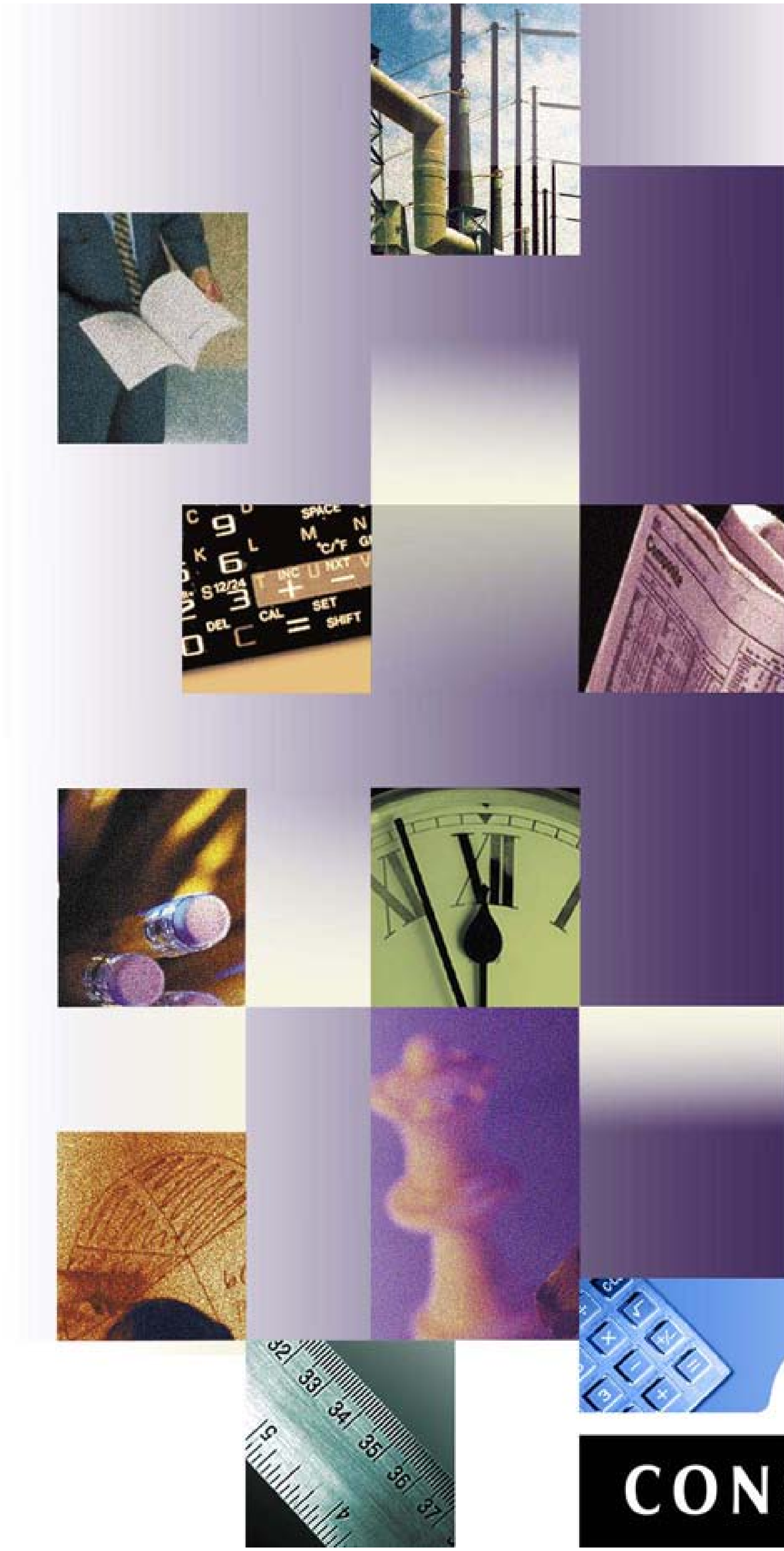

Final Environmental Impact Assessment – Vlorë Combined

Prepared for:

REPUBLIC OF ALBANIA
MINISTRY OF INDUSTRY & ENERGY

Sponsored by the U.S. Trade and Development Agency

Activity No. 2000-70093A

Grant No. GH2793403

October 6, 2003

Prepared By:

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1 EXECUTIVE SUMMARY

1.1 BACKGROUND

The Power Sector of Albania is managed by KESH, a vertically integrated utility with generation, transmission, and distribution assets. KESH is also responsible for purchased power and energy exchange with several neighboring countries. KESH is a monopoly and, for practical purposes, is the only company in the Albanian electricity sector.

Presently, the Albanian electric power system is experiencing severe problems. Hydropower represents more than 98 percent of Albania's domestic generation. According to the Strategic Action Plan, dated February 28, 2001, and prepared by the Albania Power Sector Reform Task Force, KESH is facing unusual severe drought conditions and has had to curtail electricity service to consumers in some regions for up to 10 to 12 hours per day.

The daily electricity consumption in wintertime is about 22 million kilowatt hours (kWh) per day. Under normal weather conditions, the domestic hydroelectric generation is 7 to 13 million kWh per day, while generation from thermal power plants is only 1.2 million kWh per day. Therefore, the domestic electricity production cannot meet the demand, forcing Albania to become a net electricity importer.

As can be seen, Albania lacks reasonable security and reliability of its electric energy supply and the Task Force has recommended that the Parliament should implement a comprehensive energy policy that includes the addition of new generation taking into account both least cost options and fuel diversity to assure a reliable supply of electricity throughout the year. As a result, the Ministry of Industry and Energy and KESH has begun to study the technical and financial viability of installing new base load thermal generation facilities in Albania.

A generation expansion plan was developed for the country by a consortium of European firms. This consortium includes Deutsche Energie-Consult Ingenieurgesellschaft (DECON), Electricité de France (EDF), and LDK Consultants. According to the generation expansion plan, power supply in Albania will become increasingly vulnerable without new thermal generation due to the country's high dependence on hydropower, lack of rainfall, and uncertain power imports. The report stresses the need to accelerate both detailed project design and further project planning to increase the generation share of thermal power generation in the country. Developing more thermal power generation in Albania represents a prudent approach towards avoiding a too high dependence upon potentially uncertain hydropower resources and power imports.

The United States Trade and Development Agency (USTDA) awarded a grant to the Government of Albania to assist in the development of a new thermal generation facility. The Albanian Ministry of Industry and Energy subsequently retained Montgomery Watson Harza (MWH) to perform three tasks. Task One was to evaluate and select the best site, technology, and fuel for a new base load, thermal generation facility. Task Two was to conduct a feasibility study to evaluate the technical requirements as well as the environmental, economic, and financial viability of the generation facility at the selected site.

Finally, Task Three was to conduct an Environmental Impact Assessment (EIA) of the proposed generating facility. This work commenced in 2001.

In Task One, MWH evaluated seven potential sites including sites near Durrës, Elbasan, Korçë, Fier, Shëngjin and two sites near Vlorë – Vlorë A and B. The sites were evaluated using an automated methodology, which scored each site on a number of development criteria such as fuel supply, water supply, transmission availability, cost, and environmental considerations, among others. A Draft Siting Report documenting the results of Task One was issued on June 6, 2002 and recommended Vlorë B, hereafter refer to as the Vlorë site, as the best site and distillate oil-fired, base load, combined cycle generation as the best generation technology. Moreover, the Report did not identify any initial fatal flaws in regards to fuel supply, water supply, transmission availability, and environmental considerations. On June 21, 2002, the Ministry of Industry and Energy and KESH agreed with MWH's recommendation and provided authorization to proceed with Task Two.

Based on the site location, technology, and fuel selected in Task One, MWH conducted a detailed feasibility study in Task Two to evaluate the technical requirements as well as the financial, environmental, and social viability of the potential generation facility at the selected site. More specifically, MWH:

- Developed technical requirements for the proposed generation facility
- Developed project cost estimates
- Conducted economic and financial analyses
- Conducted a preliminary environmental analysis

The Feasibility Study focused on the development of a facility with an installed capacity range of 90 to 130 MW. The Study reconfirmed the following recommendations that were originally provided in the Siting Study, namely:

- Vlorë is the best overall site for the installation of a new base load thermal generation facility
- Combined cycle technology is more advantageous than coal-fired steam technology for new base load generation in Albania
- A distillate-oil fired combined cycle generation facility is technically, environmentally, economically, and financially feasible.
- The Vlorë site has the lowest levelized generation cost of power compared to the other sites.

The study was completed on October 21, 2002 and subsequently approved by KESH. MWH was then authorized to proceed with Task Three, which was to conduct the EIA on the Vlorë site.

In addition, the generation expansion plan performed by DECON-EDF-LDK independently confirmed the results of MWH's analysis, that a distillate oil-fired combined cycle generation facility located at the Vlorë site was the best new generation option for Albania.

1.2 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

1.2.1 EIA Requirements

It is anticipated that the World Bank, the European Bank for Reconstruction and Development (EBRD), and the European Investment Bank (EIB) will jointly provide the debt financing for the proposed Vlorë power generation facility. Each financing institution has specific policies and procedures for promoting environmental protection and sustainable development. These procedures include a detailed environmental review process and preparation of an EIA prior to final approval of financing for the project. The EIA for the proposed Vlorë facility was prepared in accordance with the requirements of all three financing institutions as well as the European Union standards. The requirements of the cofinancers are similar in nature and the most stringent of the four standards have been incorporated into this EIA. For simplicity, the standards are reference hereafter as international standards.

The EIA provides a summary of available information on the baseline site conditions including the physical and atmospheric conditions, water and biological resources, cultural resources and socioeconomic conditions of the area. In the EIA process, information on the baseline site conditions along with the applicable standards and norms are used to assess the potential environmental and social impacts of the proposed generation facility.

The potential environmental impacts considered in the EIA process include impacts to the air quality, water resources, land resources, and socioeconomic/cultural conditions during construction and operation of the generation facility and associated transmission infrastructure. The social/cultural resources evaluated include labor employment, land use, raw material sources, fisheries, coastal navigation, transportation, and local community services.

The EIA also presents mitigation measures to be employed to help prevent or minimize the environmental and social impacts of the project. These are included in an environmental management plan (EMP), which can be seen in detail in the report. The EMP consists of the set of mitigation, monitoring, and institutional measures to be taken during construction and operation of the planned generation facility to eliminate, offset, or reduce adverse environmental and social impacts. The plan also includes the actions needed to implement these measures. Moreover, the EIA outlines specific environmental management and monitoring plans and identifies any necessary reporting requirements and schedules.

1.2.2 Project Description

The following discussion provides an overview of the key features of the planned thermal generation facility in Vlorë as they relate to the EIA analysis.

Site Description

The selected Vlorë site is a six hectare green field site adjacent to the offshore oil tanker terminal located on the Adriatic coast north of the Port of Vlorë. It is located approximately six km from the Port of Vlorë. The site is situated on a relatively barren coastal area with little vegetation or wildlife.

There are no major point sources of air emissions in the Vlorë area. Several industrial facilities that operated in Vlorë in the past were shutdown in the 1990's. In addition, there is no reliable existing air quality data for the Vlorë area. Due to the lack of industrial activity in the area and the lack of reliable data, it is assumed that current air quality conditions in the Vlorë area satisfy a "moderate" air quality classification according to World Bank criteria. Regardless, the Albanian Government should begin collecting site specific air quality data as soon as possible (at least 12 months). As soon as sufficient site data is available, additional air modeling should be performed to confirm the findings of this EIA and recommend any further mitigation measures, if necessary, while the Project is still being implemented.

