INTER-AMERICAN DEVELOPMENT BANK

Mexico

TERMOELECTRICA DEL GOLFO PROJECT
ME-0218

ENVIRONMENTAL AND SOCIAL IMPACT REPORT

October 1999

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1. INTRODUCTION

1.1 The *Termoeléctrica del Golfo* ("TdG") project entails the development, design, construction, operation, and maintenance of a 230-MW Circulating Fluidized Bed (CFB) petroleum coke power plant that will be located in the *Tamuín* area of the State of *San Luis Potosí*, Mexico (Figure 1-1). The TdG project will generate electricity for thirteen cement plants located in the central and northern regions of Mexico. Surplus power will be sold to *Comisión Federal de Electricidad* ("CFE" - Federal Electricity Commission), a quasi-State electricity utility provider.

1.2 According to Mexico's electricity expansion plan, the area in which the TdG project will be located has additional capacity requirements of 3,375 MW between 1997 and 2006. The TdG project will add 230 MW of additional capacity to the Mexican grid in an area with rising demand, and will therefore substitute for other planned CFE generation projects. The displacement effect will free transmission lines and reduce CFE's transmission losses, enhancing the reliability of the system by adding much needed backup generation in Central Mexico.

1.3 On October 9, 1998, the TdG project was awarded to a consortium consisting of Alstom Holdings (formerly GEC-Alstom) and Sithe International, Inc. (the "Sponsors" hereafter) through an international bidding process initiated by *Cementos Mexicanos* ("Cemex"). Cemex is the world's fourth largest cement producer and the largest cement producer in the Americas. The Sponsors will finance, construct, and develop the TdG project through a Mexican Business Trust. Electricity will be sold under a 20-year Power Supply Agreement with five cement companies, all of them majority-owned subsidiaries of Cemex.

1.4 Following this introductory section, this report is organized to include the following sections: Project Description (Section 2.0), Institutional and Legal Framework (Section 3.0), Environmental and Social Conditions (Section 4.0), Environmental and Social Impacts (Section 5.0), Environmental and Social Mitigation and Monitoring (Section 6.0), Public Consultation (Section 7.0), and Recommendations (Section 8.0).

2. PROJECT DESCRIPTION

A. General

2.1 The TdG project will comprise a power plant of 230 MW (net output) and associated infrastructure. The site for the power plant is located approximately 10 kilometers (km) northwest of the City of *Tamuín* (Figure 2-1*)*. The total area of the power plant site is approximately 132.2 hectares. The power plant will consist of two 125-MW CFB steam boilers and a 250-MW steam turbine generator, using solid petroleum coke as fuel. The boilers will be of drum type with natural circulation. Annual fuel consumption will be approximately 650,000 tonnes. The TdG project will include the construction of the following infrastructure:

- Electrical transmission line from the project site to the CFE *Anáhuac Potencia* Substation (approximately 3 kilometers in length);
- Railway spur from the project site to the existing railway to facilitate fuel delivery (approximately 1 kilometer in length);
- Pipeline to deliver raw water from the *Rio Tampaón* to the project site (approximately 13.6 kilometers in length); and

- Pipeline to convey treated wastewater for discharge to the *Rio Tampaón* (approximately 15.5 kilometers in length).

2.2 The appropriate location and alignments of the proposed infrastructure are shown on Figure 2-2.

B. Technology

2.3 The TdG facility will use two equal capacity CFB boilers fueled by petroleum coke and limestone. The CFB technology is one of the most efficient and environmentally sound ways of utilizing petroleum coke. The CFB technology allows the removal of sulfur oxides directly in the furnace, thus preventing their emissions to the atmosphere. This process is accomplished through the addition of limestone to the fluid bed. The limestone calcines in the furnace to form calcium oxide, and combines with the sulfur oxide to form calcium sulfate, which can be removed along with the ash. Further, the limestone and porous ash adsorb the metals contained in the petroleum coke at rates far better than other solid fuel combustion processes without additional pollution control equipment. The emissions of NO_x will be controlled through the use of the CFB combustion process itself. Particulate material (dust) will be controlled by two modes: the use of a series of cyclones with CFB and with an electrostatic precipitator, resulting in greater than 99 percent removal of fine particulate matter. This technology is commonly used in plants firing coal, waste coal, petroleum coke, wood, and other solid fuel products. The plant will have one stack with a height of approximately 120 meters.

C. Fuel Supply

2.4 The petroleum coke fuel required for the TdG project will be provided by *Petroleos Mexicanos* ("Pemex") through a long-term off-take agreement between Cemex and Pemex. Pemex is a State-owned oil and gas company, the largest enterprise in Mexico. Pemex will deliver petroleum coke to the project site from its new (presently under construction) *Cadereyta* Refinery, which is located near the City of *Monterrey* in the State of *Nuevo León*, Mexico. Characteristics of the petroleum coke that will be produced at the *Cadereyta* Refinery are expected to include the following:

- maximum sulfur content of 6.5 % (by weight);
- maximum ash content of 0.7 % (by weight);
- maximum nickel content of 300 parts per million (ppm);
- maximum vanadium of 2,000 ppm;
- hardness 35 to 70 HGI; and,
- heat content of 14,673 Btu/pound HHV minimum.

2.5 The petroleum coke fuel will arrive at the project site in solid form of no more than 4 inches in dimension. The fuel will be delivered in bottom dumping railcars provided by Cemex. The Sponsors will provide a rail spur and an area at the site to accommodate 70 railcars carrying about 70 to 80 tonnes per car. Fuel deliveries will normally consist of one train every two to three days in order to maintain an inventory between 108,000 and 270,000 tonnes at the site. The fuel will be unloaded and transported on a covered conveyor belt system. Water sprays will be provided at the unloading hopper for dust suppression purposes.

2.6 The petroleum coke will be stockpiled at two locations north of the high voltage electrical lines within the power plant. The active stockpile, up to 30,000 tonnes, will be fed by conveyors from

the unloading station. The area for storage of the active petroleum coke yard will be about 17,000 m^2. Water will be sprayed on the active stockpile to reduce fugitive dust emissions. The reserve stockpile, up to 270,000 tonnes, will be covered by a bituminous (or equivalent) layer to prevent fugitive dust emissions. The area for storage of the reserve petroleum coke yard will be about 63,000 m^2. Liners will be provided for both stockpiles to prevent infiltration of contaminated water. To prevent leachate infiltration, a butyl liner with a typical thickness of about 30 mls will be used for the active stockpile, and a clay (or equivalent) liner will be used for the active stockpile area. A leachate collection system, consisting of perforated pipes will be provided in the long-term petroleum coke storage area. The liner and leachate collection system will be covered with a two-foot layer of sand for filtration and protection. Leachate collected by the system will be treated at the on-site wastewater treatment plant.

2.7 The ashfill will be lined with a butyl liner with a typical thickness of about 30 mils. A leachate collection system consisting of perforated pipes will be installed for the ashfill. The liner and leachate collection system will be covered with a two-foot layer of sand for filtration and protection. The ashfill will be provided with an intermediate cover using an earthen (or similar material) layer in the areas where the distance from the ash stacker is greater than 100 m. The final cover will include (from the bottom up): 1) a layer of sand or granular soils with a high permeability, 2) a geotextile filter fabric, and 3) a minimum two-foot thick layer of topsoil. This topsoil will be covered with shallow-rooted native vegetation. A water spray system will be employed near the stacker to suppress dust formation. It is expected that the ashfill will be no higher than 24.5 m with a maximum 45-degree slope. Leachate collected by the system will also be treated at the on-site wastewater treatment plant.

2.8 Based upon the presently available information, it is anticipated that the petroleum coke, and the resultant waste ash from the power plant, will be considered "non-hazardous" material according to Mexican regulations. This is based upon the engineering and technical aspects of both the *Cadereyta* Refinery in *Monterrey* and the proposed power plant. In addition, results of analytical tests (via Mexican regulatory procedures) on the same type of material (petroleum coke and its ash) produced from a similar refinery process and petroleum feed located at a different location (i.e., the Shell-owned Refinery in Deerpark, Texas, USA) demonstrated that the tested materials were clearly non-hazardous according to Mexican regulations. The testing of the specific materials for this project is not presently feasible since no petroleum coke is currently produced at the *Cadereyta* Refinery in *Monterrey*. As part of the Mexican governmental approval of the project (i.e., INE approval of project Environmental Impact Assessment), the sponsors must, upon initiation of operations, confirm the non-hazardous nature of these materials, and if deemed hazardous, implement the necessary changes in the design and operation of the plant (see Section 3.3 for details).

D. Limestone Supply

2.9 About 300,000 tonnes of limestone will be needed annually for the TdG project. The required limestone will be purchased from an existing quarry located about 4 km west of the proposed power plant site (Figure 2-2). This quarry is owned by *Cementos Anáhuac del Atlántico* ("*Cementos Anáhuac*"), a Cemex subsidiary. Limestone will be delivered by trucks along an access road that will be constructed within the boundaries of *Cementos Anáhuac*. The proposed power plant will have a limestone inventory equivalent to 10 days of operation. The limestone will be stored at a location near the entrance of the access road.

E. Water Supply

2.10 Raw water required for the TdG facility will be drawn from the *Rio Tampaón* located just south of *Tamuín* (Figure 2-1). Originally, the project considered withdrawing water from the adjacent *Rio Choy*. In response to the request of the local community in March, 1999, the Sponsors have identified the *Rio Tampaón* as the new water source for the project. Subsequently, the Sponsors submitted an application to the *Comisión Nacional del Agua* ("CNA" - National Water Commission) and requested for a permission to use water from the *Rio Tampaón* for the project. CNA has been reviewing this request and has not expressed any objections.

2.11 A pipeline will be constructed to deliver raw water from the *Rio Tampaón* to the project site. The length of this pipeline will be about 13.6 km, and the diameter will be about 660 to 700 millimeters (mm), or 26 to 28 inches. In addition, a pipeline will be constructed to convey treated wastewater from the project site to the *Rio Tampaón*. The length of the wastewater pipeline will be about 15.5 km long, and the diameter will be about 450 mm or 16 inches. Both pipelines will generally follow the route of the existing *Tamuín* Road. In the vicinity of the power plant site, the pipelines will be parallel to the railway lines and the future electrical transmission lines.

2.12 Raw water will be treated at an on-site water treatment plant and then contained in pretreated water storage basins. Water usage during construction is estimated to be about 500 cubic meters per day (m^3/day). During operation, water usage is anticipated to be about 17,280 m^3/day or 200 liters per second (l/s). Wastewater from the plant will be treated on site before it returns to the *Rio Tampaón*. The wastewater system will consist of oil/water separators and facilities for pH adjustment, coagulation/precipitation, filtration, and sedimentation. Treatment sludge will be pumped to a thickener and de-watered with a belt filter.

F. Electrical Interconnection/Wheeling

2.13 The Sponsors will be responsible for the construction of a new 400-kV transmission line connecting the power plant and the existing *Anáhuac Potencia* Substation. The new transmission line will be about 3 km long. Power generated by the TdG power plant will be wheeled over the CFE transmission lines to the other Cemex cement facilities in Mexico. The power plant will be dispatched by Cemex with the exception that CFE will have the dispatch control when emergencies occur.

G. Operations and Maintenance

2.14 The power plant will be operated as a base loaded facility on a continuous basis (i.e., 24 hours a day; 7 days a week). The design life of the project is 30 years. A subsidiary of Sithe Energies will be responsible for the operations and maintenance of the power plant during a 20-year term. The same plant will also be responsible for pre-commercial activities. With the exception of the Plant General Manager and other key personnel, the operating and maintenance staff for the plant will consist of Mexican local workers. Services for security and maintenance support will be contracted to local companies.

H. Schedule and Costs

2.15 Construction of the project is scheduled to begin in November 1999 and commercial operation is scheduled for June 2002. A construction period of 32 months is planned. The total project costs are estimated to be approximately US $388 million.

