

INTER-AMERICAN DEVELOPMENT BANK



Mexico

***MONTERREY III POWER PROJECT
(ME-0229)***

ENVIRONMENTAL AND SOCIAL IMPACT REPORT

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TABLE OF CONTENT

1.0	INTRODUCTION	3
2.0	PROJECT DESCRIPTION.....	3
A.	PROJECT LOCATION	3
B.	PROJECT COMPONENTS AND FACILITIES	4
C.	PROJECT WORKFORCE.....	6
D.	SCHEDULE AND COSTS	6
E.	ANALYSIS OF ALTERNATIVES.....	6
3.0	INSTITUTIONAL AND LEGAL FRAMEWORK	7
A.	INSTITUTIONAL FRAMEWORK.....	7
B.	LEGAL FRAMEWORK.....	9
C.	PROJECT ENVIRONMENTAL AND PERMITTING STATUS.....	10
4.0	ENVIRONMENTAL AND SOCIAL CONDITIONS.....	12
A.	ENVIRONMENTAL CONDITIONS	12
B.	SOCIAL CONDITIONS	15
5.0	ENVIRONMENTAL AND SOCIAL IMPACTS.....	18
A.	CONSTRUCTION PHASE.....	18
B.	OPERATION PHASE	21
C.	POSITIVE IMPACTS/BENEFITS	26
6.0	ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING	27
A.	MITIGATION MEASURES	27
B.	MONITORING	30
C.	HEALTH AND SAFETY AND CONTINGENCY PLANS	30
7.0	PUBLIC CONSULTATION.....	31
8.0	RECOMMENDATIONS.....	32

TABLES AND FIGURES

1.0 INTRODUCTION

- 1.1 The *Monterrey III* Project is composed of the development, design, construction, operation, and maintenance of a natural gas fired 1,140 MW combined cycle power plant in the State of *Nuevo León*, Mexico. The Project will be developed in phases. The initial phase will generate 570 MW of electricity that will be sold to the *Comision Federal de Electricidad* (“CFE” – Federal Electricity Commission) under a 25–year Power Purchase Agreement (PPA). The subsequent phases of the Project will generate additional 570 MW of electricity that will be sold to third parties via PPAs.
- 1.2 The Project was conceived by CFE as part of CFE’s *Programa de Obra e Inversiones del Sector Eléctrico* (“POISE” – Work Program and Investments of the Electrical Sector). On August 26, 1999, CFE awarded the Project through an international bidding process to *Iberdrola Energía Monterrey, S.A. de C.V.* (“Iberdrola” or “Sponsor” hereafter) who will finance, construct, and develop the Project. Iberdrola is a Spain-based energy developer. Through its affiliates, Iberdrola owns, constructs, and operates power plants and electricity infrastructure in the European and Latin American regions.
- 1.3 The estimated total Project cost is approximately \$US 604 million. Iberdrola has requested financial assistance from the Inter-American Development Bank (IADB), consisting of a US\$75 million A Loan and a B Loan of approximately US\$378 million.

2.0 PROJECT DESCRIPTION

A. Project Location

- 2.1 The *Monterrey III* Project will be constructed in the State of *Nuevo León*. The Project site is about 20 km east of the City of *Monterrey*, near post kilometer 12 off the *Monterrey-Dulces Nombres* Highway in *Pesquería* and about 10 km southwest of the town of *Pesquería* (see Figure 1). The total area of the Project site is about 27.6 hectares. Ground elevation of the site is about 384 meters (m) above sea level. CFE previously acquired the site and recently provided it to the Sponsor for construction of the Project.
- 2.2 The *Monterrey III* power plant will be constructed on a greenfield site next to the site of the *C.C.C. Monterrey II* power plant, which is also contiguous to the site of the *Huinalá* power plant. The *C.C.C. Monterrey II* plant is currently under construction, and the *Huinalá* plant has been in operation for nearly 20 years. *Dulces Nombres* is the closest village to the site, about 2 km to the northeast. Other nearby villages include *Apodaca* (about 12 km to the northwest), *Huinalá* (about 7 km to the northwest), *San Miguel* (about 7 km to the west), *Villa Juarez* (about 7 km to the south), and *Cadereyta de Jiménez* (about 15 km to the southeast).

- 2.3 The directions, distances and adjoining owners of the power plant site are listed below:

Direction	Approximate Distance	Adjoining Owners
North Boundary	805 meters	C.C.C. <i>Monterrey II</i> Power Plant
East Boundary	583 meters	Agricultural Land Owned by Mr. <i>Oscar Sepúlveda</i> (1)
South Boundary	1,195 meters	Agricultural Land Owned by Mr. <i>Oscar Sepúlveda</i> (2)
West Boundary	216 meters	Old Road to <i>Villa Juárez</i> (2)

(1) These boundaries have been recently bought by CFE to facilitate the future construction of their own transmission lines.

(2) CFE also owns a narrow strip that surrounds the south and west boundaries of the site

B. Project Components and Facilities

Power Plant

- 2.4 The Project consists of a natural gas fired 1,140 MW combined cycle power plant. The power plant will include four ABB KA24-1 combustion turbine generators with water-cooled condensers, each feeding exhaust gas to its respective heat recovery steam generator. Steam will be fed to the steam turbine generators. Gas produced by combustion of the natural gas will be released to the atmosphere through the stack. The primary emissions from natural gas firing will be nitrogen dioxide (NO₂) and carbon monoxide (CO) with minor amounts of particulate matter (PM). In order to minimize emissions of nitrogen oxides (NO_x) during plant operation, the Project will include a dry low-NO_x (DLN) design. The cooling process will use clarified water.
- 2.5 The *Monterrey III* 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 for the Project is 25 years. The Project Company will be liable for pre-commercial activities as well as the operation and maintenance of the power plant during a 25-year term.
- 2.6 A short transmission line (less than 100 meters connecting the Project to the existing *Huinalá* substation located just north of the Project site) and a short gas pipeline (approximately 6 kilometers) will be constructed. In addition, there will be an Administrative buildings, storage facilities, parking spaces, driveways, and an access road will be constructed as part of the Project.

Fuel Supply

- 2.7 Natural gas will be supplied by *Petroleos Mexicanos* (“Pemex”) and *Petroquímica Básica* (“PGPB”) pursuant to the contracts that will be executed on or prior to the COD. Pemex is the largest State-owned oil and gas enterprise in Mexico who also owns PGPB. Pemex has agreed to supply 4,530,000 cubic meters per day (m³/day) of natural gas for the Project via an interconnection to the existing *Pemex Reynosa - Escobedo* pipeline (914-mm diameter or 36 inches). The natural gas will be delivered to the Project through a new 6 km 24-inch pipeline.

Water Supply

- 2.8 CFE had entered a preliminary agreement with the *Servicios de Agua y Drenajes de Monterrey* (“SADMON” – Water and Drainage Services of Monterrey) for providing municipal wastewater for the *Monterrey III* Project before the Sponsor won the bid. Subsequent to bid award, the Sponsor commenced contract negotiations with SADMON for supply of treated water for plant operation. SADMON has committed to delivering 470 liters per second (l/s), or 1,692 cubic meters per hour (m³/hour), of treated waste water that is needed for operating the four Project turbine units. The treated water will be delivered to the power plant via an aqueduct from the *Dulces Nombres* Wastewater Treatment Plant, which is administered by SADMON. The diameter of the buried pipeline will be about 610 mm (24 inches) with a total length of about 5.5 km. The pipeline will be constructed within a 5-m wide right-of-way.
- 2.9 According to the Sponsor, SADMON has verbally agreed to the water quality parameter limits for the treated water that will be brought to the power plant. These water quality parameter limits will be stipulated in a formal written agreement between SADMON and the Project Company.
- 2.10 The Sponsor has requested the National Water Commission’s authorization to withdraw water from an existing well located at the site, in order to supply water requirements during construction. The Sponsor will purchase potable water from the local vendors who will deliver bottled water to the power plant by truck.

Wastewater Discharge

- 2.11 The power plant will generate effluent from various sources such as wash water, RO reject, regeneration of demineralization system, and quenched blowdown. The wastewater produced during operation will be directed to an onsite facility for treatment and then discharged into *Arroyo Benavides*, which along the southern boundary of the Project site. The estimated discharge of wastewater is 135 l/s (486 m³/hour). The wastewater will be treated to meet the standards stipulated in the Mexican NOM-001-ECOL-1996 (“Pollutant Limits in Wastewater Discharges to National Water Bodies”).