Plant Technology

The EIA is based upon a two combustion turbines with one steam turbine (2-on-1) combined cycle configuration.

The emissions to the ambient air from combustion of distillate fuel oil in a combustion turbine include sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), particulate matter less than ten microns (PM_{10}), carbon dioxide (CO_2), and volatile organic compounds (VOC). Computer modeling of the impacts of the emission of SO_2, NOx, CO, and PM_{10} are described later in this executive summary. No air quality standards are set for CO_2, and VOC's; therefore, these pollutants are not modeled. The particulates may contain small amounts of trace metals that are also emitted to the atmosphere. These pollutants are emitted in negligible quantities and are therefore not modeled.

The best available technology for controlling air emissions will be used at the generation facility in order to meet applicable air quality and emission control standards. The combustion turbines will employ good combustion control and water injection technology to control the emission of NOx. In addition, the combustion turbines will also use good combustion control to minimize the products of incomplete combustion and reduce emissions of PM_{10}, CO, and VOC's. Limiting the sulfur content of the fuel will control SO_2 emissions as well.

The international air emission standards for thermal power generating facilities are summarized along with the estimated emissions from operation of the planned Vlorë plant in Table 1.1. A computer model, which is described later in this section as well as the body of the report, uses these emission rates to predict the impact of the planned facility on local air quality. As can be seen, the estimated Vlorë plant emissions are well below, and thus better, than the international emission standards. For example, estimated PM_{10} emissions from the Vlorë plant are over three times better than the standards. Estimated NOx emissions from the plant are approximately 40 percent better than the standards. And SO_2 emissions from the plant are several hundred times better than the standards.

TABLE 1.1

AIR EMISSION STANDARDS

Pollutant	Thermal Generation Facility Emission Standard		Estimated Vlorë Plant Emission
	World Bank [a]	European Union [b]	
PM_{10}	50 mg/Nm^3	50 mg/Nm^3 (dry @ 3% O_2)	14 mg/Nm^3
NOx	165 mg/Nm^3 (dry @ 15% O_2)	450 mg/Nm^3 (dry @ 3% O_2)	97 mg/Nm^3
SO_2 [c]	0.20 TPD/MW 2,000 mg/Nm^3 (dry @3% O_2)	1,700 mg/Nm^3 (dry @3% O_2)	0.0048 TPD/MW 57.4 mg/Nm^3

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

[b] *Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 0n the limitation of emissions of certain pollutants into the air from large combustion plants. If the total plant capacity exceeds 300 MW, then the SO_2 limit is more restrictive, depending on the size of the plant.*

[c] *Sulfur Dioxide emissions based on 0.1% sulfur in the fuel. This is compliant with Directive 1999/32/EC Article 4*

Noise

Offsite noise emitted from operation of the planned generation facility will meet the international standard of 70dB(A) for commercial/industrial areas. The combustion turbines should be enclosed in an acoustic enclosure to ensure that noise does not exceed 85 dB(A) at one m.

Fuel Supply

An offshore fuel oil tanker terminal and pipeline is located adjacent to the north boundary of the site. The new distillate oil-fired generation facility will utilize the existing, operating pipelines that run from the offshore terminal to the nearby Narta storage facility.

Potential impacts from distillate fuel oil handling and storage will be mitigated through use of best management practices (BMP), which are, as their name implies, practices that public and private entities adopt to incorporate pollution prevention into their operations. A spill response plan and necessary response equipment should be provided to respond to accidental releases of the distillate fuel oil. KESH is responsible for preparation of this plan during construction of the facility and for providing the necessary response equipment. It is anticipated that as many as 30 deliveries will be made per year. Monitoring and enforcement of sea conditions under which a vessel may make deliveries should be part of the plant procedures and implemented through the delivery contract. Secondary containment should be provided for on-site distillate fuel oil storage tanks.

Transmission

The transmission interconnection will require a seven km line from the planned Vlorë facility switchyard to the planned Babica substation. If the Babica substation is not constructed in time, the interconnection will be to the Vlorë substation, which is located 4.5 km away. Either transmission line will have minimal environmental impact. The typical right of way width for a 230 kV transmission line is between 40 m and 60 m. Clearing only vegetation that interferes with construction access or line operation will minimize the environmental impact from construction and operation of these lines. Where practical, access areas should be revegetated using indigenous plants.

Water

Once through cooling utilizing seawater is required for the facility. Submerged intake and discharge diffusers are anticipated to be located approximately 600 m offshore. Impacts on the marine environment due to construction of the water intake and discharge will be minimized through siting of the exact location of the intake and outfall. Construction wastes should not be disposed of in the bay.

The potential impacts on the marine environment due to operation of the water intake will be minimized through the exact siting of the intake. Bar screen intake screens with 25 cm spacing at intake should be utilized. Final screening with traveling water screens at cooling water pump suctions should be employed. An inlet velocity less than one m/s to should be used to minimized entrainment of marine organisms.

Potential impacts to the marine environment from the cooling water discharge include:

- Change to the temperature regime of the water column, and perhaps the sediment, of the receiving environment;
- Lethal and sub-lethal responses of marine organisms to the change in temperature regime;
- Stimulation in productivity in a range of organisms;
- Reduction in the dissolved oxygen saturation;
- Changes in the distribution and composition of communities of marine organisms comprising European marine sites (particularly estuaries)
- Localized changes in bird distributions usually in response to increased macroinvertebrate or fish food supplies close to thermal discharges.

The modeled thermal impacts of the cooling water discharge on the marine environment in the Bay of Vlorë are discussed in detail later in this executive summary, as well as the body of the report.

General plant wastewater will be collected and conveyed to the plant wastewater collection and treatment system. The treated effluent and cooling water return is then routed to an offshore outlet diffuser.

Chemical discharge in the plant cooling water is expected to be negligible because the only chemical that will be added to the cooling system is sodium hypochlorite, which is added to prevent biofouling of cooling system components. Other than the hypochlorite addition, cooling water will simply be pumped from the sea, circulated once through the plant and discharged back to the sea. Chlorine concentrations in the process water will be maintained at or below 0.2 mg/l to minimize the effect of chlorine at the cooling water discharge point.

This level meets the requirements of the guidelines for new thermal power plants found in the World Bank Pollution Prevention and Abatement Handbook. The residual chlorine value is typically lower than 0.2 mg/l in practice.

1.2.3 Modeled Impacts

The following discusses the modeled impacts of the generation facility air emissions on local air quality and the thermal impacts of the cooling water discharge on the marine environment.

Air Quality Impact Modeling

The international air quality standards designed to protect human health and the environment for carbon monoxide (CO), nitrogen oxides (NOx), particulate matter less than ten microns (PM_{10}), and sulfur dioxide (SO_2) are summarized in Table 1.2. Computer modeling was used to predict outdoor concentration impacts of facility emissions (see Table 1.1), and to show that the impact from the planned facility will meet the required international standards.

For this analysis, the USEPA model, Industrial Source Complex Short Term - Version 3 (ISCST3) with the Plume Rise Model Enhancement (ISC-PRIME) algorithms, were used to estimate the maximum off-property concentrations of CO, NO_2, PM_{10}, and SO_2 at ground-level. ISCST3 is an internationally recognized air modeling computer program. The model has been validated for coastal environments such as the proposed Vlorë site. The results of the modeling are shown in Table 1.2 along with the international standards. As can be seen, the results are well below, and thus better, than the air quality standards, and demonstrate that the generation facility air emissions will have minimal air quality impact and no appreciable impact on human health.

In addition, the modeling results are well below, and thus better, than the concentration limits designed to protect vegetation and ecosystems from acid deposition. Based on these results, the planned generation facility will have a negligible impact on the flora and fauna in the area. There will be no appreciable effect on other natural resources in the area due to acid deposition from the planned facility.

TABLE 1.2

WORLD BANK & EU AMBIENT AIR QUALITY STANDARDS COMPARED AGAINST MODELED AIR QUALITY IMPACTS OF THE PLANNED VLORË GENERATION FACILITY AIR EMISSIONS

Pollutant	Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)	
		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]
CO							40.9		10,000			
NOx	3.1	100	30[c], 40	16.2	150					89.3		200
PM_{10}	0.3	50	40	1.8	150	50						
SO_2 [e]	1.9	80	20[d]	9.7	150	125				53.4		350

Notes:

(grey box) = Not Applicable

a. World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998

b. Limit values are effective January 1, 2005. All of these limit values include a maximum allowable occurrence of exceedance.

c. Limit to protect vegetation.

d. Limit to protect ecosystems.

e. SO_2 Emission Based on 0.1% Sulfur in Fuel

Marine Environment

In order to assess potential thermal impacts from the proposed facility, modeling was performed to predict the potential increase in water temperature to demonstrate compliance with the international thermal liquid discharge temperature increase limit of less than or equal to three degrees Celsius (^{o}C). The once-through plant cooling water discharged into the Bay of Vlorë will increase water temperatures in the vicinity of the discharge location.

Thermal impact modeling was performed utilizing the Cornell Mixing Zone Expert System (CORMIX), developed by the USEPA and Cornell University. The model is an internationally accepted analysis tool for point source discharges and has been validated with field and laboratory data for use in a coastal bay environment (see www.cormix.info/validations.php). Industry standards concerning thermal discharges generally allocate a specific mixing zone for initial assimilation of process water discharge into a receiving body of water. A 23 m mixing zone was used in this modeling to predict the temperature increase due to the cooling water discharge. This value is within the 100 m mixing zone recommended in the guidelines for new thermal power plants found in the World Bank Pollution Prevention and Abatement Handbook.

The worst-case thermal modeling scenario was evaluated in accordance with the facility water balance. The worst-case scenario was selected for the operating condition resulting in the highest temperature differential between the effluent and the ambient water body temperature of the Adriatic Sea. The modeled outfall pipe consists of a multi-port slotted diffuser that extends 600 m from the shore at a 45-degree angle from the shore (horizontal angle) and 0.15 m from the ocean floor.

The modeling results predict a 0.87^{o}C temperature increase above ambient water temperatures at the edge of the mixing zone. This is more than 60 percent lower, and thus better, than the international impact standard of a maximum temperature increase of less than or equal to 3 ^{o}C.

1.2.4 Social Requirements

Given the socioeconomic conditions in the Vlorë area, this facility will greatly benefit the region. It is not anticipated that the construction will cause a significant influx of people from other areas. Therefore, stress on the infrastructure of the Vlorë area from this regard should be minimal.

During the eighteen-month construction period of the facility as many as 500 workers will be necessary. Most of the labor force in the Vlorë District has completed secondary schooling. The schools include 19 elementary schools, three general high schools, one trade high school, one industrial high school and one artistic high school. In addition, Vlorë is home to the Polytechnic University. The university offers undergraduate degrees in engineering and other less technical disciplines. The educational infrastructure of the area is strong and the presence of both the planned generation facility and these institutions may be mutually beneficial.

Any potential negative social impacts of the plant are outweighed by its positive impacts. The facility will be incorporated into the industrial district in Vlorë and contribute to its overall social and economic development.

