiting the use of diesel fuel to no more than 10 consecutive days and 15 total days per year.

Water Resource

6.24 The Project Company will implement standard good practices to mitigate impacts on water resource. The Project Company will implement the following specific measures during the operation and maintenance phase:

- Use only treated municipal wastewater as the source of power plant cooling water;
- Install bunds or blind sumps of reinforced concrete to isolate areas of potential diesel spillage;
- Provide secondary containment structures of reinforced concrete for diesel storage tanks and chemical storage tanks (such as the acid and caustic storage tanks), and drainage valves will be operative and normally be closed;
- Isolate areas for unloading hazardous chemicals by curbs and provide with a sump equipped with a manually operated valve to collect storm water run-off;
- Provide transformers with pits to retain 110 percent of the coolant capacity and 300 mm free board;
- Collect and direct storm water run-off from equipment slabs that may be subject to oil contamination through an oil/water interceptor prior to discharge;
- Utilize dispersion aprons, level spreaders, or other energy-dissipating devices to prevent scour and erosion due to storm water discharge from the operational site at the discharge locations;
- Commission a local water company to supply the power plant and the STP with bottled water for human consumption; and
- Provide self-contained emergency wash stations for all employees.

Wastewater Discharge

6.25 The wastewater discharge from the power plant will meet all the applicable Mexican regulations. The Project wastewater will likely be combined with the effluent from the municipal sewage

treatment plant or combined with sewage collected by the *El Bailon* Collector. For some water quality parameters, the power plant wastewater discharged will improve the quality of the water. However, depending on which waters are mixed, some parameters (e.g., total dissolved solids, sodium and chloride) may be increased, and depending on the final use of the water, may result in impacts to surface water and groundwater and agriculture. The Sponsors plan to conduct a groundwater study at the STP to characterize baseline groundwater conditions, including groundwater levels, hydraulic gradients and groundwater quality. In addition the water quality of the influent raw sewage supplied by JAPASP and the power plant effluent wastewater returned to JAPASP will be monitored by the Project Company to verify that acceptable water quality is maintained and avoid any additional undesirable impacts to water resources at the STP.

- 6.26 The Project Company will collect storm water in canals surrounding the power plant and discharge it to an on-site leaching field.

Noise

- 6.27 The Sponsors have committed to providing measures to mitigate potential impacts for the households that may experience noise levels above the World Bank Guideline. The Sponsors have prepared a Noise Mitigation Plan, which is summarized below.
- 6.28 The Sponsors have committed to taking the following steps listed below to reach a definitive resolution with the affected parties (present number is approximately six households).

Step 1 – Quantify Problem and Identify Options

During July 1999, the Project Company commissioned a study to predict the level of noise emanating from the power plant. The results of the study are presented on a plot of noise level contours together with the locations of the nearby receptor points, or affected households (Figure 5-6). Based on the results of the study, the Project Company has identified the following mitigation options:

- Noise abatement measures, such as additional insulation, window glazing, white noise generation such as central air, etc.;
- Relocation within own land, where impacted owners would have their homes moved to another part of their property that would lie outside the affected area; and
- Relocation outside area, where the Project would purchase the owners' land and relocate the affected persons according to the IDB Policy on Involuntary Resettlement (August 1998).

Step 2 – Meet with Affected Households

The Project Company contacted the affected households in August 1999. The Project Company introduced the Project to each of the affected landowners, and explained the potential noise impacts on the households due to operations of the power plant. In addition, the Project Company presented the various options identified to mitigate the noise impact to the affected households.

Step 3 – Assess Costs of Various Options

The Project Company plans to hire appraisers, engineers, and inspectors to assess the costs of the identified options and the land. The scope of work expected by the Project Company will include data gathering, analysis, and report preparation.

Step 4 – Formal Definition of Options

The Project Company will finalize the details associated with each selected potential option and will present these to the IADB and the Ex-Im Bank for review and comment. The Project Company will incorporate their responses and prepare a final report detailing the available options.