Waste

- 2.12 Solid wastes that may be generated will include paper, carton, plastics, glass, and food wastes. Other solid wastes such as exhausted resins from the de-mineralization system of the wastewater treatment facilities will be generated. These non-hazardous wastes will be either recycled or disposed. The sludge and residual solids from the treatment facilities that are not deemed hazardous will be disposed of at a site approved by the municipal authorities. The relatively small quantities of hazardous waste (such as rags soaked with oil, grease, cleaning solvents, and absorbent material) generated will be collected and transported for final delivery to an authorized company for disposal. Used lubricating oil from the gas and steam turbines will be transported to an authorized company for recycling.

C. Project Workforce

- 2.13 ABB will be the Engineering, Procurement and Construction (EPC) Contractor for the Project. ABB will provide design, engineering, procurement, and construction services on a lump sum, turnkey basis in accordance with an EPC Agreement with the Sponsor. The Project Company (Iberdrola or its affiliates) will operate the power plant.
- 2.14 The EPC Contractor has estimated that the average number of workers needed for the initial phase of the Project (2-year construction period) would be about 700, with an estimated maximum number of workers of about 850. Iberdrola has estimated that up to 70 employees (including technicians, administrative personnel, etc.) will be required during operation and maintenance of the Project.

D. Schedule and Costs

- 2.15 Construction of the Project is proposed to start in July 2000 and commercial operations for the first phase of the Project (the first 2 gas turbine units that will generate the initial 540 MW of electricity) is scheduled for April 2002. Commercial operations for the subsequent phases of the Project are scheduled for May 2002 (the third gas turbine unit that will generate additional 285 MW of electricity) and before August 2003 (the fourth gas turbine unit that will generate another 285 MW of electricity). The total costs for the Project are estimated to be about \$US 604 million.

E. Analysis of Alternatives

- 2.16 During the development stage of the Project, CFE conducted a preliminary study for screening potential sites in the State of *Nuevo León*. The methodology used in the study included: regional definition of exclusion areas, identification of candidate and potential sites, and evaluation of candidate sites. A number of criteria were used to identify technical, economic, social, and environmental concerns for each of the sites considered, including: areas under ecology protection, mountain areas, demographics (population growth), proximity to aerial runways, agricultural zones with high development, zone of project of ecological order, and urban centers.
- 2.17 Based on these environmental and technical considerations, four candidate sites were selected for final consideration: the *La Camisa* Site; the *San Juan* Site; the *Milpa* Site; and the *Empalme* Site. These potential sites were further analyzed on the basis of the technical and environmental considerations listed below and resulted in the *La Camisa* Site being selected.

Technical Considerations	Environmental Considerations
<ul style="list-style-type: none">Fuel supplyWater supply	<ul style="list-style-type: none">ClimateSoil characteristics

<ul style="list-style-type: none"> • Interconnection to the national electric system 	<ul style="list-style-type: none"> • Underground hydrology • Vegetation • Fauna • Zoning • Air quality
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3.0 INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional Framework

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

Environmental Sector

Federal Authorities

- 3.4 The *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (“SEMARNAP” – Environment, Natural Resources, and Fisheries Secretariat) was created in 1994 to centralize and streamline federal policy-making relating to natural resource management and environmental protection in an effort to achieve sustainable development. SEMARNAP regulates a broader spectrum of environmental protection issues including formulating the national environmental policies, issuing *Normas Oficiales Mexicanas* (“NOM” –Mexican Official Standards), evaluating Environmental Impact Assessments (EIA), setting conditions for wastewater discharges into national waters, conferring rights over hydraulic resources, forests, ecology, fishing, mining, exploitation of flora and fauna

and federal maritime and coastal beaches, zones and establishing, in coordination with other agencies and entities, economic instruments for the protection, restoration and conservation of the environment.

3.5 There are three decentralized organizations under SEMARNAP:

- The *Instituto Nacional de Ecología* (“INE” – National Institute of Ecology) is responsible for the development of environmental policies and regulations, the issuance of permits and licenses, and the review and authorization of an EIA. INE is responsible for the review and authorization of the *Monterrey III* Project.
- The *Procuraduría Federal de Protección al Ambiente* (“PROFEPA” – Office of Attorney General for Protection of Environment- the Mexican prosecutor Agency) is the primary federal agency authorized to enforce environmental laws in Mexico, including the regulations for the management and disposal of hazardous and industrial waste, air emission, and water pollution. All projects involving electricity generation such as the *Monterrey III* Project and all high-risk activities (such as hazardous wastes) are under the federal jurisdiction through PROFEPA to enforce compliance and through INE (National Institute of Ecology) to issue authorizations.
- 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).

Local Authorities

- 3.6 Non-federal issues and environmental matters are under the jurisdiction of the respective states and municipalities. The policies of the states and municipalities must meet or exceed federal requirements. The state and local governments are responsible only for land use licensing, construction permitting, and regulation of solid waste disposal.
- 3.7 The Ecology Secretariat of the State of *Nuevo León* is responsible for issuing environmental permits for all state facilities that are not under-federal jurisdiction and for the non-hazardous solid waste management and disposal within the state.
- 3.8 SADMÓN regulates drinking water supply and wastewater treatment and recycling within the Municipality of *Pesquería*.

Health and Safety

- 3.9 Article 123 of the Mexican Constitution states that all citizens have a right to work in a manner that is dignified and socially useful and requires all employers to implement those measures which are necessary to ensure workplace safety and hygiene and to prevent employee accidents and illnesses. The occupational health and safety provisions of Article 123 are implemented under the General Health Law (“*Ley General de Salud*”), the Federal Labor Law (“*Ley Federal del Trabajo*”) and, more specifically, the Federal Regulations of

Safety, Hygiene, and Work Environment (“*Reglamento Federal de Seguridad e Higiene y Medio Ambiente en el Trabajo*”).

- 3.10 The Health Secretariat shares its jurisdiction over the workplace with the *Secretaría de Trabajo y Previsión Social* (“STPS” – Labor Secretariat). The Labor Law establishes general provisions governing workplace conditions and expands the responsibilities of employers in order to ensure workplace health and safety. The Labor Law also provides for compensation to both temporary and permanent workers for any disability arising from occupational hazards.

B. Legal Framework

Power Sector

- 3.11 The legal framework for private generation of electricity in Mexico is still being developed. The Public Electric Energy Service Law (“*Ley del Servicio Público de Energía Eléctrica*” or “Electricity Law”), in effect since 1975, states that the State, as a general rule in accordance with the Mexico Constitution, has the exclusive authority to generate, transport, distribute, and supply electricity for the purpose of rendering a public service. The Electricity Law was amended in 1992. Key modification enacted in 1992 excluded the following activities from the definition of “public service”:
- Generation of electricity for self consumption, cogeneration, or small production
 - Generation of electricity by IPPs for sale to the CFE under long-term contracts
 - Generation of electricity for export
 - Importation of electricity by individuals exclusively for their own use
 - Generation of electricity for emergency purposes to cover shortfalls
- 3.12 The Regulations of the Electricity Law (“*Reglamento de la Ley del Servicio Público de Energía Eléctrica*”), in effect since 1993, establish the requirements for generation of electricity by private producers as well as the requirements to issue permits for self-generation to satisfy the power needs of the power plant owners. In 1995, the Electricity Law granted 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 co-generation and self-generation activities. Such advances include the approval of contract models 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).

Environmental, Health and Safety Regulatory Requirements

- 3.13 Passed in 1998, the General Law of Ecological Equilibrium and Protection of the Environment (“LGEEPA” – *Ley General del Equilibrio Ecológico y la Protección al Ambiente* or “Ecology Law”) establishes the overall framework for industrial requirements and associated fines and penalties for noncompliance. In 1996, the Ecology Law was

revised to simplify procedures, improve enforcement, and clarify responsibilities for specific federal, state and municipal jurisdictions.