1.3 CONCLUSION

The analysis performed to fulfill the EIA requirement follows international standards. The EIA establishes the baseline condition of the site and assesses the impact of the proposed generation facility on area resources. The likely positive and negative impacts of the proposed project are identified and quantified to the extent possible. Mitigation measures to be taken during construction and operation of the facility and any residual negative impacts are identified.

The planned generation facility is a state of the art combined cycle unit and will meet all applicable international standards for air emissions. Modeling was performed as part of the EIA to assess the impacts of the air emissions on local air quality. The results of the air modeling show that the plant will meet all international ambient air quality concentration standards. In addition, the modeling demonstrates that the planned facility will not result in degradation of the local air quality or the environment.

Modeling was also performed as part of the EIA to assess the impact of discharging heated cooling water into the Bay of Vlorë. Cooling water discharge modeling shows the discharge will have an acceptable impact resulting in a 0.87^{o}C rise in seawater temperature. This level of temperature increase is better than international standards.

In summary, the planned facility meets all international environmental standards and will have a positive impact on the local economy without stressing the local infrastructure and services. In addition, the facility will alleviate many of the severe problems currently being experienced in the Albanian electric power system.

2 INTRODUCTION AND BACKGROUND

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In addition, the generation expansion plan performed by DECON-EDF-LDK independently confirmed the results of MWH's analysis, that a distillate oil-fired combined cycle generation facility located at the Vlorë site was the best new generation option for Albania.

It is anticipated that the World Bank, the European Bank for Reconstruction and Development (EBRD), and the European Investment Bank (EIB) will jointly provide the debt financing for the proposed Vlorë power generation facility. Each financing institution has specific policies and procedures for promoting environmental protection and sustainable development. These procedures include a detailed environmental review process and preparation of an EIA prior to final approval of financing for the project. The EIA for the proposed Vlorë facility was prepared in accordance with the requirements of all three financing institutions as well as the European Union standards. The requirements of the cofinancers are similar in nature and the most stringent of the four standards have been incorporated into this EIA.

Under the World Bank's environmental review process, thermal generation facilities are considered a Category A project and require a comprehensive EIA or suitably comprehensive regional or sectoral Environmental Assessment (EA). This EIA provides an assessment of the potential positive and negative environmental impacts of the project and compares them to feasible alternatives including the "without project alternative". The EIA also recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse environmental impacts and improve environmental performance. In addition, the EIA outlines specific environmental management and monitoring plans and identify reporting requirements and time frames.

This report, which is the EIA, consists of the following additional sections:

- Legislative, Regulatory, and Policy Considerations
- Project Description
- Baseline Site Conditions
- Impact Identification and Proposed Mitigation
- Analysis of Alternatives
- Environmental Management Plan
- Public Consultation and Disclosure Plan

2.1 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK REQUIREMENTS OF COFINANCERS

This section discusses the policy, legal, and administrative framework within which the EIA is carried out. In addition, the section provides an explanation of the environmental requirements of the cofinanciers and identifies relevant international environmental agreements to which the Albania is a party.

2.2 PROJECT DESCRIPTION

This section provides a concise description of the proposed project and its geographic, ecological, social, and temporal context, including any offsite investments that may be required (e.g., transmission interconnection line, dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities).

2.3 BASELINE SITE CONDITIONS

This section of the EIA presents the results of an assessment of the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. The assessment takes into account the current and proposed development activities within the project area but not directly connected to the project.

2.4 IMPACT IDENTIFICATION AND PROPOSED MITIGATION

The likely positive and negative impacts of the proposed project are identified and quantified to the extent possible. The section also includes information on mitigation measures to be taken during construction and operation of the facility and any residual negative impacts that cannot be mitigated. In addition, the section identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions.

2.5 ANALYSIS OF ALTERNATIVES

This section relies on previous study work performed by MWH and DECON-EDF-LDK to systematically compare feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental impacts. This previous work is the basis for selecting the Vlorë project site and generation technology and fuel.

2.6 ENVIRONMENTAL MANAGEMENT PLAN

The project's environmental management plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.

2.7 PUBLIC CONSULTATION AND DISCLOSURE PLAN

The public consultation and disclosure plan documents interagency contacts and involvement of the public during the EIA preparation process. It identifies the Non-Governmental Organizations (NGO's) operating in the area and discusses their involvement in the process.

3 LEGISLATIVE, REGULATORY, AND POLICY CONSIDERATIONS

As mentioned earlier, it is anticipated that the World Bank, EBRD, and EIB will jointly fund this project. They all have specific policies and procedures for promoting environmental protection and sustainable development. These procedures include a detailed environmental review process prior to final approval of financing for the project. Since the World Bank would be the lead financing agency in this effort, their guidelines and report format were followed in this document. However, additional information has been gathered to meet the applicable European standards. Albanian environmental requirements are discussed later in this section.

Under the World Bank's environmental review process (OP/BP/GP 4.01) thermal generation facilities are considered a "Category A" project and require a comprehensive Environmental Impact Assessment (EIA) or suitably comprehensive regional or sectoral Environmental Assessment (EA). The EIA provides an assessment of the potential positive and negative environmental impacts of the project and compares them to feasible alternatives including the "without project alternative". The EIA should also recommend any measures needed to prevent, minimize, mitigate, or compensate for adverse environmental impacts and improve environmental performance. In addition, the EIA must outline specific environmental management and monitoring plans and identify reporting requirements and time frames.

The following tables present a summary of the standards and limit values for the World Bank and the EU. The summary includes air quality standards, air emissions limits, thermal discharge limits, wastewater discharge limits, and permissible noise levels. Table 3.1 provides hourly air quality standards for the World Bank and the EU. Table 3.2 shows the emission limits and guidelines for a thermal power plant as well as the predicted emissions for the proposed Vlorë plant. Table 3.3 provides the World Health Organization (WHO) acceptable deposition impacts from a source. These impacts are designed to protect the environment and are incorporated by reference in the EU standards.

Table 3.4 presents the World Bank guidelines on liquid discharges from thermal generation facility. Table 3.5 shows the World Bank noise impact guidelines. Finally, thermal discharge limits are included in the World Bank guidelines and allow for an impact of less than 3 ^{O}C on the receiving body of water from thermal discharge sources after a mixing zone.

TABLE 3.1

AIR QUALITY STANDARDS

Pollutant	Ambient Air Quality Standard	
	World Bank [a]	European Union [b]
PM_{10}	150 µg/m^3 24-hr ave. 50 µg/m^3 annual ave.	50 µg/m^3 24-hr ave. 40 µg/m^3 annual ave.
NOx	150 µg/m^3 24-hr ave. 100 µg/m^3 annual ave.	200 µg/m^3 1-hr ave. 40 µg/m^3 annual ave

		30 µg/m³ annual ave [c]
SO_2	150 µg/m³ 24-hr ave. 80 µg/m³ annual ave.	350 µg/m³ 1-hr ave. 125 µg/m³ 24-hr ave 20 µg/m³ annual ave [d]
CO	.	10 mg/m³ 8-hr ave

[a] World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998
[b] Limit values are effective January 1, 2005. The majority of the operation of the facility will be after the rule is in effect. All of these limit values include a maximum allowable occurrence of exceedance.
[c] Limit to protect vegetation.
[d] Limit to protect ecosystems

TABLE 3.2

AIR EMISSION STANDARDS

Pollutant	Thermal Generation Facility Emission Standard		Estimated Vlorë Plant Emissions
	World Bank [a]	European Union [b]	
PM_{10}	50 mg/Nm³	50 mg/Nm³ (dry @ 3% O_2)	14 mg/Nm³
NOx	165 mg/Nm³ (dry @ 15% O_2)	450 mg/Nm³ (dry @ 3% O_2)	97 mg/Nm³
SO_2 [c]	0.20 TPD/MW 2,000 mg/Nm³ (dry @3% O_2)	1,700 mg/Nm³ (dry @3% O_2)	0.0048 TPD/MW 57.4 mg/Nm³

[a] World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998
[b] Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 0n the limitation of emissions of certain pollutants into the air from large combustion plants
[c] *Sulfur Dioxide emissions based on 0.1% sulfur in the fuel. This is compliant with Directive 1999/32/EC Article 4*

TABLE 3.3

WHO GUIDELINE VALUES FOR INDIVIDUAL SUBSTANCES BASED ON EFFECTS ON TERRESTRIAL VEGETATION

Pollutant	Guidance Value	Averaging Time
SO_2: Critical Level Critical Load	 10-30 µg/m³ 250-1500 eq/ha/year	 Annual Annual
NOx: Critical Level Critical Load	 30 µg/m³ 5-35 kg N/ha/year	 Annual Annual

WHO Air Quality Guidelines for Europe, Second Edition (WHO Regional Publications, European Series No. 91)

Equivalence (eq) per hectare per year

TABLE 3.4

LIQUID EFFLUENTS FROM THERMAL GENERATION FACILITIES (MILLIGRAMS PER LITER, EXCEPT FOR PH AND TEMPERATURE)

Parameter	Maximum value
PH	6–9
TSS	50
Oil and grease	10
Total residual chlorine	0.2
Chromium (total)	0.5
Copper	0.5
Iron	1.0
Zinc	1.0
Temperature increase	> 3 ^{o}C

World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998 The values are over and above background levels in the cooling water source. There are no EU standards for liquid effluents from thermal power generating facilities at this time. The European Commission has produced an Integrated Pollution Prevention and Control (IPPC) document for cooling systems and chemical discharges from thermal generating facilities – the Reference Document on the Application of Best Available Techniques to Industrial Cooling Systems, Annex VII, Special Application: Power Industry. The EU only has thermal discharge standards for fresh water receiving waters at this time.

TABLE 3.5

WORLD BANK NOISE STANDARDS

Receptor	Maximum allowable log equivalent (hourly measurements) dB(A)	
	Day (07:00 - 22:00)	Night (22:00 - 07:00)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998 The plant is located in an industrial commercial area, therefore, the value of 70dB(A) applies.

3.1 ALBANIAN INSTITUTIONAL FRAMEWORK

The Albania Ministry of the Environment (MOE), formerly the Committee for Environmental Protection, has responsibility for environmental protection, management and rehabilitation in

Albania. Its authority was originally defined in the 1991 Law on Environmental Protection, which was drafted with the assistance of EU experts. This law was updated in 1998 when changes to the institutional framework were made. The MOE reports directly to the Council of Ministers and is augmented by 12 regional environment agencies (REA). Its responsibilities include:

- Completion of legal framework: A legislative and regulatory framework that conforms to EU standards is being drafted with the assistance of EU experts. The framework development is ongoing and is expected to increase the strength of the Albanian environmental regulation and enforcement in time.
- Environmental permitting: The law on Environmental Protection defines several categories of activities that are potentially damaging to the environment and require special approval from the Council of Ministers or licenses from the MOE.
- Implementation of International Conventions.

3.1.1 Key Albanian Environmental legislation

The most important pieces of legislation relating to environmental protection are listed in Table 3.6 together with a brief description of their provisions. There are many Albanian laws that contain environmental provisions and this is not a complete list.