I. Alternative Analysis

2.16 Prior to 1995, a number of candidate sites were considered for construction of a power plant project to meet the electricity demands in the region. In addition to the *Tamuín* site, the other candidate sites considered for the TdG project included the *Cadereyta* site in the *State of Nuevo León*; the *Lazaro Cardenas* site in the State of *Michoacan*; and, the *Altamira* site in the State of *Tamaulipas*. A number of selection criteria were adopted in the site selection process, including: 1) availability of sufficient water supply; 2) access to transmission lines, substations, and national power system; 3) close proximity to limestone supply; 4) proximity to petroleum coke delivery routes; 5) compatibility and suitability of land use and zoning; and, 6) others such as distances from populated areas, adequacy in room for long-term ash disposal, absence of significant biological and archaeological resources, and optimization of CFE energy distribution system. Based upon these criteria, the *Tamuín* site was selected for the TdG project. The siting process was reviewed by INE in 1998 and was considered to be reasonable.

3. INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional Framework

A.1 Power Sector

3.1 The *Secretaría de Energía* ("Ministry of Energy") is in charge of conducting Mexico's energy policy. The Ministry of Energy is also in charge of approving the exploration and development activities of natural energy resources, and auditing the operations of industry-related entities.

3.2 Established in 1937, the *Comisión Federal de Electricidad* ("CFE") is in charge of the supply of electric energy in Mexico. CFE owns and operates most generation plants connected to the grid, and has a monopoly for the transmission and distribution of electricity.

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. Being independent from CFE, CRE was created in 1994 as a technical and consultative body of the Ministry of Energy. 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. CRE is responsible for issuing the permits necessary to allow private participation in the Mexican energy generation sector.

A.2 Environmental

3.4 The federal government, through the *Secretaría Medio Ambiente, Recursos Naturales y Pesca* ("SEMARNAP" - Environment, Natural Resources, and Fisheries Secretary) has exclusive jurisdiction over the development of national policy on environmental matters; resolution of environmental issues affecting two or more states or another country; regulation of high risk

activities including management and disposal of hazardous materials and wastes; and enforcement of federal environmental regulations. Non-federal issues and environmental matters will be under the jurisdiction of the respective states and municipalities. The policies of the states and municipalities must meet or exceed federal requirements.

3.5 There are three decentralized organizations under SEMARNAP:

- The *Instituto Nacional de Ecologia* ("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 Environmental Impact Assessments (EIA).
- 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 Office of Attorney General for Protection of Environment ("PROFEPA") 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.

3.6 Specifically for this project, since all projects involving electricity generation such as the TdG project are under the federal jurisdiction, INE is responsible for approving the EIA, CNA has the authority to approve the water withdrawal and waste water discharge from/to the Tampaón River, and PROFEPA is responsible for environmental enforcement. The state and local governments are responsible only for land use licensing, construction permitting, and regulation of solid waste disposal.

B. Legal Framework

B.1 Power Sector

3.7 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;*" - "Electricity Law" hereafter), 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 from the definition of "public service" the following activities:

- generation of electricity for self consumption, cogeneration, or small production;
- generation of electricity by Independent Power Producers for sale to CFE under long-term contracts;
- generation of electricity for export;
- importation of electricity by individuals exclusively for their own use; and,
- generation of electricity for emergency purposes to cover shortfalls.

3.8 The Regulations to the Electricity Law ("*Reglamento de la Ley del Servicio Público de Energía Eléctrica*"), in effect since 1993, establish the requirements for the generation of electricity by private producers and the requirements to issue permits for self generation to satisfy the power needs of the power plant owners. In 1995, the Electricity Law granted 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 CRE have complemented the regulatory framework to private cogeneration and self generation activities. Such advances include the approval of models of contracts for interconnection, transmission, and sale of surplus electricity to CFE (January 23 and February 11, 1998), as well as the development of the methodology for establishing power transmission charges (May 15, 1998).

B.2 Environmental

3.9 The General Law of Ecological Equilibrium and Protection of the Environment ("Ecology Law" hereafter) was passed in 1988 and established the overall framework for industrial requirements and associated fines and penalties for noncompliance. In 1996, the Ecology Law was revised to simplify procedures, improve the enforcement, and clarify responsibilities for specific federal, state and municipal jurisdictions. The Ecology Law and associated regulations require that for certain projects an Environmental Impact Assessment (EIA) ("*Manifiesto de Impacto Ambiental*") be prepared and approved by INE. Depending upon the project, there are three levels of EIA: general, intermediate, or specific (most detailed). In addition to the EIA, for projects with potential "high" risks a Risk Study ("*Estudio de Riesgo*") must also be prepared and approved by INE. Upon issuing an authorization (approval) for the EIA, INE usually sets forth 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. Associated with the Ecology Law and related regulations, more than 250 environmental standards (known as NOMs) have been established by INE and CNA to regulate areas in air emission, wastewater discharge, hazardous waste, etc.

3.10 Key environmental regulatory requirements related to the TdG project include the following:

- Ecology Law (*Ley General del Equilibrio Ecológico y Protección al Ambiente*);
- Federal Law on Rights Related to Waters (*Ley Federal de Derechos en Materia de Agua*);
- Law of National Waters (*Ley de Aguas Nacionales*);
- Regulations for the Law of National Waters (*Reglamneto de la Ley de Aguas Nacionales*);
- Regulations on Environmental Impact (*Reglamento de la Ley del Equilibrio Ecológico y Protección al Ambiente en Materia de Impacto Ambiental*);
- Regulations on Prevention and Control of Air Pollution (*Reglamento de la Ley del Equilibrio Ecológico y Protección al Ambiente en Materia de Prevención y Control de la Contaminación de la Atmósfera*);
- Regulations for Protection of Environment Against Noise Contamination (*Reglamento para la Prevención Ambiental Contra la Contaminación Originada por la Emisión de Ruido*); and,
- Regulations on Hazardous Waste (*Reglamento de la Ley del Equilibrio Ecológico y Protección al Ambiente en Materia de Residuos Peligrosos*).

3.11 Specific standards applicable to the TdG project include the following:

- Maximum permissible limits of emissions by fixed sources (NOM-085-ECOL-1994) (see Table 3-1);
- Requirements related to air quality (NOMs-020- to 026-SSA1-1993) (see Table 3-2).

- Maximum permissible noise limits of emissions by fixed sources (*Reglamento para la Prevención Ambiental Contra la Contaminación Originada por la Emisión de Ruido* - November 29,1982) (see Table 3-3);
- Environmental specifications for fossil fuels used by fixed sources of air pollution (NOM-086-ECOL-1994);
- Ecological criteria on water quality (CE-CCA-001);
- Maximum amount of pollutants that wastewater can contain for discharge to rivers and national waters (NOM-001-ECOL-1996) (see Table 3-4);
- Ecological criteria to determine which species are endangered, rare, on the verge of extinction, or subject to special protection (NOM-059-ECOL-1994); and
- Requirements of sites destined for the final confinement of municipal solid waste (NOM-083-ECOL-96).

3.12 Principal approvals, permits, and authorizations required by the governments for the TdG project include the following:

- INE approval of the EIA and the Risk Study;
- INE approval of air emission, hazardous waste disposal, and handling and disposal of solid waste;
- CRE authorization for construction of the project;
- Approval of land use and construction by the local authorities;
- CNA approval of water withdrawal from wastewater discharge to the *Tampaón* River; and,
- Approval of railroad connection and right-of-way by the Ministry of Communications and Transportation.

3.13 A complete list of the applicable permits and governmental authorizations required for the TdG project are listed in Table 3-5.

B.3 Other Requirements

3.14 In addition to meeting the applicable environmental requirements indicated above, the TdG project should be designed and operated to comply with applicable guidelines set forth in the World Bank Pollution Prevention and Abatement Handbook (July 1998). Tables 3-1, 3-3, and 3-4, respectively, present the applicable standards in air emission, noise limits and wastewater discharge limits for the project.

C. Project Status

3.15 On May 24,1996, CRE granted the TdG project the permit to generate electricity for self consumption.

3.16 In 1996, Cemex developed a feasibility study (conceptual design) for waste ash disposal. Cemex reported to INE that the ashes would not be defined as hazardous wastes on the basis of chemical analysis and characterization using the Mexican hazardous waste characterization standards. On June 11, 1999, INE determined that the characteristics of the waste ash generated by the TdG project would be subject to testing by an authorized laboratory in the pre-operation stage of the project. If the ash is found to be hazardous according to the Mexican standards, INE will establish specific requirements for its disposal. If the ash is not characterized as hazardous, the Sponsors

must submit for INE's approval a plan for the construction of a solid waste landfill, including the installation of monitoring wells to detect possible leaks. On the other hand, if a hazardous nature is determined for the ash, the Sponsors must immediately submit for INE's approval a plan to handle and dispose the hazardous ash.

3.17 On April 24, 1998, Cemex presented to INE a feasibility study for the project. Cemex reported to INE that some of the specific design aspects for the project had not yet been determined because the project had not been awarded. On May 12, 1998, INE issued a notice stating that the project was feasible and requesting that a General Level EIA ("*Manifiesto de Impacto Ambiental - General*") and a Risk Study ("*Estudio de Riesgo*") be prepared.

3.18 Cemex contracted *Instituto Tecnológico de Estudios Superiores de Monterrey* ("ITESM") to prepare an EIA and a Risk Study for the project. The results of both studies were presented to INE on August 24, 1998. The EIA describes the project and the environmental and social conditions in the project area. The studies identify the environmental and social impacts related to the project, and provide a basic description of the proposed mitigation and monitoring measures. However, these studies did not include detailed presentations of potential impacts in some areas (e.g., complete air emission modeling) and associated mitigation and monitoring measures. Supplemental environmental studies and evaluations have been conducted at the request of the IDB. A revised air quality impact assessment has been prepared by Energy and Environmental Engineering, LLC (consultant to the Sponsors) in September of 1999, which includes estimates of fugitive dust emissions from the fuel, limestone and ash storage, in addition to the stack emissions from the proposed project.

3.19 On September 1, 1998, the Sponsors placed notices in three widely circulated (one national and two regional) newspapers, that in accordance with the Ecology Law, environmental information related to the project, including the EIA, was available to the public. The EIA was also made available in April 1999 at the IDB offices in Mexico City and Washington, DC. During January through June of 1999, the Sponsors have made a series of presentations about the project to the local schools, local officials, community and professional groups, and the local towns and communities near the project site (see Section 7 for details). On March 15, 1999, the Sponsors held a public meeting in *Tamuín* to inform the local residents about the project and its environmental and social aspects. This meeting was attended by representatives of SEMARNAP and INE. At this meeting, several community members expressed their concerns about the use of the *Rio Choy* as the source of water for the operation of the project and thus the water supply source was subsequently changed (see below).

3.20 The project EIA and Risk Study were reviewed by INE. In November 1998, INE issued a request for clarification of some technical issues related to the Risk Study. On February 16, 1999, the Sponsors submitted additional information to respond to that request. On June 11, 1999, INE issued an EIA authorization for the project. This authorization sets forth sixty conditions for the construction, operation, and abandonment of the project. Among others the conditions require the Sponsors to:

- Obtain applicable federal, state, and municipal permits, including an approval from CNA to extract water from the *Rio Tampaón* and to discharge wastewater to the *Rio Tampaón*.
- Submit, within 6 months from the date the EIA authorization was issued, a reforestation program for the areas affected by construction of the project.

- Suspend the project in case that archaeological vestiges are found during construction.
- Implement an air and water quality monitoring program. Results of monitoring must be presented to PROFEPA on a bi-annual basis.
- Submit, within 30 days from the date of receiving the INA authorization, a program of compliance that must be approved by INE and PROFEPA.
- Report, on a quarterly basis, compliance with the terms and conditions of the INE authorization.
- Notify INE and PROFEPA the dates of commencement and completion of construction of the project.

3.21 On July 12, 1999, the Sponsors submitted to INE and PROFEPA a program as required by INE to comply with the conditions established in the EIA authorization. On August 31, 1999, the Sponsors submitted to INE a document requesting further clarifications on INE's resolution letter. On September 7, 1999, the Sponsors received a document from the Secretary of the Environment of *San Luis Potosi*, stating that the State supports the activities of ash confinement at the proposed project site.

3.22 In response to the public opinion that the public preferred the Sponsors to use water from the *Tampaón* River instead of the *Rio Choy*, the Sponsors informed INE on May 12, 1999 that they planned to withdraw water from the *Rio Tampaón* instead of using the *Rio Choy*. As a result of this revision, a water supply pipeline (13.6 km long) and a wastewater discharge pipeline (15.5 km long) would have to be constructed between the *Rio Tampaón* and the power plant site. The proposed withdrawal rate is 450 l/s and discharge rate is 80 l/s. The Sponsors have submitted to INE an update of the original EIA, which includes the use of the *Tampoan* River instead of the *Rio Choy*. Subsequently, the Sponsors submitted to INE technical information regarding potential environmental impacts due to construction of the proposed pipelines.