- 3.14 The legal framework for the Mexican federal *Manifestación de Impacto Ambiental, Modalidad General* (“MIA” – Environmental Impact Assessment) legislation is under the Ecology Law (LGEEPA) and its associated regulations. The Ecology Law and the associated Regulations of Environmental Impact (“*Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Impacto Ambiental*”) require that an MIA for projects under Federal jurisdiction (this includes power plants) be prepared and submitted to INE prior start construction and be approved by INE. Depending upon the nature of the project, there are three levels of MIA: general, intermediate, or specific (most detailed). Upon issuing an MIA authorization, INE usually establishes specific conditions that must be met by the project during construction, operation, and abandonment.
- 3.15 Associated with the Ecology Law and related regulations, there are numerous Mexican official standards (NOMs) which have been established to regulate areas in air emission, wastewater discharge, hazardous waste, health and safety, etc. In addition to the laws mentioned above (such as the Ecology Law, the General Health Law, and the Federal Labor Law), an agreement establishing the ecological criteria (CE-OESE-002/88) must be completed in the selection and preparation of sites for the installation of conventional steam generating plants.
- 3.16 The principal approvals/permits required for the *Monterrey III* Project include:
- CRE authorization for construction of the Project,
 - INE approval of the Project MIA and the Risk Study,
 - Approval of land use and construction by the local authorities
 - INE approval of air emission, hazardous waste disposal, as well as handling and disposal of solid waste
 - CNA's approval for discharge of wastewater into *Arroyo Benavides*
- 3.17 Tables 3-1 through 3-4 present key environmental, health and safety Mexican regulatory requirements pertinent to the *Monterrey III* Project including the applicable limits and regulations for air emissions, wastewater discharge, noise, and hazardous waste for the Project.
- 3.18 The IDB will require, that in addition to meeting the applicable Mexican environmental requirements, the *Monterrey III* Project be designed and operated to comply with the applicable guidelines set forth in the World Bank Pollution Prevention and Abatement Handbook (July 1998)(see Tables 3-2 and 3-5).

C. Project Environmental and Permitting Status

- 3.19 On October 8, 1999, CRE granted the Monterrey III Project an independent power producer permit.
- 3.20 In July 1999, the *Universidad Nacional Autonoma de Mexico* (“UNAM” – Engineering Institute of the National Autonomous University of Mexico) prepared a MIA (*Manifestación de Impacto Ambiental* or Environmental Impact Assessment) and a Risk Study (“*Estudio de Riesgo, Modalidad Análisis de Riesgo*) for the Project. These studies covered all components of the Project including the power plant, water supply aqueduct, wastewater discharge pipeline, and the access road. On August 20, 1999, CFE submitted these studies to INE for review. On December 16, 1999, INE granted an authorization for the Project. On January 11, 2000, CFE requested INE to reconsider some of the conditions set forth in the INE authorization. On February 8, 2000, INE issued a complementary authorization and agreed to CFE’s request for a modification to the original approval.
- 3.21 In December 1999, the Sponsor received a land use permit and a construction permit from the Municipality of *Pesqueria*.
- 3.22 The *Monterrey III* Project has been modified since the MIA was prepared in 1999, specifically related to three major aspects: 1) an increase in the number of gas turbine units from two to four; 2) a change in wastewater discharge point from the outside location (*Dulces Nombres* Wastewater Treatment Plant) to an onsite location (*Arroyo Benavides*); and 3) the use of air cooling instead of cooling with hydrogen. As a result of the proposed modifications, electricity generation would double from 570 MW to 1,140 MW, with result increases in air emissions, water supply, and wastewater.
- 3.23 To address the modifications of the project, the IDB requested the Sponsor to conduct additional environmental and social studies and associated activities. These studies and activities included:
- Air emission modeling that reflects the current design of the Project (4 gas turbine units)(refer Section 5 for details),
 - Assessment of potential impacts and mitigation measures on *Arroyo Benavides* due to discharge of power plant wastewater. (refer to Section 5 for details),
 - Public consultation program in the project area (refer to Section 7 for details).
- 3.24 On May 31, 2000, INE officially transferred the rights of obligations of the Environmental Impact Resolutions to Iberdrola, which obligates the Sponsor to fulfil the requirements and conditions stated in the INE authorizations previously granted to CFE. Iberdrola subsequently submitted to INE a project actualization report, including the additional environmental studies as requested in the Resolutions and the updates to the MIA to reflect Project changes.
- 3.25 The Sponsor plans to submit the results of the hydrogeological study to CNA for review and approval. The submittal will include findings of the subsurface conditions at the

power plant site and the characteristics of the wastewater that would be discharged to *Arroyo Benavides*.

4.0 ENVIRONMENTAL AND SOCIAL CONDITIONS

A. Environmental Conditions

Land Use

- 4.1 The *Monterrey III* power plant site is located in the transition zone between the Metropolitan Area of Monterrey (urban zone) and the rural zone within which agriculture activities and animal grazing are present. The properties adjoining the Project site are being used for industrial and agricultural purposes, including the property to the immediate north on which the *Monterrey II* power plant is currently being constructed. As it has been mentioned, CFE has bought the area located to the east of the site and a narrow corridor that surrounds the site at the west and south.

Meteorology and Air Quality

- 4.2 Climatic and ambient air quality data for the Project region is collected at five separate locations around the Monterrey Metropolitan Area, by the Integrated Ambient Monitoring System (SIMA). The climate in the Project area is characterized by generally mild conditions. The warmest months are May, June, and July, with a average maximum temperature in June of 29.5 degrees centigrade (°C). Average maximum temperatures in winter range from 15°C to 18°C. The annual average temperature is 23.1°C.
- 4.3 The maximum precipitation occurs in the months of August, September, and October. Precipitation may vary significantly over the Monterrey area. The Southeast SIMA station reports an annual accumulation of 556.7 mm, while other stations report approximately 358 mm.
- 4.4 Wind speed conditions also vary over the SIMA network, and by month. The strongest winds occur in the summer months, when the wind speeds average about 14 km per hour (km/hour), or 3.8 m per second (m/s). The occurrence of strong winds during summer increase the dispersion of pollutants during this time. However, during the months of December and January, average wind speeds drop to about 2 km/hour (or 0.6 m/s). The prevailing wind direction in the project area is from the east.
- 4.5 The SIMA stations conduct continuous monitoring for CO, SO₂, ozone (O₃), NO₂, and particulate matter (PM). The SIMA network commenced operation in November 1992. The SIMA monitoring data are typically reported in the form of an index that combines measurements of each separate pollutant. Values of this index in excess of 100 indicate unhealthy air quality. During the period 1996 to 1998, the index values are the highest in December, with over 100 hours (spread over 10 days) in excess of 100. Approximately 91 percent of the index value are attributed to the particulate matter during these hours.

- 4.6 Based on the SIMA data, the air quality in the Metropolitan area appears to be improving. During 1996 and 1997, only three or four hours were monitored in excess of the CO standard and no exceedances were monitored during 1998. No exceedances of the SO₂ standard were monitored during 1996 and 1998. No violations of the NO₂ standard were observed during 1996 and 1998. However, the highest hourly value of 0.206 parts per million (ppm) was just below the ambient standard of 0.210 ppm. Ozone levels have consistently exceeded the ambient standard at all stations. During 1996, the hours in excess of the standard ranged from 15 to 45. During 1998, between 2 and 24 hours exceeded the standard, depending upon the station location. Similarly, exceedances of the particulate standard were as many as 490 in 1996, but had dropped to 251 in 1998.
- 4.7 Based on the existing air quality data, the Project site area appears to have relatively good air quality. However, air quality of the project region (i.e., mainly in the Monterrey city central area) may experience unhealthy air quality on some days.

Hydrology

- 4.8 There are no major streams or rivers in the immediate area of the Project site; however there are various small creeks which are intermittent in nature and have water basically associated with rainfall events. One of these creeks, the *Arroyo Benavides*, is adjoining to the Project site. There are some surface water reservoirs downstream of the *Monterrey III* power plant site and the proposed wastewater discharge point in *Arroyo Benavides*. These reservoirs contain water intermittently, and when available, water has been used for agricultural purposes.
- 4.9 A number of water wells exist in the vicinity of the Project site. Ground water levels have been reported to vary from 3 to 29 m below ground surface. Water quality appears to be good.
- 4.10 In May 2000, the Project Sponsor at the request of the IDB, conducted a hydrogeological study in the vicinity of the proposed discharge point in *Arroyo Benavides* in order to evaluate the permeability of the subsurface materials (up to 10 m below ground surface) at select locations of *Arroyo Benavides* and to help identify and evaluate the potential environmental impacts due to wastewater discharge to *Arroyo Benavides*. The results showed the upper stratum of the subsurface materials at both test locations has a higher permeability than the lower portion of the subsurface materials. The subsurface materials at both borehole locations are comprised of an upper layer of alluvial deposits overlying fractured formational materials (rock). Ground water levels were detected at approximately 8 to 15 m below grade. The results of the pumping test indicate that the water extraction rate were about 6 to 13 l/s and the hydraulic conductivity (K) was about 7.90×10^{-6} m/s to 2.83×10^{-5} m/s. The shallow portion of the aquifer appears to contain acceptable water quality for most current uses for agricultural and potable purposes.