TABLE 3.6

IMPORTANT ALBANIAN ENVIRONMENTAL LAWS

Law	Description
Law on Environmental Protection, 1991.	Contains the main provisions relating to environmental licenses and environmental impact assessment, as well as defining the responsibilities of the various regulatory authorities that deal with environment, the enforcement regime and the penalties and sanctions that may be imposed. This law was updated in 1998 to take account of changes in the institutional framework.
Hazardous Waste Decision, 1994	Specifies the permitting and labeling requirements for the import and export of hazardous waste. Incorporates the "polluter pays" principle whereby polluters are required to fund any environmental clean-up costs caused by their activities
Water Law, 1996	Provides the framework to protect water resources and makes the National Water Council responsible for issuing permits for abstractions and discharges. Inspectors can suspend operations where there has been serious violation of discharge limits. In the case of illegal abstractions fines of up to 1 million Lek may be imposed.
Water Supply and Sanitation Law, 1996	Regulates the activities of the water treatment and supply companies
Law on Urban Development, 1993	Defines a system of land use planning and construction permitting under the control of the National Council for Territory Planning and up to forty District Councils. There are two stages to the approval process. In the first stage District Councils may approve projects of up

	to a half-hectare, larger projects require National Council approval. In the second stage construction permits are issued by the relevant Ministry (Construction, Economy or Agriculture) depending on the location of the project.

The Albanian government signed the Convention on Climate Change in 1994. However, as of September 2003 the government of Albania has not ratified the Kyoto treaty.

3.1.2 Environmental Impact Assessment

The 1991 law on Environmental Protection provided the basic framework for a system of environmental impact assessments, but not the detailed specification of when an EIA is required and how it should be carried out. This detail has been left to the MOE to develop. The framework will be completed with a separate law on Environmental Impact Assessment currently being drafted. This law is expected to be completed within the next two years.

Under the 1991 law, various bodies can require the sponsors of a project to undertake an EIA. These include the MOE, the Regional Environment Agencies (REA), communes, municipalities and district councils. The projects which the law states will require EIA include:

1. Projects of national or local significance including land use planning and urban development planning and any amendments to these.
2. Projects and activities which have significant impacts on the environment and which are particularly dangerous to human health.
3. Projects for reconstruction and enlargement of activities referred to in point two of this article.
4. Projects and local activities according to the judgment and definitions made by the local authority.

The MOE has the responsibility for defining which projects fall under the definitions provided in points 1,2 and 3 above, while local authorities may make their own decisions about projects falling under point 4.

3.1.3 Permitting Requirements

The environmental permitting process is set out in the 1991 Law on Environmental Protection, as amended in 1998. The law states that the relevant competent authorities should license all economic and social activities that may have an impact on the environment. The activities specifically mentioned by the law and the authorities responsible for issuing these licenses are listed below.

1. Construction and setting into work of various facilities of local and national interest.
2. Local and national programs and plans for territory restructuring and urban development as well as their amendments.

3. Construction of roads, railways, seaports, hydropower plants, other industrial activities, land reclamation and projects governing the improvement of superficial watercourses.

4. Exploration, extraction or exploitation of natural soil and subsoil minerals and resources.

5. Exploitation of mineral or biological resources in waters intended for fishing, taking into account species, seasons, means and admissible levels of fishing.

6. Exploitation of forests that are of common interest; creation of forested areas; hunting, taking into account species, seasons, means and admissible levels of hunting.

7. Exploitation of flora, fauna, natural resources, coastal zones and sea bottoms.

8. Opening up of new areas for growing fruits in zones with protected water resources.

9. Production, sale or use of toxic products.

10. The import and export of toxic substances, and the transportation of toxic substances through the territory of the Republic of Albania.

11. Determining the manner of transportation, the site of deposit, processing and disposal of toxic and hazardous wastes.

12. The import and export of plants and animal species considered to be flora or fauna.

13. Other activities that may have an impact on the environment, and which shall be determined by National Environment Agency.

Environmental licenses for the activities listed above are required from the following authorities:

1. Council of Ministers: Activities 10 and 11

2. MOE or Relevant REA: Activities1 through 9 and 12

3. MOE: Activity 13

The permitting system for enterprises is currently in a state of transition. Prior to the 1991 law, several state institutions had the right to grant operating licenses to enterprises and coordination between Ministries was not always very effective. The responsibilities for obtaining all relevant construction and operation permits should be worked out between the owner and the construction contractor.

The EIA process followed in this report is driven by the requirements of the lending institutions. The Albanian requirements for public disclosure of the project have been discussed with the MOE and are met by following the requirements of the lending institutions. The Ministry of Industry and Energy and the Ministry of the Environment are responsible for review and approval of this EIA.

4 PROJECT DESCRIPTION

This section contains a description of the physical characteristics of the planned combined cycle power plant and is organized as follows:

- Combined cycle technology description
- Plant description
- Fuel supply
- Transmission
- Water requirements
- Transportation
- EPC project schedule

4.1 COMBINED CYCLE TECHNOLOGY DESCRIPTION

Combustion turbines are available from a number of manufacturers worldwide. A combustion turbine is a packaged machine (pre-assembled to the maximum extent practical by the equipment supplier) consisting of an air compressor, combustor, gas turbine and electric generator. Ambient air is drawn through an inlet air filter and raised to combustor pressure by the multistage axial compressor. Fuel is mixed with the compressed air and burned in the combustor section. The hot gases then expand through the turbine and are exhausted to the atmosphere. The shaft power produced by the turbine drives the compressor and an electric generator.

The typical combustion turbine converts approximately 40 percent of its fuel energy input into shaft output (power generation). The majority of the energy input is lost in exhaust heat in a simple cycle turbine. A combined cycle configuration recovers a portion of the exhaust heat and converts it to steam. Steam is then routed to a steam turbine for additional power generation. A combined cycle unit converts almost 60 percent of its fuel energy input into electricity.

A 2-on-1 combined cycle unit consists of two combustion turbines, two heat recovery steam generator (HRSG), and a single steam turbine. The high-temperature exhaust gas from each combustion turbine is routed to a HRSG in order to produce steam. The steam from both HRSG's is combined and directed to the inlet of a steam turbine for the production of power. Exhaust steam is condensed utilizing a surface condenser and associated cooling water system. Condensate is then returned to each HRSG to close the steam/condensate/feedwater cycle. Power is obtained from generators coupled to the combustion turbines and steam turbine.

4.1.1 Major Processes

The following paragraphs describe the major material flow paths associated with a typical combined cycle facility.

Fuel Supply

The standard combustion turbine for most manufacturers is based on firing either natural gas or a liquid fuel, such as distillate oil. Most combustion turbines can be specified to fire either or both fuels.

Feedwater and Steam

A typical combined cycle unit, in the size of approximately 100 MW, utilizes a non-reheat, multi-pressure steam generator to maximize energy recovery from the gas turbine exhaust. Increasing the number of steam pressure levels reduces the exhaust gas and steam / water energy difference. Two or three-pressure steam cycles achieve better efficiency than the single-pressure systems, but their installed cost is higher. They are the economic choice when the fuel is expensive or if the duty cycle requires a high load factor. This three-pressure level cycle is similar to the single–pressure cycle with the addition of the low-pressure and intermediate-pressure sections. Improved plant performance with multiple-pressure steam cycles results from additional heat transfer surface installed in the HRSG.

Heat Rejection

In the condenser, the steam turbine exhaust is condensed back into water (condensate) as heat is transferred from the steam to cooling water that is circulated through the condenser tubes. In a once-through cooling system the heated water is discharged after one or two passes through the condenser.

4.1.2 Major Equipment and Systems

Combustion Turbine Generators

A wide range of combustion turbines is available from a number of global manufacturers. Each model and manufacturer have subtle variations too numerous to describe in this report. In general combustion turbines used in power generation applications can be classified into three major categories, aero-derivative, heavy-duty industrial, and advanced class turbines.

Aero-derivative machines are based on the design, technology, and materials used in aircraft engines. In general, the lower exhaust temperatures of the aero-derivatives make them less desirable in a combined cycle configuration. Aero-derivatives are best suited for simple cycle applications.

Heavy-duty combustion turbines have higher exhaust temperatures than aero-derivative machines, and are ideally suited for combined cycle applications. Heavy-duty units are typically used in small to mid-size combined cycle units (80 to 250 MW).

Advanced-class combustion turbines include the F, G, and H class combustion turbines currently offered by manufacturers. The letters, F, G, and H, designate the firing temperature class of the unit. The advanced class machines have higher firing temperatures, more advanced materials of construction, and higher efficiencies than a heavy-duty machine. The advanced-class machines are available in larger combined cycle units (100 MW and above).

Heat Recovery Steam Generators

The HRSG utilizes exhaust energy from the combustion turbine to generate steam. Optional burners located within each HRSG can fire natural gas or oil to provide supplemental heating for additional output during peak load conditions. A three-pressure HRSG includes one high, intermediate, and low-pressure steam drum each. A two-pressure HRSG eliminates the intermediate-pressure steam drum, and places greater emphasis on the low-pressure steam drum. Tube bundles that provide the heat exchange surface are divided into various sections; superheaters, evaporators, and economizers for each pressure level. An SCR may be included at the cold end of the HRSG on a gas-fired unit for the reduction of NOx emissions, when required. For this project, the HRSG's will be specified to reserve space to accommodate a SCR, in case the unit is converted to natural gas in the future. The outlet of each HRSG consists of an exhaust stack.

Steam Turbine

Steam turbines can be divided into two basic categories: condensing turbines, which exhaust steam at less than atmospheric pressure, and noncondensing or back-pressure turbines, which exhaust steam at higher than atmospheric pressure. Both condensing and noncondensing turbines may be categorized further by the manner in which steam flows through the machine. They are matched to the exhaust energy of one or more of the gas turbines and HRSGs. Flexibility is incorporated to allow the steam turbine design to be optimized for site-related parameters such as process extractions and condenser pressure.

Heat Rejection

Even though plant configuration for the Vlorë site is based on once-through seawater cooling, configurations are also available with a wide range of owner-specified auxiliaries, including evaporative cooling towers and air-cooled condensers. Plant capability and efficiency with these systems is expected to be lower because steam turbine exhaust pressure and cooling system auxiliary power consumption are increased.

Chemical Feed System

Once-through cooling water is continuously chlorinated by an electrochlorination system, which produces sodium hypochlorite. Chlorination levels are continuously controlled to minimize the amount of free chlorine at the cooling water discharge.

Steam cycle condensate is also chemically conditioned to maintain proper steam cycle chemistry. The typical cycle chemical feed system includes provisions for feeding di-/tri-sodium phosphate to the HP and IP steam drums, and an amine and oxygen scavenger to the condensate system.