3.23 The Institute of National Archaeology and History ("INAH") issued a notice on July 17, 1998, stating that the power plant site does not contain any archaeological ruins or objects, based on a detailed site inspection performed by INAH in 1998.

3.24 INAH issued a notice on August 16, 1999, stating that no archaeological ruins or objects exist within the proposed right of way of the water supply and wastewater discharge pipelines.

3.25 On July 22, 1999, the Sponsors submitted an application to the *Secretaría de Desarrollo Urbano, Comunicaciones y Obras Públicas* (Secretary of Urban Development, Communications and Public Works) for a permit, which would allow for a change in the use of land at the project site.

3.26 The sponsors, at the request of the IDB, are presently performing ambient air quality sampling for nitrogen dioxide, sulfur dioxide and particulate matter, which is scheduled for completion by the end of October, 1999. The Sponsors are continuing to collect meteorological data at the *Tamuín* airport located northeast of the project site. The Sponsors are presently completing a traffic study to evaluate the traffic conditions at *Tamuín*.

4. ENVIRONMENTAL AND SOCIAL CONDITIONS

A. Environmental Conditions

4.1 *Location*. The TdG project will be located in the municipality of *Tamuín* in the State of *San Luis Potosí*. The site for the proposed power plant is situated about 10 km northwest of *Tamuín* and about 6 km northeast of the village of *Las Palmas*. The total area of the project site is about 132.2 hectares. The project site is connected to *Tamuín* by an access road. The town of *Tamuín* can be accessed via road, railroad, or air plane from either the Port of *Tampíco* and/or *Altamíra* in the State of *Tamaulípas* (ITESM, 1998).

4.2 *Land Use*. In 1995, the project site was granted a permit for industrial land use associated with cement production (e.g., the activity of *Cementos Anáhuac*). In July 1999, the Sponsors applied for a land use permit for heavy industry purposes (i.e., power plant). Although, the revised permit for land use has not been approved for the TdG project, it is expected that such a permit would be obtained prior to commencing project construction.

4.3 *Nearby Land Use*. The project site is adjoined to the west by the *Cementos Anáhuac* cement plant and to the north by an undeveloped land belonging to *Cementos Anáhuac*. To the south and east the project site is adjacent to the E*jido las Palmas*, who has a permit for agrarian land use. Other nearby land uses include: the *Estación Tamuín* ("*Tamuín* Train Station") located about 4 km to the east; the *Las Palmas ejido* (system of communal farming) to the south; the village of *Las Palmas* located about 6 km to the southwest; the *Anahuac Potenic*a 400 kV Substation is located about 2 km southwest, and, the *Sierra del Abra-Tanchipa* protected area located about 2 km to the west (see Figure 2-1).

4.4 *Meteorology and Air Quality*. The majority of the project area is characterized by a warm moderately humid climate with summer rain showers. Average annual precipitation is 1,150 mm. Temperatures vary between 6 to 52 degrees centigrade (°C).

4.5 A meteorological station has been operating at the nearby *Tamuín* Airport since April 1998. Based upon the limited data, the average wind speed has been estimated at 1.17 meters per second (m/s), ranging from 0 to about 7.8 m/s. The wind speeds are typically higher in winter months but lower in summer months. However, summer months are characterized by thunderstorm activities which can result in gusty winds for a short period of time. This condition is reflected in the tabulation of maximum wind velocities recorded at the *Tamuín* Airport station where the maximum recorded wind gust was in August.

4.6 The predominant wind direction at the project site is from the north through northwest. In general, winds are distributed evenly in the west-northwest to east-northeast directions. These directions are also associated with the highest wind speed. Wind flows from the south are relatively rare in the currently available data set and the wind speeds associated with these flows are low. Winds from the southwest are the least frequent at the airport, based on the available data. A wind rose showing the airport data is presented in Figure 4-1.

4.7 Air quality conditions at the project site appear to be fair (for particulate) to good (other pollutants) based on visual observations during a site visit in early April, 1999. However, no sampling data are currently available to quantify the ambient levels. The existing *Cementos Anáhuac* cement plant and its associated limestone quarry are the only major stationary sources in the project area. It appears that the quarry is the major emission source due to the generation of fugitive emissions during the periods of elevated wind speeds. Background levels of nitrogen dioxide, carbon monoxide and sulfur dioxide have been simulated by dispersion modeling of the

existing cement plant. Emissions from the cement plant were estimated using emission factors suggested by the USEPA in their document AP-42, "Compilation of Air Pollutant Emission Factors". Cement plant sources were assumed to operate continuously, which will result in an overestimate of annual emissions. The modeling indicates that existing conditions for nitrogen dioxide, carbon monoxide and sulfur dioxide are within applicable standards and guidelines, and that the airshed is not impacted as defined by World Bank guidelines. The background levels of particulate matter are unknown at this time. The Sponsors are presently conducting particulate matter ambient air quality sampling.

4.8 *Water Sources*. The closest surface water to the project site is the *Rio Choy,* which is about 2 km southeast of the project site. It is a secondary river whose source is a spring located approximately 13 km west of *Tamuín*. The *Rio Choy* runs from west to east and discharges into the *Rio Tampaón* at a location near the southern end of *Tamuín*. The *Rio Tampaón* runs generally toward the northeast direction and joins the *Moctezuma* River to form the *Panuco* River, which finally discharges its water into the Gulf of Mexico. In the vicinity of *Tamuín*, the *Tampaón* River waters are used primarily for agricultural activities including irrigation of sugar cane fields and livestock watering. Most cities in the area discharge sanitary wastewater to the *Tampaón* River without treatment. The *Tampon* River appears to be polluted in the vicinity of the proposed water intake structure for the TdG project. In the vicinity of the proposed water intake, the *Tampon* River receives the discharges of Nestle (powder milk producer) and sanitary wastewater from the municipality of *Tamuín*.

4.9 According to the data provided by CNA, the *Tampon* River has an annual reserve of 5,190,000,000 $m^{3,}$ while the annual total demand for project operation will be only 6,000,000 m^3 (approximately 500,000 m^3 per month). The average monthly flow of the *Tampaón* River is about 459,300,000 m^3 for the period of record 1954 through 1994. Average monthly flows vary from about 118,956,000 m^3 in April to about 1,175,640,000 m^3 in September. A review of limited water quality data for water samples collected from the *Tampaón* River on November 24 and 25, 1998, indicates that the chemical water quality generally appears to be adequate for agricultural, industrial, and municipal uses. However, the elevated levels of indicator bacteria reflect contamination by sanitary wastewater.

4.10 Based on the maps published by the National Institute of Statistics, Geography, and Information, the project site is underlain by "consolidated materials with low water bearing possibilities." However, the areas of *Tamuín* and *Los Patitos Lagoon* are covered by "non-consolidated materials with medium water bearing possibilities". There are three restricted areas for groundwater exploitation surrounding the site: one to the north, one to the west, and another to the east. The project site is not located within any of these restricted areas. Groundwater in the project area generally flows toward the northeast direction. Information regarding water quality, water reserves, or groundwater depth in the project area is not available.

4.11 Other nearby water sources include Lagoons *Los Patitos, Las Palmas, Grande,* and *Los Catemes*. The *Los Patitos* Lagoon is about 2 km north of *Tamuín* and covers an area of about 13 square kilometers (km^2). The *Las Palmas Pond* is about 9 km northwest of *Tamuín* and about 1 km east of the project site. This pond covers an area of about ¼ km^2 and contains pluvial water used only for watering cattle. *The Grande and Los Catemes* Lagoons are smaller water bodies near the project site.

4.12 *Flora and Fauna*. Vegetation in the project site is known as low jungle ("*selva baja caducifolia*"), characterized by small bushes and trees up to 10 m high. Such low jungle vegetation has been used for livestock and firewood. However, this vegetation has been subject to extensive burning in the past years. At present, bushes and lianas predominate the site area.

4.13 A detailed biological field investigation was conducted by ITESM in 1998. Plants and animals at the site were surveyed using 50-m transects and 20- by 20-m quadrants. In addition, ITESM conducted a literature search of the protected plants and animals and consulted with local experts. Most of the original mammals no longer inhabit the area due to human activities in the area. Within the project site, there is no indication of any of the protected species as mentioned in NOM-059-ECOL-1994. It is possible that, from time to time, some birds transitorily visit the site in their journey to more protected areas or feeding grounds. Furthermore, there was no evidence of activity or movement of reptiles within the project site although other species such as turtles, lizards, snakes, etc. are around the area.

4.14 A biological reserve ("*Sierra del Abra-Tanchipa*") is located about 2 km west of the project site. The dominant vegetation type in the biological reserve is known as low jungle ("*selva baja caducifolia*"). Other types of vegetation ("*selva baja subperennifolia", "selva mediana subperennifolia", "el encinar tropical", "el palmar*"), can also be found throughout the reserve. The biological reserve provides habitat for approximately 231 plants and 161 animal species, which are considered to be rare, threatened or endangered by the Mexican Government. At the present time Mexican federal authorities have not prepared a specific and comprehensive Reserve Management Plan, to establish the reserve characteristics, fragility, condition, total size and limits. The INE did not include any provision for this reserve in the resolution for the project EIA. This indicates that construction and operation of the project is not anticipated to impact the reserve.

4.15 *Geology*. The project site is located within the North Gulf Coastal Plain that covers the western end of the State of *San Luis Potosí*. The region has geomorphological differences given by the *Sierra del Abra* that divides the eastern plains with soft hills between *Tamuín* and *Tampíco*. The site area is characterized as a large plain with minor changes in ground elevation ranging from about 300 m to 500 m above mean sea level. The project area is underlain by artificial fill, Quaternary alluvium, and sedimentary rocks (such as Lower Cretaceous limestone, Upper Cretaceous shale, Tertiary shale, and conglomerate). As indicated by the geotechnical studies previously completed in the project area, the site is expected to be underlain by a layer of dark brown clayey soils and bedrock (shale). The estimated thickness of the surface soil layer is about 6 m to 7 m.

4.16 *Archeology and Cultural Heritage*. There are three Indian groups who predominated within the State of *San Luis Potosí* during the pre-Hispanic age: the *Huastecos*, the *Pames*, and the *Guachichiles*. The project site is located in a regional area inhabited by the *Huastecos* who belong to the Maya Family; however no indigenous peoples/families are known to live in the immediate area of the project site. It is believed that the *Huastecos* arrived first in *San Luis Potosí* Valley and then moved to the eastern region of the State. The region is rich in cultural resources. A ceremonial center of the *Huastec* Culture ("*La Hondurada*") is located in the *Las Palmas ejido* at a distance of about 6 km to the southwest. The *El Consuelo* archaeological zone is about 20 km south of the project site.

4.17 *Noise*. The nearest sensitive receptors in the project area are located in the nearby village of *Las Palmas* (Figure 2-1). Scattered residences are located along the road between the City of *Tamuín*

to the *Tamuín* Train Station. This road would serve as the access route to the project site. There are three schools and/or technical training facilities in the *Tamuín* area. No baseline noise data is available.

4.18 *Agriculture*. The project site is located in an area which has previously been used for livestock grazing. No farmlands are located at the project site.

4.19 *Traffic and Transportation*. Several roads, highways, and railroads traverse the project area. The road connecting *Tamuín* and *Las Palmas* is within a radius of 5 km from the site. The road connecting *Tamuín* and the *Tamuín* Train Station is about 3 km from the eastern edge of the site boundary. The railroad connecting *Ciudad Valles* and *Tampíco* is about 1 km from the site. A federal highway joins the municipality of *Tamuín* with *Ciudad Valles* to the west of the site and the Port of *Tampíco* to the east. A railroad connects *Tamuín* with the cities of *Tampíco* and *Ciudad Mante*.

4.20 Currently, there are no plans for construction of new roads or highways in the vicinity of the project area. Neither traffic counts or traffic projections are available for the project area. Traffic information is currently being gathered by ITESM and should be available in October 1999.