Flora and Fauna

- 4.11 The vegetation within the Project site and the surrounding areas is completely altered as a result of previous agricultural activities. Most of the vegetation studied presents a high perturbation grade due to their habitat modification. The Project site does not have any endangered, threatened, or rare species that are subject to special protection under Mexican NOM-059-ECOL-1994. The Project area is located within the *Floristic* Province of the Northeastern Coastal Plain, which extends from *Coahuila, Nuevo León and Tamaulipas* to the north of *Veracruz*. The *Floristic* Province is characterized by prevailing vegetation composed of thorny forest as well as thorny scrub. The majority of the Project site is urbanized. However, the vegetation consists of *Tamaulipeco* thorny scrub, subinner scrub, and thorny forest. Approximately 70% of the surface of the site have been used for farming.
- 4.12 The Project area is located in Zoogeographic Region 10 in the central-east part of *Nuevo León* and *Tamaulipas*. The wildlife found is typical of semi-arid environments and cultivated areas, the original ecosystem has already been altered. The Project site does not have any endangered, threatened, or rare species that are subject to special protection under Mexican NOM-059-ECOL-1994.

Geology and Seismicity

- 4.13 The Project area is located within the North Gulf Coastal Plain (*Llanura Costera del Golfo Norte*) physiographic province, subprovince of Plains and Hills. Two-thirds of the Western North Gulf Coastal Plain physiographic province is characterized by low mountain ranges, isolated mountain ranges, and island-like mountain ridges. The easterly one-third is generally flat with a gentle gradient towards the coastal lagoons and a string of low coastal dunes that comprise the border with the Gulf of Mexico. One of the prominent physiographic features in the Project area is the folding of the *Eastern Sierra Madre* at the height of *Monterrey* (surrounded by the mountains of *Topo Chico, Las Mitras, La Huasteca* and *La Silla*), creating local changes in wind direction.
- 4.14 The stratigraphy in the Project area constitutes a sedimentary sequence that extends from the Cretaceous to Recent periods. The oldest rocks that outcrop in the region are red shale-sandstone beds corresponding to the *Nazas* Formation, whose age is of the Early Jurassic period. Limestone platforms can be found overlying the previous unit on the *Cerro de la Silla*. These rocks consist of mudstone and wackestone with local interbeds of red siltstone at its base. At the end of the Late Jurassic period, detritus with interbeds of siltstone and limestone were deposited corresponding to the *La Casita* Formation, which outcrops in the north and east portions of the *Monterrey Curvature*. The oldest Cretaceous unit is the *Taraises* Formation, which outcrops all over the region and conformably overlies the *La Casita* Formation. This formation consists of interbedded clayey limestone and shale. Lastly, overlying the entire previous unit sequence include a polymictic conglomerate of Quaternary age and the alluvium produced by weathering and erosion of preexisting rocks.

- 4.15 Between 1972 and 1992, eight seismic events of low intensity with magnitudes less than 5 on the Richter scale were recorded. The epicenters were detected at a distance greater than 50 km from the Project site (four within the radius interval between 50 to 100 km; the other four within the interval between 100 and 200 km). Given the low magnitude of the historic seismic events and the distance from the Project site, the potential for expecting significant seismic events at the Project site is low.

B. Social Conditions

Location and Setting

- 4.16 The *Monterrey III* Project is located in the Municipality of *Pesquería*, State of *Nuevo León*, about 20 km east of the state capital, *Monterrey*. The Metropolitan Area of *Monterrey* is comprised of *Monterrey* and its adjacent municipalities of *Apodaca*, *General Escobedo*, *Guadalupe*, *Juárez*, *San Nicolás de los Garza*, *San Pedro Garza Garcia*, *Santa Catarina*, and *Garcia*. The Municipality of *Pesquería* lies just east of the Metropolitan Area of *Monterrey*, adjacent to the Municipalities of *Apodaca* and *Juárez*. The study area delineated by UNAM in the Project MIA includes six municipalities: *Monterrey*, *Guadalupe*, *San Nicolás de los Garza*, *Apodaca*, *Juárez*, and *Pesquería*, whose population in 1995 was 2,473,521 million (INEGI, 1998).

Demographic and Economic Characteristics

- 4.17 The Metropolitan Area of *Monterrey* is a major industrial, financial, and commercial center whose population of 3 million accounts for over 80% of the population of the State of *Nuevo León*. In 1997, *Nuevo León* had nearly 3.7 million inhabitants, or about 3.9% of the national population of 93.7 million (INEGI, 1998). *Nuevo León* is experiencing rapid growth. Between 1990 and 1997, its population grew at an average annual rate of 2.93%, which would bring the total population to approximately 4 million by 2000 (INEGI, 1998). Most of the growth is centered in the Metropolitan Area of *Monterrey*.

Local Community Characteristics

- 4.18 The Municipality of *Pesquería* is predominately rural and agricultural. However, it is gradually urbanizing as population growth expands from the metropolitan center. In 1995, its population numbered 9,359 persons. A few small concentrations of habitations are reported near the Project site. The nearest village (2 km northeast of the Project site) is *Dulces Nombres*, which had 424 residents in 1995. Other small nearby villages include *Huinalá* (7 km northwest), and *San Miguel* (7 km west). These villages were characterized as subsistence agricultural settlements; nevertheless, many dwellings have electric power, piped water, and sewerage (in *Dulces Nombres*, of 101 occupied dwellings, 100% have electricity, 95% have piped water, and 82% have sewerage). There are also a number of ranches in the vicinity, whose principal activity is cattle grazing and feedlot operations. These ranches have electric power, but use wells for water supply and cesspools or septic tanks for sanitary waste disposal.

Municipal Characteristics

- 4.19 The larger towns in the general vicinity of the Project include, besides *Pesquería*, the municipal seats (“*cabeceras municipales*”) of *Villa Juárez*, *Apodaca*, and *Guadalupe*, which are located on the order of 7 to 20 km from the site. These communities are generally well-served with infrastructure services such as piped water, sewerage, and electricity, with service coverage ranging from 69% of all residences in the *Juárez* and 71% in *Pesquería*, to over 90% in *Apodaca* and *Guadalupe*. These towns have generally well developed commercial centers and community service facilities, although *Pesquería*, as the least developed of the study area municipalities, has the smallest number of enterprises and public services.
- 4.20 Commercial activities include retail and wholesale trade, restaurants, hotels, repair shops, and various technical and professional services, while public services include public safety, schools, medical clinics, hospitals, postal, telegraph, and telephone services, parks and recreation facilities, and social assistance services. There are also a number of manufacturing and processing enterprises producing such things as foods and beverages, construction materials, wood and paper items, clothing and textiles, and plastic and metal products. Within the Metropolitan Area of *Monterrey*, nearly all residences (93%) are connected to the municipal water, electricity, gas, and sewerage systems (UNAM, 1999).

Employment Characteristics

- 4.21 The MIA indicates that the economically active population of the six study area municipalities (persons 12 years and older) represents 56.25% of the total population, with the inactive 43.74% composed mostly of females. The Municipality of *Pesquería* was reported to have a lower than average percentage of economically active persons (33.8% of its residents). More representative of the region's labor force characteristics are data for the Metropolitan Area of *Monterrey*. In 1995, nearly 1.73 million persons, about 57.1% of the Metropolitan Area of *Monterrey* population, was classified as economically active.
- 4.22 Based on the above data, the number of workers in construction activities in the Metropolitan Area numbered over 100,000, which represents the labor pool that the proposed *Monterrey III* Project would draw upon. For perspective, in late 1999, in the entire State of *Nuevo León*, officially registered construction firms (which represent only a portion of the overall industry) were reported to employ approximately 20,000 workers, of whom nearly 3,900 were skilled crafts workers and 16,100 were manual laborers. The total value of these establishments' construction work in progress was over 700 million Pesos (in current prices). Based on national statistics for the industry, the majority of construction work (54%) was in the area of infrastructure (i.e., electric power, oil and gas, transportation, and water supply) with the remainder in commercial, industrial, and residential structures.

Agriculture

- 4.23 The Municipalities of *Pesquería* and *Juárez* are predominantly agricultural areas, although they are lying in the path of development radiating from *Monterrey*. Approximately 42% of the territory of *Pesquería* is dedicated to cultivation of food crops and feed grains, while another 54% is given to livestock raising. The municipality of *Juárez* has 97% of its land in agriculture, mostly for livestock grazing. The Project site is near the boundary between the Municipalities of *Pesquería* and *Juárez*, and the surrounding land is mainly used for grazing of livestock and cultivation of feed grains. More specifically, north and east of the Project site, the land is largely in irrigated farms, growing fodder for livestock. To the south, seasonal (non-irrigated) farming and livestock grazing predominate. Large areas are covered in brush thickets, however, limiting the productivity of the land. Immediately adjacent to the Project site, there are ranches raising cattle, horses, and pigs, and operating feed lots, plus one raising poultry (UNAM, 1999).