Step 5 – Formal Presentation of Options to Affected Persons

The Project Company will make a formal presentation to the affected persons and explain the details associated with each option.

Step 6 – Entering Agreement with Owners

Once the affected persons have selected an option, the Project Company will enter an agreement with the landowners. If any of the owners require more time or further explanation or wish to discuss an alternative option to mitigate the potential noise impact, the Project Company is committed to working with them until fully satisfied.

Step 7 – Implement Selected Noise Mitigation Measures

The Project Company will need to insure that the abatement measures adequately address the adverse noise impact through an independent testing by an authorized entity. In the event that the landowners wish to relocate, the Project Company will fully comply with the IDB Policy on Involuntary Resettlement, including the submittal for IDB approval, specific procedures for resettlement.

Step 8 – Monitoring and Evaluation

During the progress of implementing the mitigation measures, the Project Company will prepare an evaluation report to the IADB and the Ex-Im Bank on the abatement and/or resettlement activities.

- 6.29 The Project Company has also prepared an estimate of time schedule for completing the proposed steps identified in noise mitigation plan. The Project Company's tentative time schedules are summarized below:

| Noise Mitigation Plan by the Project Company | Estimated Time Schedule for Completing the Step |
|--|---|
| Step 1 - Quantify Problem and Identify Options | Complete as of December 1999 |
| Step 2 - Meet with Affected Households | Complete as of December 1999 |
| Step 3 - Assess Costs of Various Options | End of January 2000 |
| Step 4 – Formal Definition of Options | Mid February 2000 |
| Step 5 - Formal Presentation of Options to Owners | End of February 2000 |
| Step 6 – Entering Agreement with Owners | End of March 2000 |
| Step 7 – Implementing Selected Noise Mitigation Measures | June 2000 |
| Step 8 - Monitoring and Evaluation | September 2000 |

Solid and Hazardous Wastes

- 6.30 The Project Company will contract appropriate contractors for disposal of solid and hazardous wastes in appropriate regular or hazardous landfills, depending upon the test results. The Project Company will perform analytical testing on sludge prior to shipment to landfill sites.

Visual Impacts

- 6.31 The Project Company will implement a re-vegetation and landscaping program along the southwest side of *Los Cerritos Hills*, using indigenous species as these are best adapted to local conditions and will preserve the ecological characteristics of the area.

6.1.2.2 Social

- 6.32 Operation of the power plant will not have any direct effects on the social and economic well-being of residents of the Municipality of *San Luis de la Paz* that would necessitate mitigating measures. Indeed, after the plant commences operation it will become a long-term source of fiscal revenues and employment benefits for the region. However, the operating phase will have some direct impacts on the households near the Project site whose properties will be impacted by noise. As part of the noise mitigation measures (e.g., see paragraph 6.28), one potential option will be the relocation of affected persons. If required, the Project Company will comply with the IDB Policy on Involuntary Resettlement. If relocation of households is necessary, compensation and rehabilitation will be fair and adequate and the affected households will be assured of the following:
- Achieving a minimum standard of living and access to land, natural resources, and services that are at least equivalent to pre-settlement levels;
 - Recovering all losses caused by transitional hardships;
 - Experiencing as little disruption as possible to their social networks, opportunities for employment or production, and access to natural resources and public facilities; and
 - Having access to opportunities for social and economic development.
- 6.33 Indirectly, the operating phase may have some social consequences, in the areas of preserving the cultural identity for the *Chichimeca Jonaz Misión*. The measures to mitigate the indirect impacts of the Project on *Chichimecas*, which are planned for the Project construction phase (see paragraphs 6.18 to 6.21), will continue into the initial years of operation.