4.21 *Visual Resources*. The site for the proposed power plant is located in a remote and undeveloped area. With the exceptions of the transmission towers/lines and the proposed stack, most of the power plant facilities will not be visible from sensitive residential areas or highways.

B. Social Conditions

4.22 As of the 1995 census, the municipality of *Tamuín* had a total population of approximately 36,500 inhabitants. The average age of the population is 19 years. Within the municipality of *Tamuín*, 10 percent of the population speaks one indigenous language (e.g., *Huasteco, Mazahua, Mixteco, Nahuatl, Otomi, Pame,* or *Purepecha*) and 87 percent of the people can read and write. Indigenous language-speaking residents are believed to be interspersed among the general population, and are not concentrated in any particular locale. This situation will be verified by interviewing of local community leaders. The municipal seat, *Tamuín*, has a population of about 15,000, with the remainder of the population residing in small villages ranging in size from a few families up to about 3,500 persons**.** The population of *Las Palmas*, the closest community to the project site, is about 2,000 inhabitants.

4.23 There are approximately 7,600 dwellings in the municipality of *Tamuín*, of which about 3,500 are located in the City of *Tamuín*. The village of *Las Palmas* has about 400 dwellings. The average occupancy for the municipality is 4.8 persons per household. Approximately 80 percent of the dwellings have no more than two bedrooms. Forty percent of the dwellings have their roofs constructed of paperboard, bamboo, or palm. Accommodations for visitors to the municipality are limited. As of December 31, 1997, a total of seven guest establishments with 265 rooms was recorded for *Tamuín*. Of these, three establishments with 206 rooms were classified as 3-star category. The other facilities consisted of a 2-star establishment (12 rooms) and 47 rooms in miscellaneous lodgings.

4.24 In *Tamuín*, most of the population has access to basic services such as potable water, electricity, and public lighting and schools. By comparison, the *Las Palmas* village has very limited access to public lighting, medical assistance, and sanitary infrastructure. Approximately 84 percent of the

dwellings have electric power, while 72 percent have potable water piped in. Only around 40 percent of the dwellings have sanitary drainage to municipal sewers or septic tanks. However, more than 60 percent of the residents have no indoor facilities for disposal of sanitary wastes.

4.25 Agriculture (farming and ranching) is the main economic activity of the population. The 1990 census reported that economically occupied persons in *Tamuín* municipality numbered about 8,700 (7,400 men and 1,300 women). About 40 percent of the population is 12 years of age or older. This is a relatively low level of participation of the working-age population in the workforce, reflecting in part a large proportion of young people in the population (many attending school or engaged in unpaid household activities), and in part a relatively high rate of inactivity (or unreported economic activity) among adults. Persons working in agriculture and hunting, and fishing numbered 4,100 workers (47 percent of the total number occupied), with the majority of the other workers occupied in manufacturing (1,500), commerce (650), personal services (590), community and social services (505), and construction (370). Earnings from labor were generally low: approximately one-third (2,900) of the occupied persons earned less than the minimum salary (mostly in agricultural occupations), while those earning from one to two minimum salaries numbered about 3,300 (about 38 percent, mostly in manufacturing and commerce). The majority of construction workers in the state of *San Luis Potosí* earned an average of two minimum salaries (as of January - February 1999, the minimum salary in the State of *San Luis Potosi* was about 29.70 Pesos per day).

4.26 Employment rates in *Tamuín* reflect nationwide and regional trends. Due to the currency crisis, the national economy suffered a large downturn in 1995, with levels of industrial output, incomes, and employment dropping sharply. In the State of *San Luis Potosí*, the construction sector experienced a sharp decline in employment between late 1994 and mid-1995, dropping from over 14,000 jobs to a low of about 2,500. The situation improved somewhat thereafter, with levels of construction jobs in the State fluctuating between a peak of 5,700 in December, 1996 and a low of about 3,850 in February, 1999. The depressed state of construction activity in the region is undoubtedly reflected in a scarcity of work opportunities in *Tamuín*.

5. ENVIRONMENTAL AND SOCIAL IMPACTS

5.1 As with any project of this type, the TdG 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 TdG project are presented in Sections 5A and 5B, respectively. Potential positive impacts (benefits) associated with the project are presented in Section 5C.

A. Impacts During Construction

5.2 Construction of the TdG project is estimated to extend over 2½ years. Potential negative impacts during construction include demands on lodging, eating, entertainment, and health services; soil erosion; increase in traffic and noise levels; potential spills; and, generation of dust, waste, and wastewater, etc. The most significant impacts are the effects on soils and the pressures on housing and public services from workers relocating to the project area. Most of these impacts are temporary and mitigable.

5.3 *Socioeconomics*. It is estimated that 600 construction workers would likely move into the project

area from outside the local area. The "local area" is typically defined as the region within which workers would drive to the project site on a daily basis and is normally less than one-hour. These workers would commute to the site from existing residences. In addition, a peak of about 300 workers would be expected to come from the local area. Average local and non-local worker numbers are much lower. The Sponsors expect that these non-local workers would first attempt to settle in nearby communities such as *Tamuín, Ciudad Valles, Alvaro Obregon, or Ebano*. These four communities have an estimated combined population of more than 75,000 individuals and all are within daily commuting distance. There is not sufficient vacant or under-utilized public or private housing in the *Tamuín* municipality (*Las Palmas* in particular) to accommodate these newcomers. Therefore, local housing during construction is a potential problem. There will be an influx of largely single adults requiring shelters, food, entertainment, and other services, for which there is little excess capacity. Of particular concern is the prospect of itinerants setting up squatter camps on the outskirts of towns, having no sanitary facilities and adding to the burden on local public safety and health agencies and personnel. Since it is presently uncertain as to where these workers may prefer to locate within the region, it is not possible to finalize project specific impacts and mitigation measures. Thus the project Sponsors have proposed an action plan that will emphasize close cooperation with local communities and officials (see Section 6 for details).

5.4 Purchases of goods and services from local businesses by construction workers and contractors will stimulate expansion of the local economy, which may attract further immigration to the municipality. Local businesses will benefit from construction-related spending, which could encourage expansion of operations and employment to accommodate the increased demands. However, after completion of construction the expanded operations may have to be reduced, thus, imposing a negative impact on local economy.

5.5 *Topography, Soils, and Flora*. The topography of the project site will be impacted as a result of the activities associated with construction of the power plant facility, transmission lines, access roads, pipelines, and railway spurs. Such activities include site preparation involving removal of vegetation, earthwork involving cut and fill operations, foundation excavation, equipment assembly, and accumulations of construction debris. These activities in areas outside of the plant site will likely alter the engineering and chemical characteristics of the near-surface soils, resulting in an increased potential for erosion and a decreased potential in soil fertility.

5.6 Recent studies indicate that the power plant site does not contain sensitive or endangered plants or animals. As such, negative impacts on biological resources are not expected at the project site. Significant impacts are also not anticipated for other project components given the limited lengths and locations of the proposed transmission line, railway spurs, and water pipelines.

5.7 *Air Quality.* During construction, earthmoving activities and heavy equipment usage have the potential to cause short-term impacts on ambient air quality. Given the relatively arid nature of the site area, fugitive particulate emissions are expected to be the most significant during construction. Vehicle traffic and heavy equipment will result in emissions of gaseous pollutants and particulate matters. However, these emissions will be spread over the construction area and are not expected to result in significant impacts.

5.8 *Traffic and Transportation.* The project would increase traffic resulting from the delivery of materials, supplies, and commuting by construction workers. The project has the potential to generate additional traffic that could not be adequately accommodated by the existing roadways, alter present patterns of circulation, and increase traffic hazards to motor vehicles, pedestrians or

bicyclists. The average workforce is estimated to be approximately 500 workers during construction and 900 workers during the peak construction period. The Sponsors have estimated that commuting workers would require 10 to 15 bus round trips per day.

5.9 *Noise.* An increase in noise levels is expected as a result of construction activities, such as delivery and transport of equipment and materials to the project site, trucks trips, heavy machines usage during site preparation, and construction of plant facilities. Because construction workers will be provided with hearing protection equipment as required by the Mexican regulations, significant negative impacts on construction workers due to increased noise levels are not expected. The nearest sensitive receptors are located in the village of *La Palmas*. The additional noise created by truck traffic will have a limited impact on local residents and community.

5.10 *Archaeology and Cultural Heritage*. Because no archaeological sites or historical resources were found at the power plant site (INAH, November 1998), negative impacts to archaeological and cultural heritage are not expected. If the ceremonial center of the *Huastec* Culture in the *Las Palmas ejido* and the archaeological site near the *Rio Tampaón* are not crossed by the proposed infrastructure, negative impacts should not be expected. No archaeological impacts are expected from construction of the water pipelines.

5.11 *Land Use*. The proposed access road, water and wastewater pipelines, transmission line, and railway spur will cross undeveloped lands that are currently zoned for commercial and industrial development. Negative impacts on land use along the alignments of the proposed infrastructure are not expected. No impacts are anticipated to farmlands from the construction of the power plant facility.

5.12 *Visual Resources.* The project site is located in a remote, generally undeveloped area. Construction of the power plant site would not result in negative impacts since the site cannot be viewed from residential areas, highways, or other sensitive visual resources. Negative impacts on visual resources along the alignments of the proposed infrastructure (i.e., water and wastewater pipelines, railway spur, transmission line etc.) are not expected.

B. Impacts Associated with Operations and Maintenance

5.13 The principal negative impacts associated with operations of a power plant are described below and include: potential changes in air quality; impacts due to water supply/withdrawal; impacts from wastewater discharge; impacts from fuel and limestone storage and waste landfill; and, impacts on noise.

5.14 *Air Quality*. During operations, major sources of emissions at the power plant are the CFB stack, the ash landfill, and the storage piles for petroleum coke fuel and limestone. The air emissions from the plant stack will include sulfur oxides, nitrogen oxides, carbon monoxide, particulate matter, and trace amounts of unburned hydrocarbons and the metals contained in the petroleum coke. Air emissions will be controlled (see Section 6B for details) to ensure that such emissions are within the maximum permissible limits under the Mexican regulations and World Bank guidelines for thermal power plants (see Tables 3-1 and 3-2 for limits). The particulate matter emissions may also contain some metals, including nickel, vanadium, chromium, cadmium and beryllium. No standard or guideline values for these compounds exist in the Mexican or World Bank requirements. However, guideline levels may be inferred from a health risk assessment

approach. A chronic health risk of less than one-in-one million is used by the USEPA and other agencies to indicate no significant risk to human health from inhalation of pollutants.

5.15 Emission estimates for the CFB boilers and dispersion modeling results supplied by the Sponsors are discussed in the following paragraphs. The air quality impact assessment has the following major components: source definition, emissions estimation, dispersion modeling (both screening and refined) and comparison of results with standards and guidelines. Each of these aspects is discussed below.

- *Source Definition*. The point sources to be considered for this analysis consist of the CFB stacks and the power plant cooling tower, and the *Cementos* cement kiln stack (the kiln is not part of this project but is an air emission source within the project area of influence). Information on power plant stack characteristics was provided by the Sponsors. Information on the cement plant kiln stack was provided by the plant operator. Stack characteristics are provided in Table 5-1 for the power plant and Table 5-2 for the cement plant.

- *Stack Height Considerations*. A good engineering practice (GEP) stack height is the greater of 65 m, or

$$H_g = H_b + 1.5L$$

where H_g = the GEP stack height (in meters);
H_b = the height of the dominant nearby building (in meters); and,
L = the lesser dimension of the height or projected width of the dominant nearby building (in meters).

According to USEPA guidelines, sources with stacks higher than their GEP stack heights are not allowed to take credit for the increased dispersion.

The ISCST3 model (further discussion is provided on the next page) used in the ambient air quality assessment combines two (Schulman-Scire and Huber-Snyder) algorithms for predicting air quality impacts and the associated building wake effects. The Schulman-Scire algorithm is applicable when the stack height is less than the building height plus one half of the lesser of the building height or width and takes into account wind-direction-specific building heights and widths when determining wake effects. The Huber-Snyder algorithm is applicable when the stack height is between 1.5 H_b and 2.5 H_b and uses the actual building height and maximum projected width for all wind directions. An USEPA approved software package, Building Profile Input Program (BPIP), was used to calculate direction specific building dimensions and the resulting GEP stack height. The direction specific building dimensions generated by BPIP were used in the ISCST3 modeling. The GEP stack height for the project is approximately 132 m. Because this height is greater than that of the actual stack (120 m), the actual stack height was used.