Ethnic Composition

- 4.24 According to the 1995 census of population, among the six municipalities comprising the project study area, out of a total population 5 years and older numbering 2,217,906 persons, indigenous language speakers totaled only 5,378 (0.24%), of whom nearly one-half spoke *Náhuatl*. The Project MIA indicates that there are no concentrations of ethnic minorities in the form of social units with distinct neighborhoods or commonly formed codes of conduct. In the Municipality of *Pesquería*, the census recorded only 13 speakers of indigenous dialects, of whom nine spoke *Náhuatl*. On the basis of census housing data, which indicate that the average occupancy of dwellings in *Pesquería* was 4.2 persons, it is estimated that the ethnic indigenous population of that municipality consisted of just three households.

Archeology and Cultural Heritages

- 4.25 The *Monterrey III* power plant site and its surrounding areas are free of remains of archeological and/or cultural importance.

Transportation

- 4.26 The main access to the *Monterrey III* power plant site is the *Monterrey-Dulces Nombres* Highway, located about 1.5 km to the northwest. Access to the Project site can also be provided via the *General Mariano Escobedo* Airport located about 7.5 km to the north. Accesses to the Project site also include the *Monterrey-Tampico* Railroad (about 4.7 km to the south), the *Monterrey-Reynosa* Railroad (about 5.5 km to the north), and the *Monterrey* Highway that crosses with the *Monterrey-Dulces Nombres* Highway.

Visual Resources

- 4.27 The visual harmony of the Project site has already been altered due to the presence of the existing *Huinalá* Power Plant and the *C.C.C. Monterrey II* Power Plant.

5.0 ENVIRONMENTAL AND SOCIAL IMPACTS

- 5.1 As with any project of this type, the *Monterrey III* Project will have both positive and negative impacts on the physical, biological, and human environment. Potential negative impacts associated with the construction and operation phases of the Project are presented in Sections 5.A and 5.B, respectively. Potential positive impacts (benefits) associated with the Project are presented in Section 5.C.

A. Construction Phase

- 5.2 Construction of the *Monterrey III* Project is estimated to extend over two years and eleven months. The most significant impacts are the direct effects of project construction activities on soil, dust generation and noise. These impacts are temporary and mitigable.

Environmental

Soils and Geological Features

- 5.3 The physical and biological characteristics of soils will be affected by construction activities. Further, excavation and leveling activities will change surface topography of the site. As the Sponsor plans to acquire rock-like construction materials from authorized dealers only, significant impacts on soils and geological features are not expected.

Air Quality

- 5.4 During construction of the proposed power plant, temporary impacts to air quality will occur from exhaust emissions from vehicles and construction equipment, and from fugitive dust. Construction activities that may result in fugitive dust emissions include: earthmoving operations during site clearing and grading, construction vehicle movements over cleared land, stockpiling of earth, and spillage from vehicles.
- 5.5 Fugitive dust emissions are variable in nature and are primarily influenced by the moisture of the material and wind speed. It is noted that wind speed in the summer months at the Project area averages over 3 m/s during certain months of the year. At speeds greater than 3 m/s, significant fugitive dust may be generated. Given that construction activities will be spread over the site and that distances to the nearest residences are significant, however, fugitive dust during construction is not expected to have significant impacts on ambient air quality.

Water Quality

- 5.6 Because there are no surface water bodies in the immediate vicinity of the Project site and the access road, the impacts on surface water during construction will be minimal. Significant impacts on groundwater resources during construction are not expected.

- 5.7 It is likely that natural drainage and surface topographic features may be altered and/or interfered with as a result of site clearance and construction activities and building of the pipeline used to convey wastewater to *Arroyo Benavides*. This may lead to an increased sediment load into the existing drainage courses. Because the topography of the Project site is relatively level and the arroyos are now subject to substantial natural erosion during runoff events, the potential for increasing sediment load into the drainage paths would be small.

Noise

- 5.8 Operation of heavy machinery and equipment during construction will increase the noise level in the Project area. However, the increase in the noise levels is temporary and limited to the equipment and machinery operation hours and the construction duration. As such, the impact is not expected to be significant as long as reasonable measures are taken to control construction noise.

Flora and Fauna

- 5.9 Construction of the Project will not result in loss of flora and species of fauna that are subject to conservation regulations. However, clearing activities will cause a loss of the vegetation cover at the site. Because the existing flora on the bank of *Arroyo Benavides* will not be affected by construction activities, impacts on local flora are limited to the surface of the site. Clearing activities will adversely impact the habitat of the scarce local fauna. However, this impact is considered not significant because it will only affect the surface of the site. Animal species such as small reptiles, insects and rodents present on-site are expected to take refuge in the southern nearby land with identical vegetation species. The contractors will be required to perform clearing activities gradually allowing animal species to relocate naturally.

Social Impacts

- 5.10 Because the *Monterrey III* Project is located within the sphere of influence of a major metropolitan area with a substantial industrial base, well-developed civic and transportation infrastructure, and large supply of skilled labor, many of the social and economic problems usually associated with a large construction project in a rural setting should not occur. The Project construction workforce will largely be recruited from local residents who can commute to the project site on a daily basis and thus no construction camp or temporary housing and social related impacts will result.

Workforce Requirements

- 5.11 At the peak of work, the *Monterrey III* Project will require a maximum of 1,000 construction workers, consisting of supervisory, technical, and administrative personnel, and workers. This peak will extend for several months during late 2001 or early 2002, having grown from an initial workforce of approximately 100 personnel earlier in year 2000. The construction workforce will gradually diminish in late 2002 as work phases are

completed, terminating the initial phase of the Project sometime in 2002 and the subsequent phases in mid 2003. Then the operating staff will be assembled, which will consist of 70 workers working over three shifts. The Project will only require about 50 non-local personnel to be relocated to the area during the construction phase, which removes a major source of social and economic disturbances from the potential impacts of the project. These people would be provided with rental housing for the duration of the construction, and most likely would be located in suburban neighborhoods of *Monterrey*, close to urban centers with the usual civic services and amenities. The workforce would commute by bus and private automobile to the site on a daily basis. The construction contractors would probably contract for busses to transport the manual workers from designated pickup locations in the metropolitan area as a mitigation measure for traffic congestion.

Indirect Social and Economic Impacts

- 5.12 Some potential exists for the Project to cause some localized disturbances to the people living near the site. The impacts would be short term and mitigable. These impacts might take the form of reduced availability or degraded quality of grazing land for ranchers in the immediate vicinity of the Project, and disturbances to nearby households from itinerants attracted to the site area by the prospect of finding casual labor or other sources of income. Most vulnerable to the latter would be the small communities of *Dulces Nombres*, *San Miguel*, and *Huinalá*, which are closest to the Project site. Less susceptible would be the more distant and larger towns of *Pesquería*, *Apodaca*, *Villa Juárez*, and *Guadalupe*, which have more developed civic facilities.

Traffic Conditions

- 5.13 Considering the setting of the Project area, significant impacts on local traffic conditions are not expected during construction.

Archeological, Historic and Cultural Heritages

- 5.14 No evidence of archeological, historical and cultural heritages was found onsite. In the event signs of existence of such goods or constructions are encountered during construction, the Sponsor will immediately inform the *Instituto Nacional de Antropología e Historia* (INAH) for further investigations. The Sponsor will temporarily suspend construction activities in the area until INAH reaches a conclusion.

Occupational Health and Safety Issues

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

emergencies. Occupational health concerns during construction include exposure to chemicals (e.g., fuels, degreasers, welding fumes) and dusts (e.g., silica); exposure to noise and radiation; exposure to extreme temperatures; and general sanitary conditions, including toilets, showers, food preparation and eating facilities, and drinking water provisions.

B. Operation Phase

- 5.16 The principal negative impacts associated with operations and maintenance of the Project power plant include: effects on air quality, impacts from wastewater discharge, and impacts due to increase in noise level.

Environment

Air Quality Associated with Plant Operations

- 5.17 During operations, the primary sources of air pollutants will be the turbine stacks. Use of low NO_x units, gas fuel, and dry cooling will minimize air emissions to primarily NO_x and CO. The Mexican Government regulates both stack emissions and ambient concentrations. Similarly, the World Bank has emissions standards that the IDB will apply to the Project. Table 3-2 presents the proposed project emission rates (for each turbine) compared to the Mexican and World Bank emissions standards and demonstrates that the Project will comply with these limits.