Electrical System

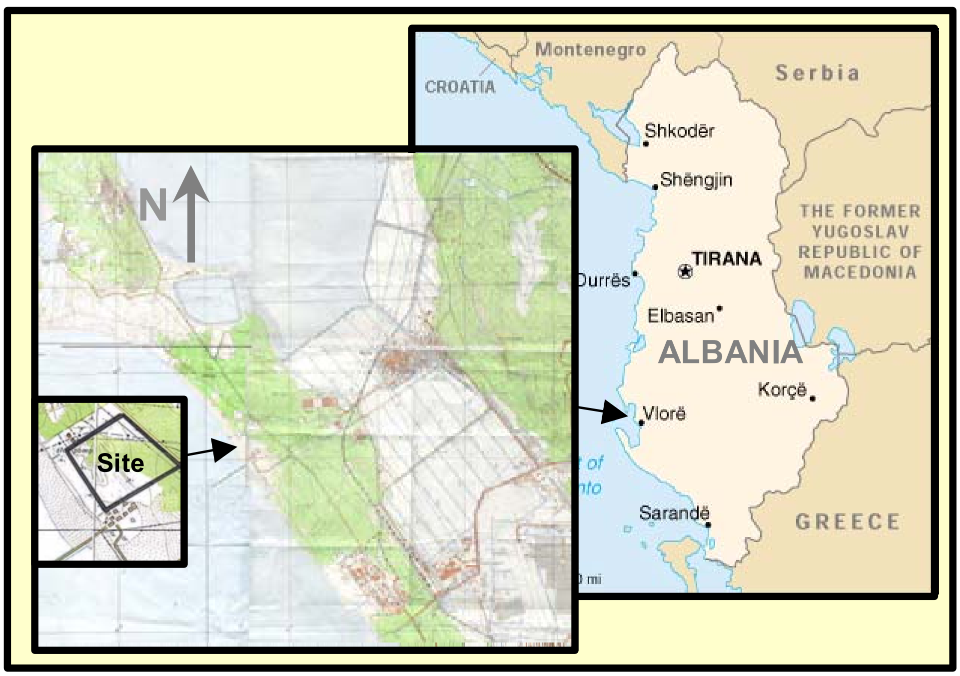
The electrical facilities include generators, which are directly coupled to each combustion turbine and the steam turbine, generator step-up transformers, the unit auxiliary power system, and an uninterruptible power supply system.

4.2 PLANT DESCRIPTION

As the result of an earlier siting and feasibility study completed by MWH, the Ministry of Industry and Energy for the Republic of Albania selected the Vlorë B site as the proper location for a new power plant. The Vlorë B site is a 16 hectare greenfield site adjacent to the offshore oil tanker terminal located on the Adriatic coast north of the Port of Vlorë. The site is located approximately two km northwest of the abandoned soda chemical factory. A location map showing the proposed site is included in Figure 4.1. The site has relatively flat topography, which consists primarily of coastal sandy areas with some trees located on the eastern portion of the facility.

Figure 4.1

Location Map



A preliminary site arrangement has been developed and is included at the end of this section. The layout of the power train equipment is based upon a 2-on-1 combined cycle utilizing environmentally conservative (unit with the greatest potential environmental impact) combustion turbines. The 2-on-1 configuration represents the largest footprint for the units evaluated in the previous studies. Therefore, sufficient space has been allocated to allow for alternate manufacturers and configurations of a similar MW size. As shown on the plant arrangement, sufficient space exists between the existing fishing pier and the tanker terminal pipeline for the combined cycle facility. Additional space is available for capacity expansion at the Site.

4.2.1 Fuel Supply

An offshore fuel oil tanker terminal and pipeline is located adjacent to the north boundary of the site. The existing tanker terminal is located 3.4 km from shore and is connected via two parallel pipelines, 300 mm and 250 mm in diameter. The existing pipelines extend from the Site to a tank farm near the town of Narta. A new 4,900 m^3 oil storage tank, with a secondary containment berm, will be constructed to provide dedicated onsite 10-day storage for the distillate-fired combined cycle facility.

A financial and economic sensitivity analysis was conducted by MWH (Final Feasibility Report, dated October 2002) to examine the effects of firing the combined cycle unit with heavy fuel oil (HFO). In summary, firing low-sulfur (<1%) heavy fuel oil (HFO) does not result in any cost savings. Firing high-sulfur HFO (>1%) results in a savings to the levelized generation cost of $0.0033/kWh, but results in significantly higher particle emissions and approximately twice the amount of NOx and SOx emissions. Distillate oil has been selected as the fuel source due to its reduced impact on the environment.

Table 4.1 represents a typical distillate fuel analysis. This fuel analysis was used in the performance cases described later in this report.

TABLE 4.1

TYPICAL FUEL ANALYSIS

Component	Value
°API	32
Specific gravity 60/60°F (15.5°C)	0.865
Kinematic viscosity, centistokes(cs) at 100°F	2.7
ASTM maximum kinematic viscosity, cs	3.4 (104°F)
ASTM water and sediment, max. vol. %	0.05
Carbon residue, wt%	Trace
Flash Point °C (min)	56
Ash, wt%	Not Applicable
Gross heating value, Btu/lb	19,489
Net heating value, Btu/lb	18,320
Sulfur, wt%	<0.1 as S

Oxygen, wt%	<0.1
Nitrogen, wt%	<0.1
Hydrogen, wt%	12.7
Carbon, wt%	86.6

Actual fuel analysis will be based on the fuel contract negotiated by KESH.

4.2.2 Transmission

As advised by KESH, the proposed interconnection point of the new plant with the Albanian transmission system is the new Babica 220/110 kV substation (2 transformers at 100 MVA each), which is located east of Vlorë. KESH will determine the exact location of the substation, as well as the exact transmission path from the plant to the substation. The new Babica 220/110 kV substation and the construction of a new Fier – Babica 220 kV transmission line are part of a project to be financed by the South Korean Government to improve the reliability and quality of service in the southwestern part of Albania. The Babica 110 kV bus will also connect to the Vlorë 110 kV, and the Selenice 110 kV substations. The construction of the Babica 220/110 kV substation and Fier – Babica 220 kV line is the first phase of a larger transmission project to be financed by the South Korean Government. The estimated cost of this phase is $14.1 million.

Further proposed phases of this transmission project include the construction of a new 110/20 kV Vlorë 2 substation (two transformers at 25 MVA each), a five kilometer Babica – Vlorë 2 110 kV line, a 90 km Vlorë 2 – Sarande 110 kV transmission line, and the new 110/20 kV Himara Substation (two transformers at 16 MVA each).

If the Babica Substation is not built, the project will interconnect into the existing Vlorë Substation with a four and a half km line. Either transmission line should acquire the necessary environmental permits for construction of the line. Securing these permits is the responsibility of KESH.

4.2.3 Water Requirements

Preliminary water mass balances have been developed for the winter, annual average, and summer operating conditions, and are included at the end of this section. The water mass balances are based on a typical 2-on-1 combined cycle configuration. The following table illustrates the seasonal water requirements of the facility:

TABLE 4.2

WATER REQUIREMENTS

Performance Case	Process (Non-Cooling) Water Requirements (m^3/hr)	Non-Contact Cooling Water Requirements (m^3/hr)
Winter	170.0	7110

Annual Average	156.3	7110
Summer	193.2	7110

The following paragraphs provide a more detailed description of the processes illustrated by the water mass balances.

4.2.4 Water Supply and Treatment

Once-through cooling utilizing seawater is required for steam cycle heat rejection. Submerged intake and discharge diffusers are anticipated to be located approximately 600 m offshore. The submerged pipelines are likely to be concrete-lined pipe or high-density polyethylene with concrete collars for negative buoyancy. The EPC contractor will be required to select the most cost effective alternative based on construction requirements and site-specific conditions.

Due to concerns about the intermittent service of the Vlorë municipal water system, plant service water will be obtained by treating seawater with a reverse osmosis (RO) desalination system to avoid unnecessary outages associated with the intermittent municipal water system. Potable water for drinking and restroom facilities will be obtained via interconnection with the Vlorë municipal water system located adjacent to the site. If necessary, the RO system can provide sufficient potable water for the facility with some additional investment.

Service water, obtained from the desalination system and stored onsite, is required for makeup to the evaporative coolers (optional), supply to the cycle makeup treatment system (demineralizer), and general uses such as equipment wash downs and hose bibs. Demineralized water is produced from an onsite demineralization system, and is stored onsite. Demineralized water is required for steam cycle makeup, NOx injection control on the combustion turbines, compressor washing, and makeup to the closed cycle cooling water system.

4.2.5 Wastewater

General plant wastewater is collected and conveyed to the plant wastewater collection and treatment system. Drains with the potential for oil contamination are routed through an oil/water separator prior to discharge to the wastewater collection sump. Sanitary drains are treated onsite by a packaged sewage water treatment plant (SWTP). The packaged SWTP system will provide secondary treatment. Demineralizer regeneration wastes and chemical drains are directed to an above ground fiberglass reinforced plastic (FRP) tank for neutralization prior to discharge. The wastewater collection sump collects wastewater from the following sources:

- HRSG blowdowns
- Evaporative cooler blowdowns (optional)
- Oil/water separator effluent

- Neutralization tank effluent
- SWTP effluent

The HRSG blowdowns may be routed to the neutralization tanks for pH adjustment prior to discharge. The wastewater collection sump collects the treated wastewater and discharges to the seal well located on the outlet side of the surface condenser. The treated effluent and cooling water return is then routed to an offshore outlet diffuser.

Stormwater, without the potential for oil contamination, is routed and discharged as dictated by the specific characteristics of the site.

4.2.6 Transportation

The Port of Vlorë is a suitable size to receive major imported equipment requiring special handling. According to KESH, the maximum unloading weight, which can be accommodated at the Port of Vlorë is up to 60 tons. Some manufacturers may need to adjust their standard shipping components to accommodate this limit or route larger items through the Port of Durrës.

The site is located approximately six km from the Port of Vlorë and the nearest improved road. The existing access road consists primarily of a dirt road bed and is in disrepair. The entire road will require substantial upgrades and resurfacing. Numerous small bridges and culverts along the route will also require upgrade to support the high loads associated with the heavy-haul of the turbine-generator components. Several low hanging distribution power lines will require modification to allow the passage of large components and construction equipment. Any permits required for this work should be obtained from the proper authority. It is not anticipated that these permits will be a critical path item in the project schedule.

4.2.7 EPC Project Schedule

The facility will likely have a 24-month construction schedule. This timeframe is considered typical for this size of project. Depending on market conditions, schedules of varying durations may be offered by the EPC bidders. This schedule is based on a generic 2-on-1 combined cycle configuration. The duration shown for the procurement of the combustion turbines is considered typical for units of this size. However the actual duration will vary somewhat between manufacturers, and will depend on the manufacturers shop status at the time of the EPC bid. The schedule reflects the EPC portion of the project only, and does not reflect the overall schedule including EPC bid period, project development, environmental permitting, and financing.

5 BASELINE SITE CONDITIONS

This section presents information related to the environmental impact assessment of the Vlorë site area. This work is based on existing data and information. The assessment includes discussion of the baseline environmental and socioeconomic conditions, a detailed assessment of project impacts, planned mitigation measures and an Environmental Management Plan (EMP).

As mentioned before, the site area is located along the coast, approximately four km northwest of the city of Vlorë and two km west of the village of Narta. The site is situated adjacent to Porti i Ri, and is owned by the Albanian government. There is an existing fuel oil pipeline that runs along the north side of the site, connecting an offshore ship terminal to an oil storage tank farm approximately near the town of Narta. Baseline (existing) conditions at the site and its surrounding area are described below.

5.1 PHYSICAL CONDITIONS

5.1.1 Topography and Physiography

The site is a sixteen-hectare, greenfield site located on a relatively flat area at the base of the Treportat Peninsula. Immediately surrounding the project area is the Bay of Vlorë and the Adriatic Sea to the west, a flood plain to the east, and the Narta Lagoon to the north. The Treportat Peninsula is a low-lying peninsula ranging from sea level to 31 m in elevation that separates the Adriatic Sea from the Narta Lagoon. Other physiographic features of the surrounding area include low hills, sand dunes, and an alluvial-filled river valley.