6.2 Monitoring Programs

- 6.34 The Company will utilize Continuous Emission Monitors (CEM) for NO and SO₂. The CEM units will be installed on each stack and will be operated during both natural gas and diesel fuel firing conditions. Plume opacity measurement will also be taken.
- 6.35 The Company will implement an Air Quality Monitoring Program. The program will include a monitoring station for meteorology and two monitoring stations for ambient air quality (NO_x, SO₂, and PM).
- 6.36 The Project Company has the responsibility and obligation to perform technical analysis of the wastewater in order to determine its quality prior to discharge. As such, the Project Company will implement a monitoring and testing program during operation. The objective is to ensure

that the power plant wastewater complies with the requirements stipulated in the Mexican NOM-002-ECOL-1996. The Project Company plans to conduct the monitoring program in accordance with the sampling of NOM-002-ECOL-1996. The power plant wastewater will be sampled on a daily and monthly basis.

- 6.37 The Sponsors will conduct a groundwater investigation at both the power plant and STP sites to establish the baseline information, which would include defining groundwater levels, hydraulic gradients, and groundwater chemistry. The Sponsors have indicated that they will implement a groundwater monitoring program at the power plant site, which would include groundwater sampling and analysis to detect potential impacts due to leaks, spills, or seepage.
- 6.38 The Project Company plans to conduct an additional ambient noise survey prior to the start of construction to establish the existing background noise level in the Project vicinity. The monitoring locations will be chosen to be representative of the existing environment. The Sponsors anticipate collecting samples at four to eight locations over multiple times, dates, and conditions. The Project Company will conduct an operational noise survey within one year after initiation of commercial operations.
- 6.39 The Sponsors will prepare an annual Environmental Performance Report to demonstrate operational compliance with the applicable regulations. The report will include, as a minimum, the following information: general plant technical information; descriptions of operation process; air emissions inventory; quantities of water used and wastewater discharged; quantities of combustion waste generated, handled and disposed; and a written action plan if the facility is not in compliance with any requirement.
- 6.40 Compliance with the applicable limits (e.g., air, wastewater, etc.) will be a part of the Project loan agreement, and thus any non-compliance detected by the monitoring program will require the Project Company to implement the necessary measures to return the operations back into compliance.

6.3 Health and Safety

- 6.41 During construction, the Environmental, Safety, and Health Execution (EHS) Plan, which has been prepared for the *Bajío* Power Plant by the EPC Contractor, addresses the critical occupational health and safety issues associated with the construction of the Plant. This EHS Execution Plan contains detailed, specific procedures (“core processes”) for mitigating the Project-related health and safety hazards. The plan also contains detailed, specific core processes covering the overall health and safety policy, responsibilities of Project health and safety personnel, health and safety training of all personnel, medical services and surveillance, recordkeeping, job hazard analysis, incident investigation, inspections, subcontractor requirements, and noncompliance procedures.
- 6.42 To effectively manage the occupational health and safety concerns associated with the operation of the *Bajío* power plant, the Project Company will prepare and implement a health and safety program in accordance with the existing Mexican regulations and World Bank Occupational Health and Safety Guidelines. The program will include core processes, such as structure and responsibility, monitoring, and training, as well as policies and procedures for occupational health and safety, emergency procedures, and accident response. The Project Company intends to maintain all of the plant equipment in accordance with the established maintenance procedures and in compliance with the recommendations of the equipment vendors and the maintenance inspection schedules prescribed by the equipment manufacturers. The Project Company intends

to handle any unscheduled maintenance or emergency repairs in a manner conforming with the safety provisions applicable to the power plant. The Project Company intends to train permanent workers with the technical skills required safely operating and maintaining the power plant prior to operation. The Project Company also intends to provide training programs on an annual basis.