Dispersion Model

- 5.18 The USEPA Industrial Source Complex (ISC) dispersion model was used to estimate ambient air quality based upon the project data (i.e. source information, emission estimates, meteorological data and receptor location). ISC is a Gaussian dispersion model designed to estimate the impact of point and area sources such as power plants. Based on model validation studies, ISC is expected to produce conservative estimates of concentration increases.
- 5.19 The Sponsor has provided estimates of emissions for the turbines on the basis of performance data provided by the turbine supplier and the assumption of operation at 100 percent load conditions. Stack characteristics provided by the Sponsor for the Project are summarized in Table 5-1.
- 5.20 High quality meteorological data are available for a multi-year period. For modeling purposes, hourly data for the period between 1996 and 1998 were used as input. Mixing height data were developed from the wind speed data and information regarding surface roughness. However, in some cases, this estimation technique leads to very low estimates (less than 50 m). In these cases, a default mixing depth of 300 m was used.

- 5.21 The model produces predictions of concentration at specific locations, known as receptors. The receptor coverage used in the dispersion modeling consisted of two nested grids, centered on the proposed power plant. The first grid extended over 10 km with a spacing of 500 m. The second grid extended out to 25 km using a grid spacing of 1 km. The second grid covered the Metropolitan Area of *Monterrey*.
- 5.23 The proposed Project is located in an area having both an operating power plant (*C.C.C. Huinalá*) and power plants under construction or start-up (*Unidad Turbogás Huinalá* and *Monterrey II*). While the impact of the existing *Huinalá* plant is reflected in the ambient monitoring data, it was necessary to include the *Huinalá Turbogás* plant and the *Monterrey II* plant in the dispersion modeling in order to predict total ambient concentrations.
- 5.24 Potential impacts of plume downwash were considered by using the USEPA Building Profile Input Program (BPIP). The primary structures that may lead to plume downwash are the air cooling condensers and the heat recovery steam generator structures.
- 5.25 The model assumes that atmospheric conditions are constant (steady state) over each hourly period for which impacts are simulated, and includes algorithms to simulate plume rise, plume dispersion and transport, and plume impact on areas of elevated terrain. Modeling results are summarized in Table 5-2.
- 5.26 The dispersion modeling for nitrogen dioxide examined two scenarios. The first scenario examines conditions leading to the maximum impact of the *Monterrey III* Project. Assuming total conversion of the project emissions of NO_x to NO_2 , the *Monterrey III* Project is predicted to result in a one-hour concentration increase of 42 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) in the Metropolitan Area of *Monterrey*. The predicted concentration increase from the *Monterrey II*, *Monterrey III*, and *Huinalá Turbogás* plants is predicted to be $111.7 \mu\text{g}/\text{m}^3$.
- 5.27 As discussed above, the SIMA monitoring data indicate that some hours of the year approach the ambient NO_x standard. The meteorological data were examined to determine the conditions resulting in the maximum plant impact, and their hours of occurrence. This examination demonstrates that the maximum impact of the *Monterrey III* Project, alone and in conjunction with the other plants, occurs under low wind speed stable conditions that occur between 10:00 P.M. and 5:00 A.M.
- 5.28 The SIMA data were then examined to determine the maximum monitored background levels for these hours. Background values at all the SIMA stations for this period are relatively low, reflecting the lack of emissions from motor vehicles during these late night hours. When adding the maximum predicted power plant impact to the concurrent background, the total predicted concentration is $313.9 \mu\text{g}/\text{m}^3$. Isoleths of concentration are presented in Figure 5-1.
- 5.29 A second NO_2 scenario included conditions when background levels are at their greatest, specifically during mid-day periods. Although dispersion conditions are much more

favorable then at night, due to a more unstable atmosphere and higher wind speeds, a relatively small impact from the facility could result in violations of the one-hour standard because of the high background. An examination of the SIMA data reveal that many of the maximum monitored conditions occur during calm periods. Calm periods are those when wind speeds approach zero. During calm conditions, dispersion modeling can not be performed because of the lack of a meaningful wind direction.

- 5.30 In order to address this issue, calm hours were not modeled, but the next non-calm hour was examined, and this modeled value was then added to the maximum monitored background value. The maximum one-hour value monitored by the SIMA network is $358 \mu\text{g}/\text{m}^3$ under calm conditions. The predicted power plant impact during the next non-calm hour is $7.8 \mu\text{g}/\text{m}^3$ for a total predicted concentration of $366 \mu\text{g}/\text{m}^3$.
- 5.31 Additional NO_2 modeling was conducted for receptors located in *Dulces Nombres* and at other “near-field” locations. For this modeling, the conversion of NO_x emissions to NO_2 was performed using the Ozone Limiting Method (OLM). The OLM is the recommended approach for modeling of NO_2 impacts for receptors close to the emissions source. The results of this modeling for the *Monterrey II*, *Monterrey III* and *Huinalá Turbogás* plants are presented in Figure 5-2, and indicate a maximum one-hour impact of $62.2 \mu\text{g}/\text{m}^3$.
- 5.32 The maximum annual average impact from the *Monterrey III* power plant in conjunction with the *Monterrey II* plant and the *Huinalá Turbogás* plant is predicted to be $2.4 \mu\text{g}/\text{m}^3$. When added to the maximum annual average background value from the SIMA stations, the total predicted nitrogen dioxide concentration is approximately $30 \mu\text{g}/\text{m}^3$. While there are no fixed monitoring stations in the immediate project area, limited monitoring performed in 1997 by UNAM indicates a background level of approximately $36 \mu\text{g}/\text{m}^3$. Using this value, the total predicted concentration would be $98.2 \mu\text{g}/\text{m}^3$.
- 5.33 Gas-fired power plants also emit significant amounts of CO and particulate matter. The ISCST model was also used for these pollutants. The predicted one-hour and eight-hour concentration increases are 85 and $35.7 \mu\text{g}/\text{m}^3$, respectively. The predicted 24-hour and annual average particulate matter concentration increases are 17.8 and $3.79 \mu\text{g}/\text{m}^3$.

Uncertainties Associated with Modeling

- 5.34 The impact on air quality has been assessed using dispersion modeling in accordance with accepted scientific practices. The results indicate that the proposed project will not lead to a violation of any applicable standards when firing natural gas. Sources of uncertainties in dispersion models include the following:
- The basis of the model
 - Source input data such as emission rates and stack parameters
 - Meteorological data
 - Background air quality data
 - Receptor locations

- 5.35 The ISCST model is a Gaussian dispersion model determined by the USEPA to be a “Guideline Model”. As such it has received extensive peer review and application in the scientific community. ISCST is considered appropriate for this project and has been applied in a manner consistent with current standards of scientific practice. Gaussian models are known to be conservative. That is, the models overpredict impacts in most cases. USEPA studies have indicated this overprediction, when correlated in both space and time, to be from a factor of 2 to 10.
- 5.36 Source data may also induce uncertainty. In the case of the proposed power plant, the Sponsor have provided source and emissions data, based on available facility design and information from similar facilities. Based on experience from other projects, these data are reasonable. Meteorological data are available from the Monterrey airport, and these data are expected to be representative of the Project area.
- 5.37 In order to predict total concentrations for comparison to standards and guidelines, model predicted concentrations must be added to the existing background levels. Background data are available from a network of continuous monitoring stations.
- 5.38 Receptors are those points where the model produces predictions of impacts. If the receptor grid has a very coarse spacing, the point of maximum impact may be missed. The Sponsor has examined a detailed receptor grid with a spacing of 500 to 1000 m. This grid provides a reasonable degree of certainty that the point of maximum modeled impact has been included.
- 5.39 In summary, it is concluded that the modeling has been conducted using appropriate dispersion models and data input. The results represent reasonably conservative predictions of project impacts to ambient air quality.

Water Supply

- 5.40 The water consumed by the Project will be used primarily to meet four major requirements during the operational phase: the requirement for the steam cycle, the blowdown system, the plant wash water, and non-potable water domestic use. As discussed in Section 2 of this report, adequate treated waste water will be delivered from the *Dulces Nombres* Wastewater Treatment Plant to support operation of the power plant. No groundwater or other surface water will be withdrawn for the Project. As such, additional strains on the existing water resources are not expected.
- 5.41 The Project Company will provide bottled water for drinking and self-contained emergency eyewash stations during operation. Once the power plant is fully commissioned, the facility will provide adequate support for the entire staff (up to 80 persons). As such, significant impacts on the community’s existing water resources are not expected.