The primary surface water drainages in the project zone are the Vjose River, which drains into the Adriatic Sea north of the Narta Lagoon, and the Shushices River, which is tributary to the Vjose River. The low hills to the east of the project site are associated with the northernmost extension of the Lagunare and Kurveleshi mountains. The highlands (foothills) of the northernmost Lagunare Mountains average 60 m in elevation but reach a maximum elevation of approximately 245 m near Llakatundi village. The village is approximately 10 km from the Vlorë site. As this mountain range extends south and east, the main peaks rise to upwards of 1,800 m in elevation. The foothills of the Kurveleshi Mountains, which border the eastern side of the Shushices River valley and the southern side of the Vjose River valley, reach a maximum elevation of nearly 385 m near the village of Kropisht.

The Narta Lagoon, located approximately two km north of the site, is a shallow marine lagoon that borders the southern extension of the Vjose River delta. The southern portion of the Vjose River delta has been converted to a commercial salt operation. Former swamplands, now drained, are located north of the saltpan and south of the Vjose River. These rich agricultural lands are slightly above sea level. The Vlorë floodplain consists of a large area located between the Narta Lagoon and the city of Vlorë. A pumping station located on the southeast corner of the floodplain drains the lowland.

5.1.2 Regional Geology and Soils

The mountains of Albania, based on lithologic and tectonic relationships, are divided into two main geologic subdivisions, the Inner and the Outer Albanides. The Inner Albanides are dominated by ophiolitic nappes with no petroleum potential. The Outer Albanides consist of four semi-parallel thrust zones: the Krasta-Cukali Zone, the Kruja Zone, the Ionian Zone, and the Sazani Zone.

The site is located within the Ionian and Sazani zones. Overlying portions of these thrust zones are three post orogenic basins: the Durrës Basin overlying the northern portion of the Ionian Zone; and the Korçë and Burreli basins, which mainly overly portions of the Inner Albanides.

According to available geological studies, the regional geology between Elbasan and Vlorë consists of 30 percent marine sedimentary rock, 35 percent ultra basic rock, and 35 percent marine sedimentary rock with segments of lava basalt. The landscape between Lushnje and Elbasan is made up of various forms of marine sedimentary rock. Between the site and Lushnje, the surface geology consists primarily of marine sediments and non-divided river sediments.

The coastal portion of the block from Vlorë to Poro consists of quaternary marine sands and gravels on tertiary molasses headlands. The molasses were deposited in the Peri-Adriatic Depression, which overlies older carbonate sediments. Molasses also constitutes the central hilly portion of the area.

The molasses consist of sandstones, siltstones, shales and marls. Gypsum crops out near Narta where a small abandoned quarry is located. Quaternary marshy deposits are found at the northern end of the Narta Lagoon. Quaternary and recent alluvium is found in the valleys of the Shushices and Vjose rivers. These sediments consist mainly of coarse sand and limestone pebbles.

Finer-sized sediments are found in the more distal portions of the valleys. Older Tertiary and Mesozoic limestone crops out near Kanina and Drashovice south of the site. This limestone is resistant to erosion and is quarried in several places for lime, building materials and fill.

The limestone is part of two major thrust zones: the Ionian Thrust Zone, which consists of two main thrust belts, the Cika Belt to the south and the Kurveleshi belt to the north; and the second major thrust zone, the Sazani Zone, which crops out on Sazani Island and the Karaburuni Peninsula. The Ionian Zone is the major oil and gas producing area in Albania.

The western part of Vlorë and the plain area bordering the Adriatic Sea are part of the Narta syncline. The hilly area to the east is a part of the Trevllazri anticline. The Narta syncline is made up of Neogene and Quaternary deposits. In general, the Neogene deposits consist of clay, clay stone, sandstone and conglomerate. The Quaternary deposits consist primarily of clayey silts and sands.

According to the results of previous soil investigations, the maximum thickness of the Quaternary deposits is about 90 m. The lower section of the Quaternary deposits contains layers of clayey silts of lagoon-marine origin. These layers are overlaid by marine sandy deposits. In the lowland area situated on the western periphery of Vlorë, one to two m of recent clayey loam deposits cover the sand deposits.

The site is located on marine sandy deposits. The sand is medium grained with a very low amount of clay to a depth of about five meters below ground level (mbgl). Below that, the sand becomes fine grained until 15 mbgl, where it then grades to sandy clay.

5.1.3 Seismicity

Albania is one of the most earthquake-prone countries in the Mediterranean region and is periodically subject to moderate to severe earthquake activity. The entire coastline of Albania lies on active fault zones. Most earthquakes result from periodic movement of blocks along the deep-seated Ionian-Adriatic faults. Over 211 earthquakes of magnitude 4.5 of greater were recorded in Albania between 1900 and 1999. On average, an earthquake causing damage occurs every two years. The most devastating earthquake on record in Albania occurred on April 15, 1979 (magnitude of 7.2) and was centered near the village of Bacallek near Shkoder.

The Vlorë region is influenced primarily by a fault that runs through Vlorë and along the Shushices River valley. The area surrounding the Panaja Block is mapped as having an expected maximum magnitude of 6.5 to 7.0. The central part of the block, including the city of Vlorë, has an expected maximum magnitude of 7.1 to 7.5.

5.2 ATMOSPHERIC CONDITIONS

5.2.1 Meteorology

Albania has a subtropical Mediterranean climate. It is characterized by mild winters with abundant precipitation and hot, dry summers. The interior of the country is generally cooler and wetter due to the higher elevation of the mountains. The weather can also vary dramatically from north to south.

The annual mean temperature in Albania varies between 7°C over the highest zones and 15°C on the coastal zone. The lowlands have mild winters; averaging about 7°C. Summer temperatures in the lowlands average 24°C with high humidity. In the southern lowlands, temperatures average about five degrees higher throughout the year.

Annual mean precipitation in Albania is approximately 1,485 millimeters (mm) per year. The majority of this precipitation (70 percent) falls during the winter months (October – March) and precipitation is usually heaviest in the mountains. The heavy precipitation experienced during the wet season is a result of the convergence of the prevailing airflow from the Mediterranean Sea and the continental air mass. On average, November receives the highest amount of precipitation, while July and August receive the least amount of precipitation. The annual number of rainy days (>1.0mm) varies between 80 and 120 days/year.

Prevailing winds generally blow out of the north in Albania, however local wind patterns vary with topography, especially in the interior mountains. The prevailing winds at the site blow from the Northwest – from the plant toward Vlorë. The average annual wind speed varies between 1.0 and 6.4 meters per second (m/sec). The highest values are usually recorded along the coastal zone and in the north and northeast part of the country.

Climatic Conditions in Vlorë

Vlorë is situated on a coastal plateau in the southern portion of Albania and experiences Central Mediterranean weather patterns. Meteorological data have been collected at Vlorë since 1931. Average monthly temperature and precipitation data collected between 1931 and 1991 are presented in Table 5.1. The average monthly temperatures in Vlorë during the period of record ranged between a high of 24.5°C in July and a low of 8.9°C in January. Annual precipitation in Vlorë varied between 708.7 mm (1961) and 1,773.0 mm (1937), however the average annual precipitation over the period of record is 1,090 mm.

TABLE 5.1

AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION, VLORË STATION (1931-1991)

Month	Temp (°C)	Precipitation (mm)
January	8.9	148
February	9.8	11.4
March	11.7	95
April	14.8	78
May	18.4	55
June	22.2	32
July	24.5	14
August	24.4	27
September	22.2	73
October	18.4	134
November	14.5	164
December	10.9	156

Source: Albanian Academy of Science, Hydrometeorological Institute

The sea and the local topography influence wind patterns in Vlorë. According to the Hydrometeorological Institute of Albania, the predominant wind direction during the summer is out of the northwest and west. Daytime winds during the summer months are typically associated with relatively cooler and moist air masses blowing off the sea. During the winter, the wind generally blows offshore with the prevailing wind direction from the east and northeast. Average annual wind velocity in Vlorë is 2.5 m/sec, however stronger winds with gusts upwards of 7 m/sec periodically blow from the south and southwest. The average annual frequency of calm (no winds) is approximately 43 percent. The most frequent winds blow from Southeast in winter and from the Northwest during the summer months.

5.2.2 Air Quality

There are no major point sources of air emissions in the Vlorë area. Several industrial facilities that operated in Vlorë in the past were shutdown in the 1990's. In addition, there is no reliable existing air quality data for the Vlorë area. Due to the lack of industrial activity in the area and the lack of reliable data, it is assumed that current air quality conditions in the Vlorë area satisfy a "moderate" air quality classification according to World Bank criteria. Air monitoring should be performed after the facility is in operation and confirmatory modeling should be performed using background air quality data collected.

5.2.3 Noise

There is no information concerning the existing ambient noise pollution levels in the Vlore area. Noise is not a major concern in the immediate area surrounding the site. There are no sources of significant noise emissions at the site other than natural background noise levels common in an isolated area along the coast. Noise levels within the city of Vlorë are typical of any urbanized area and are primarily associated with vehicle traffic. Confirmatory noise levels should be monitored during operation of the facility.

5.3 WATER RESOURCES

The following section describes the water resources at or near the Vlorë B Site, including the Vjose and Shushices rivers, Narta Lagoon, Bay of Vlorë, and regional groundwater conditions. The section also includes a brief discussion of water availability for the planned Vlorë power plant.

5.3.1 Vjose and Shushices Rivers

The primary surface water drainages in the vicinity of the project area are the Vjose River and one of its major tributaries, the Shushices River. The Vjose River basin is 6,706 km^2 and is one of the largest river basins in Albania. Average bankfull discharge is 195 cubic meters per second (m^3/sec). Its headwaters originate in the Pindus Mountains of northwestern Greece and it drains into the Adriatic Sea approximately 10 km north of the Narta Lagoon. The Shushices River, which is a tributary to the Vjose River, originates in the Lagunare and Kurveleshi mountains and flows in a north/northwesterly direction. The confluence of the Shushices and Vjose rivers is located at the foot of the northern Kurveleshi Mountains, approximately 10 km northwest of the Site.

Water quality data for the Vjose and Shushices rivers are not available. However, it is likely that local practices have impacted the lower portions of these drainages. Villages in the Vlorë area dispose of solid waste and untreated sewage directly into nearby rivers and streams. Local streams frequently receive agricultural runoff. In addition, sedimentation may occur downstream of rock quarrying operations in the river valleys.

5.3.2 Narta Lagoon

The Narta Lagoon is located about two km north of the site. The lagoon is approximately 42 km^2 (4,200 hectares) and has an average depth of 0.5 to 1.2 m. It is separated from the Adriatic Sea by the Treportat Peninsula, but communicates with the sea through two narrow channels in the peninsula. Salinity in the lagoon has been measured between 20 and 80 grams per liter (g/l).

The Narta Lagoon habitat supports a wide variety of species. There is evidence that the lagoon is being adversely impacted by natural and anthropogenic activities. According to a recent Global Environment Facility (GEF) study, the Narta Lagoon is experiencing sedimentation of channels that provide marine and fresh water input. The lagoon reportedly receives waste discharges from agricultural runoff, untreated sewage, and a commercial salt operation. Uncontrolled fishing, often reportedly done with the use of explosives, may also affect the ecological characteristics of the lagoon.

Water quality data for the lagoon are not available. Additional information regarding the existing biological resources of the area is provided in later in this report.