- *Emissions Estimation*. The calculated emissions and other exhaust parameters for the TdG project and the cement plant are also presented in Tables 5-1 and 5-2. All averaging intervals assumed operation of the CFB and at full load for 8,760 hours per year. The emissions from the CFB are based on information provided by the Sponsors incorporating the proposed pollution control measures. Emissions from the cement plant have been based upon operations data and published emission factors. The estimated heat input to the cement kiln was applied

to emission factors suggested by the USEPA in their document AP-42, Compilation of Air Pollutant Emission Factors. These factors are derived from operating data from multiple similar facilities, and they are expected to provide a conservative estimate of emissions.

In addition to the stack emissions, the proposed power plant project will result in fugitive particulate emissions from fuel, limestone, and ash storage. Fugitive particulate matter emissions were also estimated using USEPA emission factors, along with information provided by the Sponsors related to the amount of each material expected to be stored. Wind speed data used to estimate wind erosion potential were taken from the *Tamuín* airport data set. Table 5-2 presents the estimated fugitive emissions.

- *Dispersion Modeling*. The air quality impact assessment uses a sequential approach to dispersion modeling, in keeping with generally accepted modeling practices. First, a screening level model (the USEPA SCREEN3 model) was used to define the area of significant impact for the project. SCREEN3 is a Gaussian plume model designed specifically for the screening-level analysis of impacts from a single industrial point source. The model estimates maximum concentrations in both simple and complex terrain. Once the modeling domain was established, refined modeling was performed with the USEPA Industrial Source Complex, Short-Term (ISCST). ISCST is the USEPA-recommended model for point and area sources in industrial complexes such as the power plant and cement plant. ISCST uses a steady-state assumption (that is, emissions and meteorological conditions do not change over a one-hour period). The model can analyze the interaction of multiple sources. The ISCST model results were then used to compare with applicable standards and guidelines. Input to the models consists of source data and emissions estimates (discussed above), meteorological data, and receptor data.

- *Meteorological Data*. Approximately one year of meteorological data has been collected at the *Tamuín* Airport. However, significant data gaps exist in the data set and not all parameters required for dispersion modeling are included. The SCREEN3 model uses an assumed set of worst-case meteorological conditions that cover a wide range of wind speed and stability conditions. Because of limitations in the airport data, this same set of worst-case conditions was used in the ISCST model. The use of such a "worst-case" data set should result in conservative impact predictions

- *Receptor Networks*. The design of the receptor network for the screening level (SCREEN3) analysis was approached conservatively. The network consisted of receptors spaced 100 m apart (from 100 to 2,000 m in the downwind direction), 200 m apart (from 2,000 to 4,000 m in the downwind direction), and 500 m apart (from 4,000 to 10,000 m in the downwind direction). Each receptor was assigned an elevation, which corresponded to the highest terrain point surrounding the site at or near the given radial distance from the site.

  Two categories of receptor grids were used in the refined ISCST air quality analysis: 1) a coarse receptor grid describing the study area, and 2) a fine receptor grid describing areas determined from the coarse receptor grid to require further analysis as the areas of highest likelihood of ground level impact. This approach significantly reduced computing time and data requirements yet provided a verification of the compliance with applicable AAQS standards.

A uniformly spaced Cartesian grid network, with spacing of one km (1,000 m) and covering the entire significant impact area, was used for the coarse receptor grid. Receptors were placed at ground level and terrain elevations of each receptor, taken from Mexico topographic maps (at a scale of 1:50,000), were included in the modeling analyses.

The fine grid receptors were determined from the coarse grid analysis based on those areas where ambient ground-level concentrations were expected to be at their maximum. The resolution of the fine grid was 100 m extending in a rectangular coordinate system around the critical receptor.

- *SCREEN3 Modeling Results*. A screening analysis was performed to determine the significant impact area for refined modeling. The cooling tower was modeled using a single emission point with a stack having an equivalent diameter to maintain a constant plume exit velocity. The results of the screening level modeling are summarized and compared to the modeling "levels of significance" in Table 5-3. These levels of significance, which are much lower than regulatory ambient air quality limits, are suggested by the USEPA for use in permitting of new or modified facilities to define if and how additional emission modeling should be performed. The following conclusions can be drawn from the screening analysis:

  The 1-hour emissions of carbon monoxide (CO) from the project are predicted by the screening analysis to have an insignificant impact on the ambient air quality. However, refined modeling is required for the eight-hour averaging period. SCREEN3 results for sulfur dioxide, nitrogen dioxide, and stack emissions of particulate matter require refined modeling.

  Screening for particulate emission from the cooling tower plume showed that the ambient impacts caused by the plume are lower than the modeling levels of significance.

  The SCREEN3 model is used to determine the plant load conditions that are likely to cause the highest impacts when using the more detailed ISCTST3 model. SCREEN3 was run using the 50% and the 100% plant load condition. Results indicated that the highest impacts were caused at the 100% load condition for most meteorological conditions and terrain heights. In some cases, the results indicated that results from the 50% and 100% load conditions were equivalent. Because the SCREEN3 model predicted the 100% load condition to cause impacts greater than or equal to the 50% load condition, the 100% plant load condition was chosen to be used in the ISCST3 modeling.

  The distance to the point of maximum impact determined by the models in the screening analysis was between 1,100 m and 3,800 m from the proposed project. The magnitude of the concentrations with increasing distance confirm that the highest impacts should occur predominantly within a 10 km radius around the project.

- *ISCST3 Modeling Results*. The SCREEN3 analysis results indicated that the ground-level concentrations of sulfur dioxide (SO_2), nitrogen oxide (NO_x), particulate matter (PM), and CO were predicted to be above the "level of significance" values. Therefore, impacts from the emissions of SO_2, NO_x, PM, and CO were analyzed further in a refined model.

  The stack parameters used in the ISCST3 analysis were representative of the worst-case condition determined by the screening analysis. The ISCST3 analysis consisted of a determination of the predicted impacts from the project in conjunction with the existing cement plant to assess whether

the project would not cause or contribute to any violations of the applicable standards or guidelines.

The modeling results are presented in Tables 5-4, 5-5 and 5-6. Table 5-4 contains the highest estimated impacts from the TdG project alone; Table 5-5 contains the results from the *Cementos Anáhuac* cement plant alone, and, Table 5-6 contains the combined (or highest) estimated impacts. Isopleths of predicted concentrations are shown in the attached Figures. As can be seen by reviewing these figures, the modeling demonstrates compliance with ambient air quality standards for all pollutants and averaging times.

The expected concentrations of metals were applied to unit risk values recommended by the USEPA, and the results predict no significant risk to public health.

The modeling results also predict that the fugitive emissions from fuel, limestone and ash storage will not lead to a violation of the applicable standards or guidelines.

5.16 Long-term deposition and absorption of contaminants emitted from a generating source can have an affect on soils. In particular, the deposition and absorption of SO_2 can lower the pH of soil with resultant chemical and biological reactions. Deposition of nitrogen dioxide can enhance vegetation growth since nitrates are plant nutrients. Because the effect on soils is a long-term concern, it is most appropriate to consider the area of the highest long-term ambient concentrations predicted by the dispersion modeling. Ambient concentrations of SO_2 and NO_x predicted by the dispersion modeling are below the Mexican standards. The ambient standards were established to protect the environment and typically, ambient concentrations of pollutants below the standards will not have a significant, detrimental effect on vegetation. Thus compliance with these standards should provide protection of these resources and no significant effects are anticipated given the acceptable ambient concentrations and the natural buffering capacity of the soil.

5.17 Using worst case default meteorological data, ground-level concentrations predicted from the modeling were compared to the applicable U.S. and Mexican standards, and guideline levels published by the World Bank. The results demonstrate that the TdG project should not cause or significantly contribute to any violations of these levels.

5.18 *Water Supply*. An application for a water supply permit has been submitted to CNA for removal from the *Tampaón* River (withdraw rate of 17,280 m^3/day), for which compliance, should ensure protection of water resources within the river. The annual total demand for project operation will be only 6,000,000 m^3 (approximately 500,000 m^3 per month) while, according to the data provided by CNA, the *Tampon* River has an annual reserve of 5,190,000,000 m^3 and an average monthly flow of about 459,300,000 m^3 (average monthly flows vary from about 118,956,000 m^3 in April to about 1,175,640,000 m^3). Thus there is sufficient flow into the *Tampaón* River to meet the water needs of the project while not impacting river water resources.

5.19 *Wastewater*. The project will generate three types of wastewater discharges: industrial (average of 1,944 m^3/day), sanitary (24 m^3/day), and storm water. Industrial wastewater, sanitary wastewater, and storm water from industrial areas will be collected, treated on-site (oil/water separators and facilities for pH adjustment, coagulation/precipitation, filtration, and sedimentation) and discharged into the *Tampaón* River. An application for a wastewater permit has been submitted to CNA. Wastewater discharges will comply with applicable Mexican and World Bank limits (see

Table 3-4). No thermal impacts on wastewater discharge are anticipated since any heat generated would be dissipated in the 16 km long wastewater pipeline.

5.20 *Fuel Supply and Storage*. A maximum of one train per day will arrive at the project site. Each train will consist of about 70 cars of fuel. The average number of trains will be on the order of one train of 70 cars every two to three days. The train will travel along the existing rail line connecting *Cadereyta Jimenez* (State of *Nuevo León*) and *Tamuín*. Current traffic on this rail line is generally low, typically 2 to 3 trains per day. With an increase of train traffic for an average of only one train every two to three days, no significant impact on rail traffic is expected. The existing rail line has been operational for years. Potential interruptions to fuel supply due to railway maintenance are not expected. Fuel supply to the power plant should not be a major concern because Pemex has agreed to deliver adequate amount of petroleum coke from its *Cadereyta* Refinery to the project site. No significant risks or impacts are anticipated due to the fuel supply via train due to the fuel characteristics (e.g., solid material, non-hazardous) and limited risk of accident.

5.21 Based upon the design and operation of the fuel storage facilities (see Sections 2 and 6 for details) and the results of the fugitive air emissions modeling, no significant impacts related to dust or air emissions are anticipated.

5.22 *Limestone Supply*. The limestone required for the project will be trucked from the nearby limestone quarry that has an estimated reserve of more than 400 years. No significant impacts due to the shortage are anticipated. The estimated yearly demand for the TdG project, 300,000 tonnes, is relatively small in comparison to the production at the cement plant of about 2,880,000 tonnes per year, and thus no induced or indirect impacts from the facility are anticipated.

5.23 *Hazardous and Solid Waste*. The use of petroleum coke will generate bottom and fly ash as a result of the combustion process in the boilers. Commercial facilities for disposal of combustion wastes are not available in the *Tamuín* area. Therefore, construction and operations of an on-site landfill for ash disposal will be needed (see Section 2 for detailed description) which should result in no significant impacts. Preliminary results of the laboratory analysis performed in accordance with applicable Mexican standards indicate that samples of similar petroleum coke fly (from an US facility) and bottom ash are not hazardous (within the permissible limits established for the tests of corrosivity, reactivity, explosivity, toxicity, and biologically infectious). It is recognized that the test results depend upon coke quality and variations in coke quality are possible. INE has required that once the facility initiate operations that the ash be tested and monitored to determining whether the ash could be managed as non-hazardous waste. Other hazardous wastes generated by the project (i.e., waste oil, oily rag, maintenance waste, etc.) are expected to be managed according to the existing regulations. Solid wastes typically generated from the power plant (i.e., toilette waste, office waste, food waste, etc.) are expected to be disposed of at the on-site landfill.

5.24 *Noise*. Operations of the power plant will increase existing noise levels. The plant has been designed so that noise levels at the plant boundary are within acceptable Mexican limits (68 dB(A) between 6:00 a.m. and 10:00 p.m.; 65 dB(A) between 10:00 p.m. to 6:00 a.m.), and the World Bank Guidelines for Industrial zones (see Table 3-3). Noise modeling of the power plant operations confirmed compliance with these limits at the plant boundary. Actual noise limits at the plant boundary will be lower than predicted since a natural vegetation (i.e., green belt) will be maintained along the southern and eastern plant boundaries (i.e., direction of receptors).