7.0 PUBLIC CONSULTATION AND DISCLOSURE PROCESS

- 7.1 The Sponsors have prepared a Public Consultation and Disclosure Plan (PCDP) for the *Bajío* Project. The purpose of the PCDP was to establish the process by which the Sponsors would consult and inform key stakeholders in the planning, development, construction and operation of the Project. The objective of the PCDP was to ensure that the local communities and other interested parties would be fully informed about the Project, and would have the opportunity to raise their concerns to the Sponsors and the Project Company. The Sponsors initiated the consultation process after being awarded the Project and are committed to continuing this process. The consultation has focused on the needs and concerns of potentially affected local residents, as well as local groups with an interest in the well being of the local environment and economy.
- 7.2 The PCDP includes the key steps listed below (further details are presented in subsequent paragraphs).
- The PCDP commenced with a preliminary (or “diagnostic”) consultation consisting of individual and group interviews/meetings with key stakeholders to assess their awareness of the Project, initial reactions and concerns, and to identify any other interested parties to be contacted during the PCDP.
 - The Sponsors are involved in a public education and information program and have distributed various written and visual materials describing all aspects of the Project to the public.
 - The Sponsors have conducted formal public meetings in the vicinity of the project site to enable the public to express their concerns, and recommendations regarding the Project.
 - The Sponsors will continue the consultation process and incorporate the information obtained throughout the consultation process into design, construction, operation and maintenance of the Project.
- 7.3 The Sponsors began their early consultation with the local stakeholders in June 1999. The Sponsors held a number of meetings with the municipal leaders to discuss the Project, introduce the Sponsors management team, describe the preliminary PCDP, and solicit their assistance in identifying other stakeholders within the community. In July 1999, the Sponsors contacted the residents residing adjacent to the Project site.
- 7.4 The Sponsors conducted 26 interviews as part of the initial community consultation diagnostic process. The purpose of the interviews was to determine participants’ level of knowledge of the Project, their opinions regarding development of the Project, and information needs required to better understand the Project. Of the 163 people interviewed, approximately 43% accepted the idea of a power plant in their community; 7% opposed it; and, 50% asked that more information be disseminated. During this diagnostic stage of the PCDP, the Sponsors placed specific emphasis on the households within a 1-km radius of the project site. A complete demographic profile for each was prepared including the number of family members living in the house, their economic activity, land ownership status and other demographic information.

- 7.5 The Sponsors initiated a comprehensive dissemination process to provide information about the Project during the month of September 1999. Printed materials for technical and non-technical publications (e.g., fact sheets, illustrations, posters, maps, etc.) were prepared and distributed to the general public. Project materials were made available to the public throughout the Municipality of *San Luis de la Paz*. A notice of availability was published in the local newspapers.
- 7.6 In addition, the Sponsors placed advertisements in local and state newspapers and informed the public where interested parties could obtain further information or contact the Project Company. The Environmental Impact Assessment (EIA or MIA) was made available in September 1999 for local public review and inspection at a central location within the Municipality of *San Luis de la Paz*. Executive summaries of the MIA were also made available free of charge to members of the public.
- 7.7 The Sponsors organized four formal public meetings in October 1999. These meetings were held in and around the town of *San Luis de la Paz*. The Sponsors made the necessary arrangements for the public consultation meetings in close cooperation with local government officials. The meetings were publicized through personal solicitations with the stakeholders identified, written invitations, and posters within the Municipality of *San Luis de la Paz*. In addition to the general public, the following groups were specifically invited to the meetings held on October 12, 13, and 14, 1999:
- General public from the town of *San Luis de la Paz*, the urban center closest to the Project site;
 - Residents in the *Los Cerritos* area, a small cluster of houses adjacent to the power plant site;
 - General public from *Estacion Pozo Blanco*, a small village located at a distance of about 3 km from the Project site; and
 - General public from the *Chichimeca Jonaz Misión*, an indigenous group residing just outside the town of *San Luis de la Paz*.
- 7.8 The meetings were coordinated with the Mayor and other officials of the Municipality of *San Luis de la Paz*. At the meetings, the Sponsors made a presentation about the Project Company and provided a general description of the Project. The Sponsors outlined potential economic opportunities created by the Project. The Sponsors described the use of water for the power plant and the STP, the emissions of air and noise from the power plant, and the needs for maintenance of local culture. The Sponsors also discussed the results of the updated MIA and EHSA reports and provided clarifications to the questions raised by the public. The Sponsors placed special emphasis on discussing possible impacts and beginning negotiation of potential mitigation measures with the *Los Cerritos* residents due to their close proximity to the power plant site. Printed materials were provided to the public at each meeting. The Sponsors have committed to evaluating the questions raised at the meeting and providing further clarification in the final EHSA report.
- 7.9 Almost 300 participants attended the public consultation meetings. The local residents and the general public in the vicinity of the Project site generally appreciated the opportunity to be informed of the *Bajío* Project. According to the meeting participants, the PCDP process provided information regarding various elements of the Project, especially the use of sewer water for the operation of the power plant rather than well water. It is clear that expectations for employment and other benefits within the community are high. A list of selected typical questions, concerns,

and comments from the local population who participated in the formal public meetings is provided below:

- Potential negative impacts on human health and safety issues, including air, noise, waste disposal, odors, workers' behavior and public safety, accidents, explosions, radioactivity, and agricultural products near the power plant;
- Noise levels from the power plant;
- Potential loss of water supplies;
- Possible community benefits from the Project for the *Chichimecas*;
- Maintaining *Chichimeca* traditions and culture;
- Possible development of infrastructure;
- Anticipation of potential employment opportunities;
- Need for job training program;
- Effects of electricity privatization on electricity pricing; and
- Selection of the alignment of the access road and its effect on properties.

7.10 The Project Company has committed to establishing a forum for continuing the consultation process throughout construction and operation of the power plant. The primary emphasis will be to assure stakeholders that the environmental management practices established in the final EHSA report and other regulatory documents will be fulfilled through a comprehensive monitoring process, and to ensure that, if any complaints are made, they are handled promptly and professionally. As part of the PDCP, ongoing consultation committed by the Sponsors and the Project Company will include the following:

- Appointment of a Community Liaison Officer to act as the point of contact for stakeholders and any other interested parties;
- Initiation of an Environmental Forum where members of the Project Company will meet with local stakeholders at regular intervals throughout construction and operation of the Project;
- Preparation of an Annual Environmental Report to contain monitoring information for review by regulatory authorities and the stakeholders; and
- Advanced announcement, through newspapers, of abnormal events, such as delivering construction materials and equipment and steam blowing to commission the plant.

8.0 RECOMMENDATIONS

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

1. All applicable environmental, health and safety Mexican regulatory requirements.
2. All requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project or the Company.
3. All environmental, health and safety requirements of the Project Contracts, including the Power Supply Agreement, and any subsequent modifications.
4. All aspects and components of all Project environmental, health and safety documents.
5. Applicable aspects of the World Bank Thermal Power Guideline for New Plants (World Bank Pollution Prevention Handbook, July 1, 1998).

6. Applicable aspects of the World Bank General Environmental Guideline (World Bank Pollution Prevention Handbook, July 1, 1998).
7. Applicable aspects of the World Bank Monitoring Guideline (World Bank Pollution Prevention Handbook, July 1, 1998).
8. Applicable aspects of the International Finance Corporation General Health and Safety Guideline (July 1, 1998).
9. Applicable aspects of the U.S. Ex-Im Bank environmental requirements (April 1998).
10. IDB Policy on Involuntary Resettlement (August 1998), if resettlement actions are performed.
11. Use only diesel fuel with sulfur levels of less than 0.5% by weight and use diesel fuel only in emergency situations as defined as less than 15 days per year and no more than 10 days of continuous operation.
12. Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable which potentially could have environmental, social, or health and safety negative effects.
13. Send written notice of any and all noncompliance with any environmental requirement of the loan agreement and any significant environmental or social accident, impact event or environmental claim.
14. Ensure that all companies contracted for construction or operation activities comply with the applicable environmental requirements of the loan agreement
15. Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the Project.
16. Implement an environmental, health and safety management system that is consistent with ISO 14001.