Wastewater Discharge

- 5.42 The Project will generate three types of wastewater discharges: industrial wastewater from the power plant processes, sanitary sewage from power plant personnel, and storm water runoff.
- 5.43 Collection sumps, reservoirs and tanks at the power plant site that hold wastewater or contain chemicals will have the potential to leak, which will adversely impact the groundwater resources beneath the Project site. The Project Company's operational procedures will require that any leakage or spillage from these sumps, tanks and reservoirs is immediately cleaned up and the cause for the leakage or spillage is immediately corrected.
- 5.44 According to the Sponsor, the power plant wastewater discharge to *Arroyo Benavides* would comply with the Mexican NOM-001-ECOL-1996 and World Bank limits. However, to the extent that infiltration occurs in the *Arroyo Benavides*, seepage to groundwater at the waste water discharge site could result in the degradation of the groundwater quality. The direction of the groundwater flow is westward in the vicinity of the power plant wastewater discharge point, towards the City of Monterrey and the municipal water supply wells. The degradation of the water quality could adversely impact existing and future users of the water resources.

Noise

- 5.45 The Sponsor has committed to comply with the Mexican standards for operational noise that the total noise level from the *Monterrey III* power plant, when measured at the property boundary, will not exceed the 68-dBA level during daytime (6:00 A.M. to 10:00 P.M.) and the 65-dBA level during nighttime (10:00 P.M. to 6:00 A.M.).

Hazardous and Solid Wastes

- 5.46 Generation of hazardous and non-hazardous wastes during operation and maintenance of the Project is considered as an impact to the environment that can be controlled or mitigated with the implementation of adequate waste management systems (see Section 6 for details). Thus, impacts due to operation-related hazardous and solid wastes are considered as not significant. Solid wastes that may be generated will include paper, carton, plastics, glass, food wastes, and exhausted resins from the de-mineralization system of the wastewater treatment facilities. Relatively small quantities of hazardous waste (such as rags soaked with oil, grease, cleaning solvents, and absorbent material) will be generated. Used petroleum products (oil, grease, etc.) will also be generated.

Traffic Conditions

- 5.47 A significant increase in road usage will not be required and thus no noticeable impacts on traffic conditions are expected during operation.

Visual Impacts

- 5.48 The proposed power plant will be located next to a new power plant (*Monterrey II*) and an existing power plant (*Huinala*). The existing and the new power plants are expected to have similar characteristics. In general, the Project region can be characterized as a rural zone with cultivated lands isolated industries, and sites covered by native vegetation. As such, no significant visual impacts are expected due to the addition of *Monterrey III*.

Risk

- 5.49 The operation of industrial facilities, which includes power plants, have a probability of occurrence of accidents which could cause materials damages or endanger the life of workers, depending of the magnitude of the episode. The likelihood of such an event is reduced for the project because no fuel will be stored in site and air (instead of hydrogen or any other cryogenic substances) will be used for cooling purposes.

Social Impacts

- 5.50 No significant long-term social impacts are expected during operation of the power plant, given its proximity to a major metropolitan area and the relatively small number of permanent workers required (approximately 80 persons). The operational staff will likely be recruited from residents of the area, who could commute to work on a daily basis and therefore would not need to relocate to the vicinity of the plant site. Consequently, local communities are not likely to experience any significant impacts of population change due to the Project.

C. Positive Impacts/Benefits

- 5.51 The Project will add 1,140 MW of new generation capacity to the central region of Mexico. This Project, together with the other projects included in CFE's expansion plan, is expected to be able to meet the increasing electric power demand in the region. The Project will have a positive impact in the region by generating and providing competitively priced and more reliable electric power, and by supporting the objective of the Government of Mexico for developing the open power market using a technology in an environmentally sound manner. The *Monterrey III* Project will have a positive impact on local economy through the creation of jobs, procurement needs, and taxes.
- 5.52 The project was expanded with a fourth unit in order to generate power exclusively for a group of private industries. Currently, old oil fired equipment located in downtown Monterrey supplies electric energy and steam to these group of private industries. Shutting down part of the old boilers will result on an environmental benefit by eliminating an oil source in a dense populated area.

6.0 ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING

6.1 The Sponsor is committed to mitigating environmental and social impacts due to construction and operation of the *Monterrey III* Project. The mitigation measures proposed during construction and operation will be adopted and imposed as conditions of contracts with contractors to build and operate the power plant. The Sponsor and the EPC Contractor have developed a series of comprehensive Environmental Policies, Management Manuals, and Work Plans for the Project. These documents address a variety of environmental and social issues that are critical to the successful execution of the Project during construction. Selective topics covered in these documents are listed below:

- Environmental requirements, procedures and responsibilities during construction;
- Protection of flora and fauna and use of borrow materials;
- Management of water resources and control of rain and stormwater during construction;
- Use of fuels and procedures for handling and disposal of construction materials, wastes (residual oil, lubricant, solvents, paints,), solid waste and wastewater;
- Emission of combustion gases, noises, suspended particles, volatile organic compounds during construction;
- Hiring and training of personnel;
- Health and safety during construction;
- Execution of environmental protection plan;
- Filing, integration, and archiving of environmental-related files and administering contracts;
- Responsibilities of Project Manager Project Environmental Coordinator, and Contractors Procedures and requirements for preparation of reports to INE, PROFEPA, and SEMARNAP.

A. Mitigation Measures

Construction-Phase

Soils and Topography

6.2 The Sponsor and the contractors will implement standard good practices and the following measures to mitigate impacts on soils and topography during construction, such as obtain construction materials (stone and rock) from authorized borrow sites and prevent exploitation of new borrow sites.

Air and Dust Emissions

6.3 In order to minimize impacts due to dust emissions during construction, the Sponsor will implement the following mitigation measures:

- Monitor construction activities during periods of elevated wind speed. The site environmental coordinator for the Project will have the responsibility to limit construction activities if significant dust generation is observed.
- Cover soil and material stockpiles when not being actively worked.
- Water active construction areas on a regular basis.
- Provide a cover to trucks transporting soil or materials.
- Limit vehicle speeds to a maximum of 20 km/hour on construction roads and within the Project site.
- Request the contractor to develop a schedule for preventive and corrective maintenance on equipment, machinery, and vehicles in compliance with Mexico regulations.

Water Resources

- 6.4 The Sponsor will employ standard good practices and the following measures to mitigate potential impacts on water resources:
- Obtain water from authorized sources such as SADMON or CNA.
 - Obtain authorization to withdraw water for construction activities from the existing well on site..
 - Comply with CNA requirements regarding any mitigation measures associated to *Arroyo Benavides* (e.g. Re-route the *Arroyo* towards the southern limit of the site to minimize potential impacts).
 - Re-use water to the greatest possible extent.

Noise

- 6.5 The Sponsor and the contractors will employ standard good practices and the following measures to mitigate potential impacts on noise:
- Equip all motorized vehicles with mufflers and “closed exhaust”.
 - Measure noise levels to assure that the relevant noise standards are not exceeded.
 - Limit vehicle speeds to a maximum of 20 km/hour on construction roads and within the Project site.
 - Provide noise protection device to workers at the site.

Flora and Fauna

- 6.6 The Sponsor and the contractors will implement standard good practices to mitigate impacts on flora and fauna during construction. Specific measures will include the following:
- Establish an Environmental Education Program for all workers and employees. The purposes of the program will be to provide information and guidelines regarding protection of flora and fauna species, and to instruct all personnel to follow all environment-related practices during construction.
 - Prohibit burning and the use of herbicides or chemicals during site clearing.
 - Use existing roads and respect existing natural vegetation bordering the site.

- Construct green areas using selective species compatible with the environment.
- Prohibit hunting, capturing, and marketing of flora and fauna species.
- Clear vegetation in stages to allow for gradual migration of wildlife.
- Contract the services of wildlife specialists, if needed, to capture the species that require relocation to nearby areas.

Operation Phase

Air Quality

- 6.7 During operation the primary emissions of concern are of NO_x and CO. The Project will use dry-low NO_x combustion technology in the gas turbines and natural gas as the exclusive fuel. As such, significant impacts on air quality are not expected.

Wastewater Discharge

- 6.8 The Sponsor has committed to treat the power plant wastewater to be in compliance with limits stipulated in NOM-001-ECOL-1996 and World Bank limits when being discharged to *Arroyo Benavides*, which is an intermittent river that has water only in the rainy season.

Noise

- 6.9 The Sponsor has committed that the noise levels on the perimeters of the plant will exceed the Mexican standards of 68 dB(A) and 65 dB(A) during daytime (6:00 A.M. to 10:00 P.M.) and nighttime (10:00 P.M. to 6:00 A.M.), respectively. As necessary, mitigation measures will be defined and implemented based upon results from noise monitoring programs during operations.