5.25 *Socio-Economics*. No significant long term social impacts are expected during operations of the power plant, given the location of the project site and the relatively small number of permanent workers required (under 100 individuals) during operation.

5.26 *Land Use*. ITESM has reported that no long-term comprehensive growth and/or development plans have been adopted by the City of *Tamuín* and the village of *Las Palmas*. While growth in a region can cause increases in ambient air quality concentrations due to mobile sources, construction, and other growth-related aspects, the proposed TdG Power Plant will not likely directly cause growth in the area.

5.27 *Traffic and Transportation*. About 90 workers will be required during operation of the power plant. Although local workers will be hired, perhaps one-half to two-thirds of the operators will come from elsewhere. No significant impacts due to an increase in vehicle traffic are expected during operations.

5.28 *Flora and Fauna.* It is likely that some rare and protected species exists in the region. However, there is no indication of any of the protected species mentioned in standard NOM-059-ECOL-1994 within the project site. The site is only used as a traffic area for wildlife species migrating toward protected or feeding areas. Additionally, vegetation within the project site was previously disturbed by extensive burning, livestock grazing, and collection of firewood. As no listed plant or wildlife species have been observed in the vicinity of the proposed power plant, the project is not expected to have an impact on threatened or endangered species.

C. Positive Impacts/Benefits

5.32 The TdG project should have a positive environmental impact by generating electricity via the use of waste petroleum coke that will be produced at the Pemex *Cadereyta* Refinery. The TdG project supports the Government of Mexico's objective of converting crude oil into low lead gasoline while providing a beneficial use for the petroleum coke (a refinery byproduct) in an environmentally sound manner.

5.33 The TdG project will have a positive impact through the creation of jobs, and an improved local economy due to the procurement needs and taxes.

6.0 ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING

6.1 Impacts on environmental and socio-economic conditions of the project site due to construction and operation should be mitigated. The mitigation measures and monitoring programs initially proposed by the Sponsors are summarized in this section.

A. Mitigation Measures

A.1 Construction Phase

6.2 Appropriate measures to mitigate potential negative environmental impacts will be implemented during construction. Specific mitigation activities will include the following (see Table 6-1 for additional details): minimal removal of vegetation and near-surface soils during site preparation; control of dust and air emissions and proper maintenance of construction vehicles; implementation

of soil erosion measures; implementation of proper water and waste management procedures; implementation of proper management procedures for use and storage of petroleum products; re-vegetation of impacted areas after construction; and control of noise levels and heavy traffic.

6.3 A project specific Site Environmental Management Plan for the construction phase will be developed by the project construction company, as required by the project EPC contract. The plan will include, as a minimum, procedures for the following areas: general demolition and construction waste; contaminated soil (if present); special waste; recoverable waste; fuel and lubricants; surface water discharge; sewage discharge; noise; transport; and commission and initial operation.

6.4 In terms of mitigation of social-economic impacts during construction, the proposed Socio-economic Action Plan is based on frequent communication with local government representatives and consists of two components: (1) identifying "initial" mitigation that is agreeable to both the Sponsors and local communities, and (2) monitoring the effectiveness of mitigation over time and making changes, if necessary. The plan will ensure that reasonable and necessary mitigation is implemented and also provides flexibility so that actual mitigation corresponds with actual impacts.

6.5 A local project liaison representing the Sponsors will initially meet with the municipal leadership and present an estimate of the likely population increase, the construction schedule and other information. The liaison would ask to communicate with community leaders for feedback on whether problems are expected in such areas as housing, public services, transportation, noise, etc. As construction proceeds, mitigation could be refined, depending on the level and type of actual impacts. As an example, the number of the Sponsors-provided worker housing units could be increased in a relatively short period of time if in-migration is greater than planned, or if available housing units are fewer than expected. Conversely, if a particular type of impact has been overestimated, the proposed mitigation could be reduced.

A.2 Operation Phase

6.6 *Air Quality*. Air emissions from the combustion process will be controlled through the appropriate use and operation of the CFB, which produce inherently low emissions, and particulate control equipment. The air emissions will comply with applicable Mexican and World Bank maximum permissible limits (see Tables 3-1 and 3-2). The use of a CFB combustion process where fuel is mixed with limestone, results in more than 90 percent of the sulfur being removed before the gases leave the boiler. The same process removes both sulfur dioxide and sulfur trioxide. Because of the staged combustion creating a reducing atmosphere in the combustion area, there is little formation of SO_3. The estimated design emission of sulfur dioxide is less than 1,080 mg/Nm^3 (dry basis, oxygen of 6 percent). The emissions of NO_x will be controlled through the use of the CFB combustion process itself, which typically has a NO_x generation of 200 ppm (at 6 percent oxygen). Particulate material (dust) will be controlled by two modes: the use of a series of cyclones with CFB and with an electrostatic precipitator or baghouse, resulting in greater than 99 percent removal of fine particulate matter.

6.7 The design and control (i.e., mitigation) measures to control the potential impacts from the petroleum coke and limestone handling and storage are presented in Sections 2.C and 2.D.

6.8 *Wastewater*. The project will collect and treat all wastewater generated on site, including cooling tower blowdown, boiler blowdown, low volume waste, rainwater runoff from material storage areas, sanitary wastewater, and leachate that might be generated at the ashfill. Sanitary wastewater (average of 24 m^3/day) will first be passed through a septic tank to remove solids and the remaining liquid mixed with the industrial wastewater (average of 1,944 m^3/day) for treatment. Storm water will be collected in canals surrounding the plant, passed through an oil/water separator, and then treated in the wastewater treatment plant. The wastewater treatment system will consist of neutralization, coagulation and flocculation, precipitation/sedimentation, and clarification. Treated wastewater discharged into the *Rio Tampaón* will comply with the Mexican wastewater discharge standards and the applicable guidelines in the World Bank Pollution Prevention and Abatement Handbook (July 1998) (see Table 3-4). Solids resulting from the water treatment system will be combined with the ash and placed in the on-site ash disposal area.

6.9 *Fuel Storage Area*. The fuel storage area will be lined with either a natural (e.g., clay) or synthetic liner, with a maximum design permeability of 1 x 10^{-7} millimeters per second (mm/sec). The fuel storage area will be provided with a storm water runoff collection system. The storm water collection and storage facilities prior to the treatment system will also be provided with a liner with a maximum design permeability of 1 x 10^{-7} mm/sec. The storm water will be treated so that the treated effluent, when combined with liquid waste effluent from other sources at the project site, will not exceed the allowable wastewater limits (see Table 3-4).

6.10 *Hazardous and Solid Waste*. The fly and bottom ashes generated (about 330,000 tonnes per year) during the combustion process will be confined in an on-site landfill. The ashes will be unloaded into closed transportation systems and will be transported in storage tanks to a landfill. In addition to the use of closed transportation systems, fugitive dust will be reduced by conditioning the ash with water during disposal. The landfill will be lined with either a natural (e.g., clay) or synthetic liner, with a maximum design permeability of 1 x 10^{-7} mm/sec. The current landfill design calls for a double composite liner of HDPE, sand, and clay (from the bottom up). This landfill will be developed in cells and will be provided with temporary and permanent cover during development. A leachate collection system of perforated pipe is included in trenches in the sand layer above the HDPE. The final cover will consist of a layer of sand, HDPE, and topsoil. This cover will be vegetated with native plants that have shallow root systems and will prevent infiltration of rain water which could generate leachate. Although preliminary results of the laboratory analysis from similar facilities have demonstrated that the coke, the sediment ashes, and the fly ashes are non-hazardous, a final decision on the ash characteristics will be made by INE following a period of continuos testing during the initial stage of operations. If the ash is finally considered as hazardous waste the current landfill design will be upgraded. Assuming that the calculated total production of ash for 20 years is less than 6.6 million tonnes, the total confinement area required will be about 271,000 m^2. Hazardous wastes other than ash will be disposed in a certified landfill for hazardous waste, located in Mina, State of Nuevo León. Solid waste will be disposed of at the on-site landfill.

6.11 *Noise*. The plant equipment itself and installation of the equipment have been designed so that the noise levels will be within acceptable limits at the plant boundary (NOM-081-ECOL-1994) and the World Bank guidelines. A natural vegetation corridor (i.e., green belt) will be maintained along the southern and eastern plant boundaries (i.e., direction of receptors) which will decrease the actual noise limits at the plant boundary.

B. Monitoring

6.12 The Sponsors will develop an Environmental Compliance Monitoring Plan that will provide the details associated with environmental monitoring. The plan will include sampling and analysis procedures and also describe the use of the monitoring data and test results (e.g., comparison with applicable standards, etc.). The following presents a summary of the proposed plan to monitor stack emissions, quality of wastewater discharge, groundwater, and noise levels during operation.

6.13 The CFB stack will be equipped with continuous emissions monitors (CEM) for nitrogen oxides, carbon monoxides, and sulfur dioxide. The CEM will be operated in accordance with the USEPA guidelines for quality control and quality assurance. Stack emissions will also be monitored with a continuous opacity meter. Continuous opacity monitoring will not result in measured values of particulate emissions. However, a monitored increase in opacity would indicate a failure of the particulate control system and then repairs could then be undertaken in order to eliminate excess emissions.

6.14 Wastewater produced by the TdG project will be monitored to ensure that it complies with applicable standards. The monitoring program will be designed to comply with Mexican regulatory requirements (e.g., wastewater discharge permit) and monitoring requirements and guidelines in the World Bank Pollution Prevention and Abatement Handbook.

6.15 A minimum of three monitoring wells will be installed around the fuel and combustion waste storage areas. The final numbers, locations and depths will be selected to ensure that the wells can immediately detect any significant amounts of effluent generated by either the fuel or combustion waste storage areas. A groundwater monitoring program will be developed to provide for consistent sampling and analysis procedures to ensure that the results of monitoring will provide an accurate representation of the groundwater quality. The sampling program will be monthly for the first three months of operation and quarterly thereafter. Additional monitoring will be conducted if the results dictate.

6.16 An ambient noise survey will be conducted 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. It is anticipated that samples will be collected at four to eight locations over multiple times, dates, and conditions. An operation noise survey will be conducted within one year of the commercial operation date.

6.17 Based upon the environmental monitoring programs, an annual Environmental Performance Report will be prepared to demonstrate operational compliance with the applicable regulations. The report will include, at 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.

C. Contingency Plan

6.18 A Spill Prevention Control and Countermeasure (SPCC) Plan for the construction phase of the project will be developed by the EPC contractor. The SPCC Plan will include: a facility diagram showing areas where chemicals and oil are stored or handled; typical and maximum quantities of chemicals and oil stored onsite; identification of likely pathways; locations of spill containment materials and cleanup equipment; procedures for dealing with various types of anticipated spills and releases; safety precautions for personnel involved in spill cleanups; notification requirements

for regulatory agencies, company and corporate contacts and community individuals; actions that facility personnel should take in the event of a spill; actions that local/regional authorities and contractors have agreed to take in the event of a spill; an up-to-date list of names and telephone numbers of the emergency coordinator and alternates; and evacuation plan for facility personnel. Procedures will also be developed for potential emergencies or major accidents including, fire, explosion, structures collapse, and traffic accidents involving heavy vehicles.

6.19 The Sponsors will also develop an Emergency Plan and SPCC for the operational phase of the project. This plan will be based upon the project risk analysis, as authorized by INE.

D. Health and Safety

D.1 Construction Phase

6.20 Given the project characteristics, the critical safety aspects during construction include transportation for materials and equipment to the site, handling and storage components, fuel, supplies and materials, crane and hoister operation, hot and height works, handling of pressurized gas cylinders, and welding operations. From the occupational health point of view, the most relevant aspects associated with project construction include: potential exposure to chemicals (fuel, degreasers, lubricating oil, welding fumes), noise, and thermal radiation, general sanitary conditions, including toilets, showers, eating facilities, and drinking water provisions. A construction phase Health and Safety Plan will be prepared by the EPC contractor and will include, as a minimum, safety procedures to perform each one of the aforementioned operations. An experienced safety professional will be assigned to enforce and supervise the required safety measures application. The necessary Personal Protection Equipment (PPE) will be provided to workers.