8.2 Prior to the date of Financial Closure, the Company must fulfill the following conditions:

1. Present a finalized plan, subject to IDB approval, for the power plant operation with fuel oil that demonstrates compliance with the applicable SO₂ emission and ambient air quality standards.
2. Present the finalized written agreement with JAPASP related to water use and the sewage treatment plan and a plan to mitigate any potential impacts to water resources that may be caused by the wastewater discharge from the power plant.
3. Obtain a formal commitment from SUTERM to maximize the hiring of construction workers from among residents of *San Luis de la Paz*, consistent with the skills and scheduling requirements of the Project and the availability of applicable skills in the local labor force pool.
4. Present a contingency plan to develop temporary accommodations in the site vicinity in case the construction work force will have to be recruited from outside the municipality.

8.3 Prior to First Disbursement of the Loan, the Company shall fulfill the following conditions:

1. Submit, subject to IDB approval, the final construction Environmental and Social Management Plan (ESMP), including cost estimates, time schedule and designated responsibilities for each individual component.
2. Present the finalized SPCC Plan for the construction phase (e.g., spill and emergency response procedures, etc.), including assurances that adequate resources will be provided to ensure the plan will be fully implemented.
3. Present the finalized Health and Safety Plan for the construction phase.
4. Present a Project Supervision Plan which will include the specific methods (e.g., use of independent environmental consultants, environmental health and safety audits and

- inspections, etc.) to be implemented to ensure all environmental and social measures and programs for the Project are completely and properly implemented by all responsible parties.
5. Present the results from the first round of sampling from the ambient air monitoring program.
 6. Implement a procedure and assign responsibility for investigating and resolving complaints (e.g., noise, dust, light, etc.) during the construction phase of the Project, including power plant, STP, and ancillary facilities.
 7. Submit further information regarding characterization of hydrogeology and baseline groundwater conditions at the power plant site and the STP site.
 8. Evaluate traffic conditions of local roadways and highways in the Project area and present information on potential impacts related to the construction and operation of the power plant and the sewage treatment plant.
- 8.4 Prior to initiation of construction of the Sewage Treatment Plant, the Company shall present to the IDB a copy of all necessary related Mexican environmental authorizations/permits.
- 8.5 Prior to each disbursement, the Company must certify compliance with all environmental requirements in the loan agreement.
- 8.6 The Company shall as a specific requirement for Project Technical Completion:
1. Submit to IDB, in form and substance satisfactory to IDB, a final Construction Phase Environmental and Social Report, which shall include: (i) Company's certification that the construction of the Project complied with all environmental requirements; (ii) information concerning any and all substantial deviations from the original construction plans and specifications set forth in the construction contracts, and a description of resulting adjustments made to the environmental and social mitigation measures or monitoring programs; (iii) information concerning any and all environmental or social liabilities, complaints, demands, or environmental claims; and (iv) copies of any and all important environmental or social documents or reports executed in order to satisfy environmental legal requirements.
 2. Submit to IDB, in form and substance satisfactory to IDB, a finalized Environmental and Social Management Plan for the operational phase of the Project.
 3. Submit to IDB, in form and substance satisfactory to IDB, the Contingency Plan (e.g., SPCC, Emergency) and for the operational phase of the Project.
 4. Submit to IDB, in form and substance satisfactory to IDB, the Health and Safety Plan for the operational phase of the Project.
 5. Submit to IDB, in form and substance satisfactory to IDB, the plans and procedures for the operation of the Sewage Treatment Plant, including the approval from the pertinent Mexican authorities regarding disposal of sludge to be generated from the sewage treatment facility.
- 8.7 During the life of the Loan Agreement, the Company must prepare and submit an Environmental and Social Compliance Report, in form and content acceptable to IDB. During Project construction (i.e., until Project Technical Completion), the Company must prepare a quarterly report and the report must be received by the IDB in the subsequent month. After construction, the report must be prepared annually and must be submitted within 60 days after the close of the Calendar Year. In addition, during the first year of power plant operation, the Company must submit quarterly Environmental Monitoring Reports, in form and content acceptable to IDB.
- 8.8 The Bank will monitor the environmental, social, and health and safety aspects of the Project via internal Bank supervision actions (e.g., site visits, review of documentation, etc.) and will contract an external independent environmental consultant to perform more detailed

supervision/monitoring actions during Project construction and initial operation. 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.