5.3.3 Vlorë Floodplain

The Vlorë floodplain consists of a large area between the Narta Lagoon and the city of Vlorë. A pumping station located on the southeast corner of the floodplain drains the lowland. Detailed information pertaining to the frequency and extent of flooding in this area is not available.

5.3.4 Adriatic Sea / Bay of Vlorë

As a member of the Barcelona Convention and Protocols, Albania is involved in an international monitoring program to track and analyze physical and chemical parameters of Mediterranean coastal waters. Albania's monitoring network consists of six monitoring stations located at beaches, harbors, lagoons, and river outlets in the Adriatic Sea, including one station located in the Bay of Vlorë. The date of the most recent analyses for which data is available is 1996. The stations monitored temperature, pH, salinity, suspended solids, and dissolved oxygen. There is no specific information available on the fauna in the Bay of Vlorë.

The Adriatic and Ionian Sea coast of Albania is approximately 429 km long. Fresh water from Albania's river basins flow into the sea at an average annual flow rate of approximately 1,300 m^3/sec. Coastal waters off of Albania have been impacted by years of industrial, agricultural and domestic discharges, including disposal of liquid and solid waste directly into the sea as well as into rivers and groundwater systems that feed into the sea. These impacts are evidenced by elevated concentrations of nutrients, bacteria, heavy metals and other contaminants, especially in coastal waters close to populated areas and major river outlets.

Analyses of water chemistry, sea sediments and mussel samples indicate that the coastal waters in the Bay of Vlorë exhibit similar water quality characteristics to coastal waters in other parts of the country. However, levels of mercury in the sediments of Vlorë are much higher than those of other zones. The elevated mercury concentrations are attributed to discharges from the abandoned soda chemical plant located west of the city along the coast. Fecal coliform counts are also much higher directly off the coast of Vlorë as a result of the city's practice of discharging sewage directly into the sea. The results of seawater quality analyses are presented below.

Physical, Chemical and Bacteriological Parameters

Coastal waters were analyzed for temperature, pH, suspended matter, dissolved oxygen, and fecal coliform counts. The results are presented below in Table 5.2 and Table 5.3. The high levels of fecal coliform that are present at the beaches of Vlorë and the other main population centers of Durrës and Saranda exceed standards recommended by the World Health Organization (WHO) and the United Nations Environment Programme (UNEP), which range from 100 to 1,000 FC/100 ml.

TABLE 5.2

RESULTS OF PYHICAL AND CHEMICAL ANALYSES OF SEAWATER IN ALBANIA (1996)

Station Code	General Location of Monitoring Station	Temp. (°C)	PH (std. units)	S (%)	Suspended Solids (mg/l)	Dissolved O_2 (mg/l)
E1 1	Mati gorge	22.6	8.47	5	9.5	7.95
E1 2	200m from gorge	22.0	8.52	8	6.8	7.58
E1 3	800m from gorge	20.0	8.48	24.5	7.6	7.40
E2 1	Ishmi gorge	27.0	8.03	25.0	17.4	6.84
E2 2	200m from gorge	25.0	8.66	35.0	5.1	7.95
E2 3	800m from gorge	23.5	8.70	35.5	7.3	8.88
C1 1	Durrës	20.0	8.49	37.5	2.7	7.77
C1 2	Durrës	20.0	8.49	36.7	1.6	7.58
C1 3	Durrës	20.0	8.51	25.7	1.6	7.58
E3 1	Shkumbini gorge	24.0	8.51	N/A	111.0	7.03
E3 2	200m from gorge	24.0	8.45	N/A	113.0	7.58
E4 1	Seman gorge	27.0	8.35	N/A	419.0	6.66
E4 2	200m from gorge	26.0	8.19	N/A	475.0	6.66
E4 3	800m from gorge	24.0	8.24	N/A	21.3	9.76
C2 1	Vlorë	27.0	8.51	N/A	5.7	12.66
C2 2	Vlorë	25.5	8.57	N/A	2.1	7.40
C2 3	Vlorë	26.0	8.52	N/A	20.0	7.19
C3 1	Sarande	25.5	8.54	N/A	1.30	7.40
L3 1	Butrint	27.0	8.64	N/A	0.40	7.40

Source: Institute of Hydrometeorology

TABLE 5.3

RESULTS OF FECAL COLIFORM ANALYSES FOR MAIN BEACHES IN ALBANIA

Beach	Maximum Average (FC/100ml)	Minimum Average (FC/100ml)
Shëngjin	130	4
Durrës	1,750	123
Vlorë	4,183	430
Dhermiu (close to Vlorë Bay)	23	0
Himara (close to Vlorë Bay)	155	16

Borshi	32	0
Saranda	2,075	275

Source: Institute of Public Health

Heavy Metal Concentrations

The results of 1996 sampling and analysis of sediment and mussel samples in the Bay of Vlorë support the conclusions of recent studies that identify the abandoned soda chemical plant in Vlorë as a source of extensive mercury contamination. The chemical plant, which is located approximately two km south of the site, operated between 1978 and 1992. The plant was then substantially destroyed during civil unrest in 1997. The plant included an electrolysis building, a vinyl chloride monomer (VCM) production unit, and a polyvinyl chloride (PVC) production unit. UNEP has recently conducted detailed site investigations and risk reduction analyses, and has designated the area a "hot spot" posing imminent risks to public health and the environment.

According to UNEP, the soda chemical plant used excessive quantities of mercury in its chlorine-alkali electrolysis operations and disposed of mercury-contaminated materials in a dumpsite between the abandoned plant and the Adriatic Sea. Approximately 65 tons of mercury was reportedly lost in spills during the production period. The plant was constructed without any effluent control measures and all wastewater was discharged into the Bay of Vlorë without treatment. Sampling and analysis performed in 1998 indicated that metallic mercury (Hg) and mercury dichloride ($HgCl_2$) are the prominent contaminants at that site. The relatively high permeability of the local geology facilitates easy transportation of contaminated groundwater to the Adriatic Sea.

The results of chemical analyses of mussel samples from Vlorë and other monitoring stations along the coast of Albania are presented in Table 5.4. The results of detailed sediment analyses conducted in the Bay of Vlorë are presented in Table 5.5.

TABLE 5.4

RESULTS OF CHEMICAL ANALYSES OF MUSSEL SAMPLES FROM COASTAL WATERS OF ALBANIA [1]

Element	Shëngjin Station C 4.3	Durrës Station C 1.3	Vlorë Station C 2.2	Sarande Station C 3.1	Seman Station E 4.1	Karavasta Station L 1.1	Butrint Station L 3.1
Mercury (Hg)	0.021	0.040	0.129	0.024	0.061	0.113	0.103
Lead (Pb)	0.212	0.410	---	0.417	0.290	-.242	0.280
Cadmium (Cd)	0.448	0.192	0.219	0.213	0.205	0.330	0.229
Copper (Cu)	2.61	2.11	2.13	1.83	1.67	3.52	1.19
Chromium (Cr)	0.770	0.538	0.821	0.359	1.82	1.49	0.198
Zinc (Zn)	14.0	30.4	42.6	21.8	17.8	16.2	11.4
Manganese (Mn)	3.70	2.03	3.77	7.85	8.25	5.78	5.34
Iron (Fe)	130.4	101.5	261.4	101.5	291.5	219.5	22.05

[1] *Results presented in table represent average concentrations in mg/kg wet weight*

Source: Department of Analytical Chemistry of Natural Science Faculty of the University of Tirana

TABLE 5.5

COMPOSITION OF HEAVY METALS IN SEDIMENTS IN THE BAY OF VLORË (IN MG/KG)

Station	Distance from Shore (m)	Hg	Pb	Cd	As	Cu	Zn	Cr	Ni	Mn
1	100	0.59	23.2	0.14	60.3	9.3	22	331	172	724
	300	0.39	14.7	0.13	38.2	8.6	28	322	195	731
	700	0.68	9.80	0.12	84.9	17.0	40	300	177	682
2	100	0.37	11.2	0.14	33.6	9.5	28	230	208	692
	300	0.54	17.4	0.18	15.8	8.8	26	342	186	759
	700	0.54	16.9	0.20	27.5	8.6	52	583	174	731
3	100	0.45	20.8	0.17	17.2	7.1	28	300	183	731
	300	0.57	12.6	0.16	18.5	7.1	17	315	163	750
	700	0.56	20.1	0.14	26.4	7.7	22	382	174	752
4	100	0.40	24.5	0.23	27.0	14.0	26	2416	128	753
	300	0.14	20.3	0.21	31.6	7.3	22	1850	146	1032
	700	0.18	14.4	0.12	36.1	7.9	55	1442	162	849
5	100	0.15	15.4	0.20	41.8	6.8	19	392	124	669
	300	0.21	20.1	0.12	60.4	8.6	44	944	160	843
	700	0.17	14.6	0.14	30.6	9.2	44	1355	169	846

Source: Department of Analytical Chemistry of Natural Science Faculty of the University of Tirana

5.3.5 Groundwater

The Vlorë site and its immediate surroundings are generally poor in groundwater resources. Groundwater does accumulate in shallow sandy deposits, however this water is typically of poor quality and low volume. Nonetheless, groundwater is occasionally extracted using hand-dug wells. The depth of the groundwater level at the Vlorë Site varies between 1 and 10 m. The primary groundwater flow direction is west toward the Adriatic Sea.

As discussed previously, mercury and other chemical discharges have contaminated groundwater resources in the vicinity of the abandoned chemical plant to the south of the Vlorë Site, however, there is no evidence that the groundwater in the immediate vicinity of the Vlorë B Site has been impacted by those discharges and the general groundwater flow from the source of the mercury contamination is away from the Vlorë site. UNEP's feasibility study for risk reduction measures (June 2001) shows the extent of the contamination and that it does not impact the Vlore site.

5.3.6 Water Availability

The planned Vlorë power plant will utilize seawater to provide cooling and process water for the plant. The total project water requirements under average annual conditions will be approximately 7,266.3 m^3/hr (46 million gallons per day (mgd)). Once-through cooling utilizing an estimated 7,110 m^3/hr of seawater will be required for steam cycle heat rejection. In addition, approximately 156.3 m^3/hr of seawater will be treated with a reverse osmosis (RO) desalination system to provide service water for makeup to the evaporative coolers (optional), supply to the cycle makeup treatment system (demineralizer), and general service water uses such as equipment wash downs and hose bibs. Demineralized water will be required for steam cycle makeup, NO_x control water injection on the combustion turbines, compressor washing, and makeup to the closed cycle cooling water system. Potable water requirements for the drinking and restroom facilities, which are estimated at approximately 0.2 m^3/hr of water, will be obtained from the Vlorë municipal water system.

5.4 BIOLOGICAL RESOURCES

The Site is situated on a relatively barren coastal area with little vegetation or wildlife. The Narta Lagoon and Karaburuni Peninsula, which are located in the northern and southern regions of the Bay of Vlorë, respectively, support an abundance of species and habitats and have been recognized internationally as areas of ecological importance. Both areas are protection under Albania's *Law on Protected Areas.*

The following is an overview of biological resources at the Narta Lagoon and Karaburuni Peninsula, as well as a discussion about threatened and endangered species and the status of regulatory protection for these two areas.