D.2 Operation Phase

6.21 Given the plant characteristics, critical safety aspects during the regular plant operation include raw materials (coke and limestone) transportation to and within the site (from stockpiles to plant), fuel (diesel) storage, pressurized vessel operation, and maintenance operations. The principal occupational health concerns associated with plant operation are potential exposure to chemicals (for water and wastewater treatment), noise, fugitive particulates (coke, limestone, and ash), and thermal stress. To effectively manage these safety and occupational health concerns, the Sponsors will prepare and implement a Health and Safety program accordingly to existing Mexican regulations and IFC General Health and Safety Guidelines. This program shall include, as minimum, material safety data sheets, safety and health risk identification, health and safety procedures, monitoring plan, medical surveillance plan, training, and accident investigation/record keeping/reporting.

7.0 PUBLIC CONSULTATION

7.1 In September of 1998, the Sponsors published a notice in three popular newspapers; one with national coverage and two with local coverage (State of *San Luis Potosí)*. This notice described the Sponsors intention to construct the plant, and the availability of EIA for review at *Tamuín*. Also, the Sponsors made available the entire EIA and its executive summary on the Internet. As required by the existing applicable regulations for environmental impact issues (Art. 34 Fraction

1), the intent of this notice was to share information with local communities about the potentials project impacts. Through this right-to-know action, the community has the opportunity to know and express its concerns about the TdG project. The EIA was also made available in April 1999 at the IDB offices in Mexico City and Washington, DC.

7.2 On March 15, 1999, the Sponsors held a public meeting to disseminate project information at the local level. During the meeting, the Sponsors made a general presentation, and distributed brochures to attendees. In this meeting the *Tamuín* community expressed its concern regarding the selection of the *Rio Choy* as the water source for the project. The concerns include the fact that the *Rio Choy* is the water supply for the town of *Tamuín* and the river supports a rich and diverse biologic ecosystem. As a result, the Sponsors have chosen the *Rio Tampaón* as a new water source for the project. In general, no other concerns were expressed.

7.3 From January to June of 1999, the Sponsors have conducted the second round of public outreach at *Tamuín*, organized a meeting with the Ecology Commission of the State of *San Luis Potosí* Congress, made a presentation for the State of *San Luis Potosí* Governor, organized a visit to a similar plant in US with the participation of federal and state government officers, and opened a project office in *Tamuín* to receive on regular basis community comments and observations.

7.4 The project has been very interactive with the *Tamuín* community. For example, the Sponsors recently participated in the Town Fair. During that time, the Sponsors disseminated more information to the local residents about the project. The Sponsors also organized technical contests focusing on power generation with secondary and high school students. Personal computers and other awards were provided to the winners.

8.0 RECOMMENDATIONS

8.1 The Bank will require as part of the Loan Agreement that the Company (TEG) 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 project environmental, health and safety document, including without limitation the Environmental Impact Assessment *(Manifestación de Impacto Ambiental*), Risk Studies (*Estudio de Riesgo*), the Environmental Management Plan, the Health and Safety Manual, the Spill Prevention and Control and Countermeasures Plan, and the Emergency Plan.
5. World Bank Thermal Power Guidelines for New Plants (World Bank Pollution Prevention Handbook, July 1, 1998).
6. World Bank General Environmental Guidelines (World Bank Pollution Prevention Handbook, July 1, 1998).
7. World Bank Monitoring Guidelines (World Bank Pollution Prevention Handbook, July 1, 1998).
8. International Finance Corporation General Health and Safety Guidelines (July 1, 1998).

9. Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable, particularly those changes which could have environmental or social effects.
10. Send written notice within thirty days of (i) any and all noncompliance with any environmental requirement of the loan agreement (ii) any significant environmental or social accident, impact event or environmental claim, and (iii) actions taken and preventative measures implemented for the future regarding any such breach, accident, impact or event.
11. Ensure that all companies contracted for construction or operation activities comply with all environmental requirements.
12. Implement routine activities to make project-related environmental and social information available to the local public and to maintain a system of consultation with the public.
13. 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 the results from the ambient air quality sampling for nitrogen dioxide, sulfur dioxide and particulate matter.
2. Present the results from the traffic study to evaluate the traffic conditions at *Tamuín*.

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 Management Plan, including cost estimates, time schedule and designated responsibilities for each individual component. In particular, the final plan must provide additional and specific details related to mitigation and monitoring measures for construction worker-related impacts (including code of conduct, etc.), dust control, and traffic impacts.
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 initial ambient noise monitoring.
6. Submit evidence that all applicable environmental, health and safety requirements of the loan agreement have been implemented.

8.4 Prior to each disbursement, the Company must fulfill the following conditions:

1. Certification of compliance with all environmental requirements in the loan agreement.
2. Description of any non-compliance with any environmental requirement and action plan to correct non-compliance.
3. Description of any additional or new environmental or social liabilities, including without limitation environmental claims, or material complaints, or unforeseen environmental, health or safety impacts or risks.

8.5 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. The plan must specifically include monitoring programs for stack emissions, ambient air quality, noise, and water quality.
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, evidence that the specific waste ash generated by the TdG project are classified as non-hazardous according to Mexican regulatory requirements, and if not non-hazardous, a specific plan, subject to IDB acceptance, to handle and dispose the hazardous ash.

8.6 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 Bank 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. The report must include, at a minimum, the following:

1. Company's certification of compliance with all environmental requirements of the loan agreement;
2. Information concerning any and all non-compliance with any environmental requirement, including a brief description and justification and corrective measures taken;
3. Description of any and all relevant environmental or social circumstances or problems, and actions taken and measures implemented in order to prevent the repetition of the same;
4. Description of any and all environmental or social risks or liabilities, either existing or foreseen;
5. Description of any and all environmental, social, or health and safety complaints, demands, inquiries, third party communications, or environmental claims concerning the Project or the Company;
6. Description of the status and results of all environmental and social programs and summary of the previous time-period results/data from the environmental and social monitoring programs; and
7. Copies of any and all important environmental or social documents or reports executed in order to satisfy Environmental Laws.

8.7 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.

TABLE 3-1
AIR QUALITY STANDARDS

Pollutant	Design [5]	Mexican Limits [1][4][7]	World Bank Limits [2][3][4]
Sulfur Dioxide (SO_2)	0.90 Lb/MMBtu (334 $mg/Nm^{3)}$ or 90 % removal	2,200 ppmv or 5,767 mg/Nm^3	2,000 mg/m^3 or 120 tons per day
Nitrogen Dioxide (NO_2)	0.30 Lb/MMBtu (111 mg/Nm^3)	375 ppmv or 705.5 mg/Nm^3	365 ppmv or 750mg/Nm^3 (Coal Fired)
Particulate	0.03 Lb/MMBtu (11.1 mg/Nm^3)	350 mg/m^3	50 mg/m^3 or efficiency > 99.9 %

Notes:
(1) Mexican NOM-085-ECOL-1994 (Starting January, 1998)
(2) World Bank Pollution Prevention and Abatement Handbook (July 1998)
(3) ppmv - parts per million (volume)
(4) mg/m^3 - milligrams per cubic meter
(5) Lb/MMBtu - pounds per million Btu
(6) Ng/J - nanograms per joule
(7) Mg/Nm^3

TABLE 3-2
MEXICAN AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Concentration Limit
Sulfur Dioxide	• 24-hour • Annual	• 341 ug/m^3 (0.13 ppm) • 79 ug/m^3 (0.03 ppm)
Nitrogen Dioxides	• 1-hour	• 395 ug/m^3 (0.21 ppm)
Total Particulate (TSP)	• 24-hour • Annual	• 260 ug/m^3 • 75 ug/m^3
Fine Particulate (PM_{10})	• 24-hour / Once a Year • Annual	• 150 ug/m^3 • 50 ug/m^3
Carbon Monoxide (CO)	• 8-hour (rolling average) / Once a Year	• 12,595 ug/m^3 (11.00 ppm)
Ozone	• Once a year for three years	• 216 ug/m^3 (0.11 ppm)
Lead	• 3 month (arithmetic mean)	• 1.5 ug/m^3

TABLE 3-3
MAXIMUM PERMISSIBLE NOISE LIMITS

Permissible Limit		Day Time (dBA)	Nig
Mexican Regulations		68	
World Bank Standard	Residential Zone	55	
	Industrial Zone	70	

TABLE 3-4
MAXIMUM PERMISSIBLE WASTEWATER DISCHARGE LIMITS

Parameter	Units [1]	Current Mexico (Daily Average)	Current Mexico (Monthly Average)	World B
Temperature	C	40	40	
Temperature Increase	C			< = 3
Oil And Grease	mg/L	25	15	10
Floating Matter	-Higher than 3mm [2]	-Absent	Absent-	
Settable Solids	ml/L	2	1	
Total Settable Solids	mg/L	125	75	
Total Suspended Solids	mg/L	60	40	50
Biochemical Oxygen Demand (BOD)	mg/L	60	30	
Total Residual Chlorine	mg/L			0.2
Free Available Chlorine	mg/L			
Total Nitrogen	mg/L	25	15	
Total Phosphorous	mg/L	10	5	
Fecal Matter	MPN/100 mL	2,000	1,000	
Asbestos	mg/L			
Cyanide	mg/L	2.0	1.0	
Antimony	mg/L			
Arsenic	mg/L	0.2	0.1	
Beryllium	mg/L			
Cadmium	mg/L	0.2	0.1	
Copper	mg/L	6.0	4.0	0.5
Chromium	mg/L	1.0	0.5	0.5
Iron	mg/L			1.0
Mercury	mg/L	0.01	0.005	
Nickel	mg/L	4	2	
Lead	mg/L	0.4	0.2	
Selenium	mg/L			
Silver	mg/L			
Thallium	mg/L			
Zinc	mg/L	20	10	1.0
PH	-		5 to 10	6 to 9
Pesticides [5] *25 Compounds*	mg/L			

TABLE 3-4
MAXIMUM PERMISSIBLE WASTEWATER DISCHARGE LIMITS

Parameter	Units [1]	Current Mexico (Daily Average)	Current Mexico (Monthly Average)	World B
Base/Neutral Extractable [5] *47 Compounds*	mg/L			
Acid Extractable [5] *11 Compounds*	mg/L			
VOCs [5] *28 Compounds*	mg/L			
PCBs				
Bottom Ash				
Fly Ash				

Notes:
(1) mg/L – milligrams per liter; ND - No detectable.
(2) USEPA - U.S. Environmental Protection Agency; CFR - Code of Federal Regulations.
(3) There are no Federal numeric limits for thermal discharges. In reference to thermal discharges, 40 CFR 131.12 degradation requirements and then refers to Section 316 of the Clean Water Act which states: "The thermal compone require effluent limitations more stringent than necessary to assure the protection and propagation of a balanced indig shellfish, fish and wildlife in and on that body of water." EPA delegates to individual states the establishment of wate protect beneficial uses. These can vary depending on the state, the surface water, and species to be protected. In Ca prohibits thermal discharges having a maximum temperature greater than 5 ° above the natural receiving water temp water.
(4) Limits apply to chemical metal cleaning wastes.
(5) Limits apply to cooling water blowdown.
(6) Limits apply to once through cooling water.
(7) From the U.S. EPA List of Priority Pollutants.
(8) There shall be no discharge of polychlorinated biphenyl (PCB) such as those commonly used for transformer flu
(9) The quantity of pollutants discharged in bottom ash transport shall not exceed: 100 mg/L daily and 30.0 mg/L m mg/L daily and 15.0 mg/L monthly average for oil and grease.
(10) There shall be no discharge of wastewater pollutants from fly ash transport water.