Water Resource

- 6.10 Water required for the operation of the *Monterrey III* Project will be delivered to the site through an aqueduct from SADMÓN's *Dulces Nombres* Wastewater Treatment Plant. Water will be used for reposition in the water-steam cycle for cooling and general services.

Management of Solid and Hazardous Wastes

- 6.10 Solid wastes will be separated, stored, reused, recycled, or disposed of by a company approved by the relevant authorities. Hazardous wastes will be collected, temporarily stored, transported, confined or disposed of according to Mexican Regulation by a company specialized and with the relevant permits. Used lubricating oil from the gas and steam turbines will be transported to an authorized company for recycling.

B. Monitoring

- 6.11 The Project Company will utilize Continuous Emission Monitors (CEM) for NO_x and O₂. The CEM units will be installed on each stack and will be operated during both natural gas.
- 6.12 The Project Company has the responsibility and obligation to perform technical analysis of the wastewater in order to determine its quality prior to discharge. The Project Company will implement a monitoring and testing program during operation to ensure that the power plant wastewater discharge to Arroyo Benavides complies with the requirements stipulated in the Mexican NOM-001-ECOL-1996 and World Bank limits and monitoring requirements.
- 6.13 Monitoring of noise and ambient air quality is also planned.
- 6.14 The Sponsor will prepare an annual Environmental Performance Report to demonstrate operational compliance with the applicable regulations. The report will include 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. Health and Safety and Contingency Plans

Construction

- 6.15 The EPC Contractor will prepare an Environmental, Safety, and Health Execution (EHS) Plan that will address critical occupational health and safety issues associated with construction. This EHS Plan will contain detailed, specific procedures for mitigating health and safety hazards. The Plan will also contain detailed, specific core processes covering the overall health and safety policy, responsibilities of project health and safety personnel, health and safety training of all personnel, medical services and surveillance, record-keeping, job hazard analysis, incident investigation, inspections, subcontractor requirements, and noncompliance procedures.

Operation

- 6.16 The Project Company has committed to develop a Health and Safety Plan and Contingency Plan, prior to plant operations, in order to minimize, control, prevent, and respond to worker health and safety risks and other unplanned events (e.g., explosions, fires, sulfuric acid and/or sodium hydroxide leaks, sodium hydroxide spills, etc.).

D. Responsibilities and Costs

- 6.17 To effectively manage the environmental, social and occupational health and safety concerns associated with the operation of the *Monterrey III* power plant, the Sponsor will allocate specific human and administrative resources. An environmental specialist was recently hired to support coordination of the environmental and social mitigation measures. The costs associated to environmental and health and safety activities during construction amount can not be fixed. The EPC Contractors must afford any charge in order to fulfill any environmental requirement. As an estimation, 700.000 US dollars during construction and 50.000 US dollars for annual operation are estimated.

7.0 PUBLIC CONSULTATION

- 7.1 The Project Sponsor has developed a Public Consultation and Disclosure Plan (PCDP) for the *Monterrey III* Project. The purpose of the PCDP is to establish the process to consult and inform key stakeholders in the planning, development, construction and operation of the Project.
- 7.2 The Sponsor initiated the formal consultation process in May 2000 by conducting a preliminary (or “diagnostic”) consultation consisting of individual and group interviews/meetings with key stakeholders to assess their awareness of the Project, initial reactions and concerns, and to identify any other interested parties to be contacted during the PCDP. Specifically, the Sponsor contacted a total of 98 local residents, and held a number of meetings with the municipal leaders to discuss the Project, to introduce the Sponsor management team, and to solicit their assistance in identifying other stakeholders within the community. In addition, the Sponsor provided the public with printed materials delineating technical and non-technical information about the Project. Such materials were also made available to the public throughout the Municipality of *Pesquería*.
- 7.3 The Sponsor organized a formal public meeting in the town of *Pesquería* on May 27, 2000. The Sponsor arranged the public consultation meeting in close cooperation with the local government officials. The meeting was publicized within the *Monterrey* Metropolitan Area through personal solicitations with the stakeholders identified. The updated MIA was made available for inspection at a central location within the Municipality of *Pesquería*. Executive summaries of the MIA were made available free of charge to members of the public. Almost 50 participants attended the public consultation meeting. The local residents and the general public in the vicinity of the Project site generally appreciated the opportunity to be informed of the *Monterrey III* Project. Comments by the public focused on employment opportunities and the possibility of local farmers using the power plant wastewater. In response to a request to consider discharging the wastewater to other locations along *Arroyo Benavides* so that the farmers could utilize the water, the Sponsor indicated that the Project Company would evaluate its technical feasibility and suggested that the farmers should discuss this option directly with CNA, since they are the appropriate authority for a final decision regarding utilization of discharged water, having the Project Company no legal competence to authorize this water consumption..

- 7.4 The Sponsor plans to continue the consultation process and will incorporate the information obtained throughout the consultation process into design, construction, operation and maintenance of the Project. Throughout the public consultation process, no opposition to the development of the Project has been expressed.
- 7.5 The original Project MIA was made available to the public initially in August 1999 when CFE submitted the request for authorization of the Project from INE. This MIA was subsequently made available again, at the request of the IDB, to the local public in late December 1999. Updated information about the Project, specifically related to increased air emissions and change in wastewater discharge location was made available in March 2000. The complete updated MIA was made available in May 2000.

8.0 RECOMMENDATIONS

- 8.1 The Bank (IDB) will require as part of the Loan Agreement that the Company (Iberdrola Energía Monterrey S.A. de C.V.) and all portions of the Project shall, at all times during the life of the Loan Agreement, comply with each of the following:
1. All applicable environmental, health and safety Mexican regulatory requirements.
 2. All requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project or the Company.
 3. All environmental, health and safety requirements of the Project Contracts, including the Power Supply Agreement, and any subsequent modifications.
 4. All aspects and components of all Project environmental, health and safety documents.
 5. Applicable aspects of the World Bank Thermal Power Guideline for New Plants (World Bank Pollution Prevention Handbook, July 1, 1998).
 6. Applicable aspects of the World Bank General Environmental Guideline (World Bank Pollution Prevention Handbook, July 1, 1998).
 7. Applicable aspects of the World Bank Monitoring Guideline (World Bank Pollution Prevention Handbook, July 1, 1998).
 8. Applicable aspects of the International Finance Corporation General Health and Safety Guideline (July 1, 1998).
 9. Use only natural gas as the exclusive fuel.
 10. Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable which potentially could have environmental, social, or health and safety negative effects.
 11. Send written notice of any and all noncompliance with any environmental requirement of the loan agreement and any significant environmental or social accident, impact event or environmental claim.
 12. Ensure that all companies contracted for construction or operation activities comply with the applicable environmental requirements of the loan agreement
 13. Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the Project.

14. Implement an environmental, health and safety management system that is consistent with ISO 14001 and BS 8800.
- 8.2 Prior to the date of Financial Closure, the Company shall fulfill the following conditions:
1. Finalize the formal contractual agreement with SADMÓN related to water supply for the Project power plant.
 2. Obtain INE approval for project modifications associated with the additional capacity to be installed.
 3. If discharging wastewater to the *Arroyo Benavides*, present final information and procedures, as necessary, to demonstrate, to the satisfaction of IDB, that potential impacts on surface and groundwater from the Project wastewater discharge into the *Arroyo* will be adequately mitigated.
- 8.3 Prior to First Disbursement of the Loan, the Company shall submit, subject to IDB approval planned environmental monitoring programs for Project operation phase. :
- 8.4 Prior to each disbursement, the Company must certify compliance with all environmental and social requirements in the loan agreement.
- 8.5 The Company shall prior to Commercial Operations of the Project, submit to IDB, in form and substance acceptable to the IDB, the following:
1. Environmental and Social Management Plan for the operational phase of the Project.
 2. Contingency Plan (e.g., SPCC, Emergency) and for the operational phase of the Project.
 3. Health and Safety Plan for the operational phase of the Project.
- 8.6 The Company shall as a specific requirement for Project Technical Completion, 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.
- 8.7 During the life of the Loan Agreement, the Company must prepare and submit an Environmental and Social Compliance Report, in form and content acceptable to IDB. This report shall be prepared quarterly until one year after initiation of operation and annually thereafter.

- 8.8 The Bank will monitor the environmental, social, and health and safety aspects of the Project via internal Bank supervision actions (e.g., site visits, review of documentation, etc.) and will contract an external independent environmental consultant to perform more detailed supervision/monitoring actions during Project construction and initial operation. In addition, the Bank will have the right, as part of the Loan Agreement, to contract for the performance of an independent environmental, health, and safety audit, if needed.