TABLE 3-5
PERMITTING REQUIREMENTS

Area	Authorization	Legal Citation	Description	
Construction	• SE • Municipality	• LSPEE • RLSPEE • REDU&OP	An authorization is required for construction of new generation facilities. A license and/or permit is required by municipalities prior to construction.	Pending
Environmental Impacts	• SEMARNAP • INE	• LGEEPA • RMIA	An Environmental Impact Assessment is required.	The EIA 1999 by to INE a program establish
Permit to build on archaeological site	• INAH	•	An authorization indicating that the no valuable cultural/archaeological resources exists within the project site.	INAH is Sponsor issued a dated A water pi
Land Use / Property Ownership	• FNM • SEDU&OP • Private Owners	• LGAH • REDU&OP	A license for industrial land use is required. A right-of-way permit is required for installation of pipelines (water and wastewater) and transmission lines crossing local roads, rail tracks, and private lands.	The Spo applicati permit o State ap
Pressurized Vessels/Steam Generators	• STPS	• RFSHMAT	An authorization is required to operate pressurized vessels and steam generators.	Pending
Operating (Environmental) License	• SEMARNAP	• RMPCCA	A license is required for all fix sources of air emission.	Pending
Risk	• SEMARNAP • INE	• LGEEPA • RMIA	A Risk Assessment is required.	The Risk 11, 199
Water Supply	• CAN	• LAN • RLAN	A water supply concession is required for withdrawing water from a river.	On Apri submitte water w Tampaó withdra (l/s) and

TABLE 3-5
PERMITTING REQUIREMENTS

Area	Authorization	Legal Citation	Description	
Wastewater Discharge	• CAN	• LAN • RLAN	A permit and a registration is required for discharging wastewater to a river.	A separa dischar been sub

Notes for Table 3-1, Listing of Agencies, Laws, and Regulations

Agencies		
CFE	*Comisión Federal de Electricidad*	Federal Electricity Commission
CAN	*Comisión Nacional del Agua*	National Water Commission
CRE	*Comisión Energia*	Energy Regulatory Commission
FNM	*Ferrocarriles Nacionales de México*	National Railroad Company
IMSS	*Instituto Mexicano del Seguro Social*	Mexican Social Security Institute
INAH	*Instituto Nacional De Antropolgia E Historia*	National Institute of Anthropology and His
INE	*Instituto Nacional de Ecologia*	National Ecology Institute
PEMEX	*Petroleos Mexicanos*	Mexican Oil Company
SCT	*Secretaria de Comunicaciones y Transportes*	Communication and Transportation Secret
SE	*Secretaria de Energia*	Energy Secretary
SECOFI	*Secretaria de Comercio y Fomento Industrial*	Trade and Industry Development Secretary
SEMARNAP	*Secretaria de Medio Ambiente, Recursos Naturales y Pesca*	Environment, Natural Resources, and Fishe
SEDU&OP	*Secretaria Estatal de Desarrollo Urbano y Obras Públicas*	Urban Development & Public Works State
SRE	*Secretaria de Relaciones Exteriores*	Foreign Relations Secretary
SS	*Secretaria de Salud*	Health Secretary
STPS	*Secretaria del Trabajo y Prevision Social*	Labor and Social Prevision Secretary
Laws		
CPEUM	*Constitucion Politica de los Estados Unidos Mexicanos*	Mexican Federal Political Constitution
LAN	*Ley de Aguas Nacionales*	National Water Law (12/1/92)
LFT	*Ley Federal del Trabajo*	Federal Labor Law (April 1, 1979)
LGAH	*Ley General de Asentamientos Humanos*	General Human Settlements Law (7/21/93)
LGEEPA	*Ley General del Equilibrio Ecologico y Proteccion al Ambiente*	General Ecological Balance and Environme
LEPA	*Ley Esatatal de Protección Ambiental de San Luis Potosí*	State Environment Protection Law for San
LGS	*Ley General de Salud*	General Health Law (6/14/91)
LIE	*Ley de Inversion Extranjera*	Foreign Investment Law (12/27/93)
LOAPF	*Ley Organica Administracion Publica Federal*	Public Administration Law (2/21/92)

Notes for Table 3-1, Listing of Agencies, Laws, and Regulations

LSPEE	*Ley del Servicio Publico de Energia Electrica*	Public Electric Energy Service Law (12/22
LSS	*Ley del Seguro Social*	Social Security Law (6/1/94)
Regulations		
RFSHMAT	*Reglamento Federal de Seguridad e Higiene y Medio Ambiente de Trabajo*	General Labor Safety and Health Regulatio
RLAN	*Reglamento de la Ley de Aguas Nacionales*	National Water Regulation (1/12/94)
RLIE	*Reglamento de la Ley de Inversion Extranjera*	Foreign Investment Regulation (5/16/89)
RLSPEE	*Reglamento de la Ley del Servicio Publico de Energia Electrica*	Public Electric Energy Service Regulation (
RMIA	*Reglamento de la Ley General del Equilibrio Ecologico y Proteccion al Ambiente en Materia de Impacto Ambiental*	Environmental Impact Regulation (6/7/88)
RMPCCA	*Reglamento de la Ley General del Equilibrio Ecologico y Proteccion al Ambiente en Materia de Prevencion y Control de la Contaminacion de la Atmosfera*	Air Emissions Regulation (12/25/88)
RMRP	*Reglamento de la Ley General del Equilibrio Ecologico y Proteccion al Ambiente en Materia de Residuos Peligrosos*	Hazardous Waste Regulation (12/25/88)
RPACCOER	*Reglamento para la Prevención Ambiental Contra la Contaminacion Originada por la Emision de Ruido*	Noise Pollution Prevention and Control Re
REDU&OP	*Reglamento Estatal de Desarrollo Urbano y Obras Públicas de San Luis Potosí*	State Urban Development & Public Works (Issuing date not available)

TABLE 5-1
STACK PARAMETERS AND EMISSION RATES

ID	Stack Height (m)	Stack Diameter (m)	Operating Load (%)	Exhaust Velocity (m/s)	Exhaust Temperature (K)	NO_x (g/s)
Main Stack	120	4.57	100	20.67	398	94
Main Stack	120	4.57	50	10.36	398	47
Cooling Tower	13.7	25 (10 cell equivalent)	100	18	304	0

Notes: Values represent exhaust flow and velocity and emission rates from the two CFB boilers combined.

TABLE 5-2
SOURCE PARAMETERS FOR TdG POWER PLANT INTERACTIVE SOURCE PAR

Source	Location (meters from TEG Stack)		Source Elevation	Stack Height	Stack Diameter	Stack Temperature	Stack Velocity	
	West	South	(m)	(m)	(m)	(K)	(m/s)	SO_2
TdG Power Plant	0	0	60	120	4.57	398	20.67	246
Fuel Storage	N/A	N/A	60	N/A	N/A	ambient	N/A	0
Limestone Storage	N/A	N/A	60	N/A	N/A	ambient	N/A	0
Ash Storage	N/A	N/A	60	N/A	N/A	ambient	N/A	0
Cementos Anáhuac Cement Facility	2,570	3,060	120	40	4.0	373	12	8.08

TABLE 5-3
SUMMARY OF SCREENING RESULTS

Pollutant/Load	Averaging Interval	Regulatory Level of Significance (ug/m ^{3})	Impact (ug/m ^{3})
SO_2 (100% Load)	3-Hour	25	882
	24-Hour	5	220
	Annual	1	55.1
SO_2 (50% Load)	3-Hour	25	644
	24-Hour	5	161
	Annual	1	40.3
NO_X (100% Load)	1-Hour	NA	434
	Annual	1	27.2
NO_X (50% Load)	1-Hour	NA	246
	Annual	1	15.4
PM (100% Load)	24-Hour	5	94.6
	Annual	1	23.7
PM (50% Load)	24-Hour	5	54.7
	Annual	1	13.4
CO (100% Load)	1-Hour	2,000	822
	8-Hour	500	616
CO (50% Load)	1-Hour	2,000	466
	8-Hour	500	350

TABLE 5-4
SUMMARY OF REFINED MODELING RESULTS - TdG ALONE

Pollutant		Concentration (ug/m^3)	X-Coordinate (m)	Y-Coordinate (m)	Mexico AAQS * (ug/m^3)
SO_2	3-hour average	332	-4,000	-2,000	N/A
	24-hour average	148			341
	Annual average	29.5			79
NO_x	1-hour	182	-4,000	-2,000	395
	Annual	18			N/A
PM_{10}	24-hour	64	-4,000	-2,000	150
	Annual	16			50
CO	1-hour	344	-4,000	-2,000	N/A
	8-hour	241			12,595

* Ambient Air Quality Standards

TABLE 5-5
SUMMARY OF REFINED MODELING RESULTS – EXISTING CEMENTOS ANÁHUAC CEM

Pollutant		Concentration (ug/m^3)	X-Coordinate (m)	Y-Coordinate (m)	Mexico AAQS * (ug/m^3)
SO_2	3-hour average	60.1	-4,000	-3,000	N/A
	24-hour average	26.7			341
	Annual average	5.3			79
NO_x	1-hour	137	-4,000	-3,000	395
	Annual	11			N/A
PM_{10}	24-hour	14.6	-4,000	-3,000	150
	Annual	2.9			50
CO	1-hour	16.3	-4,000	-3,000	N/A
	8-hour	11.4			12,595

* Ambient Air Quality Standards

TABLE 5-6
SUMMARY OF REFINED MODELING RESULTS - COMBINED SOURCES

Pollutant		Concentration (ug/m^3)	X-Coordinate (m)	Y-Coordinate (m)	Mexico AAQS * (ug/m^3)
SO_2	3-hour average	332	-4,000	-2,000	N/A
	24-hour average	148			341
	Annual average	29.5			79
NO_x	1-hour	227	-4,000	-6,000	395
	Annual	18.2			N/A
PM_{10}	24-hour	64	-4,000	-2,000	150
	Annual	12.8			50
CO	1-hour	344	-4,000	-2,000	N/A
	8-hour	241			12,595

* Ambient Air Quality Standards

TABLE 6-1
PROPOSED PRINCIPAL CONSTRUCTION MITIGATION MEASURES

Impacts	Recommended Mitigation	When Impact Would Occur
Topography:		
Site Preparation	Revegetate disturbed areas following construction.	Construction; Operation
Storage of piled materials on-site	Revegetate and grade waste piles following operation.	Operation
Construction of transmission line	Remove transmission structures following operation.	Construction; Operation
Soils:		
Soil erosion (power plant)	Revegetate after construction. Construct a runoff collection system and silt traps. Minimize vegetation clearing.	Construction
Soil erosion (transmission line)	Minimize clearing, leave tree stumps in place, avoid creeks or other wet areas.	Construction; Operation
Decreased soil fertility	Add fertilizers to selected areas.	Construction; Operation

Surface Water:		
Site preparation could alter drainage patterns and increase erosion.	Design slope areas to maintain natural drainage patterns. Locate ash disposal areas away from drainages.	Construction; Operation
Soil erosion and sedimentation could impact water quality	Revegetate after construction. Construct a runoff collection system and silt traps. Minimize vegetation clearing. Where possible, cover exposed areas.	Construction; Operation
Fuel Spill.	The fuel storage area will be on a concrete slab and will be surrounded by concrete walls. Spills would be contained by SPCC procedures.	Construction; Operation
Ground Water:		
Increased infiltration of contaminants resulting from site clearing and grading.	Develop a runoff collection system, limit vegetation clearing. Where possible, cover "bare" areas.	Construction
Air:		
Fugitive dust created by vehicular activity.	Spray roads and construction debris piles with water. Some roads may be paved or surfaced with non-hazardous dust control chemicals.	Construction; Operation
Flora:		
Removal of common plants during site preparation. No protected plants will be harmed.	Revegetate (also see Surface Water and Soils mitigation).	Construction
Fauna:		
Habitat loss and increased noise would affect common wildlife species. No protected animals will be harmed.	Revegetate (also see Surface Water and Soils mitigation).	Construction; Operation
Landscape and Visual Quality:		
Plant facilities diminish quality of the landscape.	Minimize land disturbance. Paint buildings to blend with landscape. Implement reforestation program to enhance site appearance. Following operation, remove plant facilities.	Construction; Operation; Post-Operation

Noise:		
During construction, increased traffic associated with transportation of equipment and materials, site preparation, and facility construction.	Limit construction activity to daytime hours. Use hearing protection equipment for workers.	Construction
Hygiene and Health:		
Health of facility workers affected by exposure to fugitive dust, fuel, construction residuals, and noise.	Suppress dust, use on-site sanitary facilities, dispose of construction debris, provide personal protective equipment, noise control, worker training and other appropriate supervision.	Construction; Operation; Post-Operation
Social and Economic:		
During construction, increased congestion and demand for housing and services. No adverse effect during operation.	A socioeconomic action plan will be implemented.:	Construction
Provide jobs and income for the local communities.	Positive socioeconomic effect, no mitigation needed.	Construction; Operation