5.4.1 Narta Lagoon

The Narta Lagoon is located approximately four km northwest of Vlorë, and approximately two km north of the site. The lagoon and the surrounding ecosystem that extends north to the Vjose River delta covers approximately 10,000 hectares and is composed of forests, wetlands, sand dunes, beaches, and agricultural land. The Narta Lagoon area has been the focus of recent biodiversity studies conducted by the United Nations Development Programme (UNDP) and the Global Environmental Facility (GEF). Albania is a member of the Convention on Biological Diversity and has enlisted the expertise of the UNDP and GEF to help formulate a National Biodiversity Strategy and Action Plan. The Narta Lagoon is not currently identified as a Ramsar Site under the Ramsar Convention on Wetlands.

General Characteristics of the Narta Lagoon Area

As described in the 2002 UNDP/GEF project report entitled, "Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region," the area of the Narta Lagoon and Vjose River delta has the following ecological characteristics.

- 5,000 hectares of wetlands, including approximately 4,000 hectares of free water surface and 1,000 hectares of salinas (salt marshes) supporting halophytic and hydrophilic vegetation.
- 2,000 hectares of forests, including Mediterranean pine forests of Pishe Poros and Mediterranean shrubs (this area is often referred to as the Soda Forest)
- 500 hectares of vegetated and non-vegetated sand dunes and beaches.
- 2,500 hectares of agricultural land or uncultivated salt lands.

The Narta Lagoon itself is approximately 42 km^2 (4,200 hectares) with an average depth of 0.5 and 1.2 m. The lagoon interacts with the sea via two channels in the Treportat Peninsula.

One channel is approximately 900 m long and is situated on the northwest side of the lagoon while the other channel is 190 m long and is located on the southwest side of the area. The lagoon also receives fresh water from various drainage channels. There are two islands in the southwestern portion of the lagoon. The bigger of the islands, Zverneci, is dense with cypress trees and has a small 14th century monastery. The salinity of the lagoon has been measured at 20 and 80 g/l.

Species and Habitats of the Narta Lagoon Area

As mentioned above, the GEF reports that the Narta Lagoon is undergoing rapid degradation from sedimentation of channels that provide marine and fresh water input. Moreover, the lagoon may be adversely affected by agricultural runoff, sewage discharge, discharge from a commercial salt operation, and liquid chemical wastes (from the abandoned chemical plant) that are being stored in a holding pond on the south side of the lagoon.

The lagoon reportedly provides habitat for over 190 different species of birds, including two threatened species of pelican and kestrel (see discussion below) and about 40 different species of migratory water birds that winter in the Narta Lagoon area. The area is Albania's primary wintering site for species of Flamingos, Shelduck, Pintail, Golden Eye, Kentish Plover and Golden Plover. Winter consensuses conducted between 1995 and 2001 registered an average of 48,700 individual water birds (see Table 5.6).

TABLE 5.6

WINTERING WATER BIRDS AT NARTA LAGOON

	1995	1996	1997	2001
No. of species	33	32	35	44
No. of individuals	14,651	19,638	81,223	79,321
National %	10.2	10.9	33	31

Source: Museum of Science and Biological Research Institute of Albania

Breeding season is also a popular time for water birds at the Narta Lagoon. Terns and waders are usually very abundant during this time. In 2000, a total of 633 nesting pairs of birds were recorded.

The Narta Lagoon provides habitat for an estimated 38 species of mammals, including various species of hedgehog, shrew, bat, pipistrelle, hare, fox and weasel. The bottlenose dolphin, which is the most common type of dolphin in the coastal waters of Europe, has been observed in the coastal waters adjacent to the lagoon. Some species of mammals common to the Narta Lagoon area are listed on the World Conservation Union's (IUCN) Red List of Globally Threatened Species (see discussion below).

There is a wide variety of vegetation in the Narta Lagoon area, including 69 species of flora that the Albanian Museum of Science considers "noteworthy species" (species with ecological, economic or patrimonial value). The most prevalent types of flora include hydrohytic vegetation common in wetlands, halophytic vegetation common in salt lands, and

Mediterranean pine forests of *Cypresus sp* and *Pistacia lentiscus*. A portion of the pine forest (Pishe Poros forest) is classified as a "Managed Nature Reserve" (Category IV) by the IUCN (UNDP/GEF, 2002).

Commercial Activity in the Narta Lagoon Area

Several types of commercial activity take place at or near the Narta Lagoon, the most prevalent of which are fishing and salt production. A private fishery operates in the lagoon at a site known as Gjoli i Nartes, which is close to the Vlorë Site. The enterprise reportedly employed 60 fishermen in 1996. Current employment statistics are not available. Fishing occurs in the lagoon and at fixed trap stations in the canals that connect the lagoon with the sea. Between 1986 and 1990, the total yearly catch from this enterprise ranged from 206 to 339 tones. Current statistics are not available but the figure is estimated to have declined to around 110 tones. Crab typically account for 35 to 50 percent of the total catch. Exclusive of crabs, the lagoon produces an estimated 36 to 63 kg per hectare per year, however agricultural runoff and industrial and domestic wastes from Vlorë may be adversely affecting fish communities. In addition to the larger commercial operation, approximately 50 people own small boats and fish for a living in the Novosela Commune.

Salt is produced in the northern portion of the Narta Lagoon area by a commercial operation known as the Skrofotina Salt Works. The company reportedly produced 120,000 tonnes of salt in 1996, however production has since decreased significantly. Production in 1999 was estimated at 21,150 tonnes. The salt works employs 150 people during the winter months and up to 3,000 people during the summer months, although the site did not appear to be in full operation during a recent site visit. The operation consumes approximately 6 million m^3 of water from the Narta Lagoon each year (approximately 30 percent of the lagoon capacity). Most of the salt produced at this site is used in industrial processes or is exported for use as a de-icing agent on roadways.

Other economic activities that take place in the vicinity of the Narta Lagoon include agricultural activity, oil and gas exploration, and rock quarrying. Agricultural activity includes cultivation of olive and grape fields, however much of these fields have recently been neglected due to labor shortages brought on by emigration. A Croatian company recently received an environmental license from the Albanian Parliament to conduct drilling operations and construct an associated road, and is conducting oil exploration in the sea southeast of the Narta Lagoon. Mining of gravels, sands and bitumen for construction-related purposes is done in the Vjose and Shushices river valleys, upstream of the Vjose River delta.

5.4.2 Karaburuni Peninsula

The Karaburuni Peninsula and surrounding environment is a large area encompassing, in addition to the peninsula, the Llogara National Park, Sazani Island, the Rreza Kanalit Mountains, Orikumi Lagoon, and the Dukati Valley. This 35,000-hectare region, which surrounds the south/southwestern portion of the Bay of Vlorë, ranges from coastal plains to alpine forests.

According to GEF's 1999 Biodiversity Strategy and Action Plan for Albania, some of the vegetation found in the Karaburuni Peninsula area includes alpine and subalpine pastures and meadows, Macedonian fir (*Abies borissi-regis*) forests mixed with pine forests of *Pinus nigra* and *Pinus leucodermis*, and mixed deciduous woodlands with *Quercus coccifera* and *Q. macrolepis*. The area is also characterized by typical rocky coastal environments, a small wetlands area, and various meadows of *Posidonia oceanica*. The area supports well-developed littoral and benthos communities and is frequented by some species of dolphin (*Delphinus delphi* and *Tursiops truncates*). The caves and shores of the Karaburuni Peninsula provide habitat for the monk seal (*Monachus monachus*), however its actual occurrence in these areas is not well documented. Endemic and threatened and endangered species that are found in the region include *Taxus bacata*, *Ceratonia siliqua*, *Pitymys felteni*, and *Pitymys thomasi* (see discussion later in this section).

The Karaburuni Peninsula is a hilly and mountainous cape that covers a surface area of approximately 62 km^2 (6,200 hectares) and reaches peak elevations of 730 m to 840 m. The peninsula separates the southern portion of the Bay of Vlorë from the Ionian Sea. The narrow Mesokannali Channel separates the northern tip of the peninsula from Sazani Island. The Karaburuni Peninsula is classified as a Managed Nature Reserve (Category IV) by the IUCN.

The Llogara National Park, which is approximately 25 km south of the site, is a 1,010-hectare area composed largely of black pine and juniper forests. It is located in the north and northwestern portion of Llogara. Its designation as a National Park reflects its status as a Category II ecosystem according to the IUCN. Wildlife that inhabits this area includes wild goat, wild pig, mountain partridge, wild pigeons, rabbits and falcons. Species of gazelle used to be common in this area, however the GEF (2002) reports that this species is no longer found in the park.

Between the Karaburuni Peninsula and the Llogara National Park is the Rreza Kanalit Mountains. This is a smaller mountain range that extends approximately 24 km from north to south and is only four to seven km wide. Its major peaks reach elevations of 1,200 to 1,500 meters. The prominent valley between the Rreza Kanalit range and the larger Lagunare range to the northeast is known as the Dukati Valley. The northern extent of the Dukati Valley ends to the southern tip of the Bay of Vlorë, where a small lagoon referred to as the Orikumi Lagoon is situated. The Orikumi Lagoon is approximately 150 hectares and 0.5 to 3 m deep. It interacts with the sea through a single 50-meter long channel, however, similar to conditions at the Narta Lagoon, the function of this channel is being affected by sedimentation. Moreover, the original flood plain forests that surrounded the lagoon have disappeared and the former fresh and brackish water types of habitats and vegetation are being replaced by salt land species. The lagoon is also showing signs of eutrophication.

5.4.3 Threatened and Endangered Species

The most critical species of concern in the Narta Lagoon and Karaburuni Peninsula areas are three species of fauna that are listed by the IUCN as globally threatened or endangered (2000 Red List of Threatened Species). These species include the Dalmatian Pelican (*Pelecanus crispus*), the Lesser Kestrel (*Falco naumanni*), and the European River Otter (*Lutra lutra*). All three of these species are known to inhabit the Narta Lagoon area, however the extent to which they are found in the Karaburuni Peninsula region is not known. Albania's Museum of Science and Biological Research Institute consider many other species of flora and fauna in the Narta Lagoon and Karaburuni Peninsula ecosystems endemic, rare or threatened.

A list of threatened and endangered fauna species common to the Narta Lagoon area is presented in Table 5.7. It is important to note that, with the exception of the species included on the IUCN Red List, the criteria used by the Museum of Science to classify these species is not clear and data available at this time are not considered complete. Detailed information pertaining to the three globally threatened species is provided below.

TABLE 5.7

THREATENED AND ENDANGERED FAUNA SPECIES IN THE NARTA LAGOON AREA

Common Name	Scientific Name	Conservation Status	Notes
Dalmatian pelican	*Pelecanus crispus*	Conservation Dependent	2000 IUCN Red List
Lesser kestrel	*Falco naumanni*	Vulnerable	2000 IUCN Red List
European river otter	*Lutra lutra*	Vulnerable	2000 IUCN Red List
Horshoe bat	*Rhinolophus euryale*	Threatened	Rarely observed in Narta Lagoon area
Common jackal	*Canis aureus*	Threatened	Widespread at the Narta Lagoon; considered critically endangered in Albania
Badger	*Meles meles*	Threatened	Rarely seen, but extensive dens have been identified in northwest portion of Narta Lagoon area
Western polecat	*Mustela putorius*	Threatened	Scarcely distributed in Narta Lagoon area
Common dolphin	*Delphinus delphis*	Threatened	Frequency with which this species is observed in Vlorë's coastal waters has been declining; uncontrolled fishing and use of explosives in coastal waters thought to be a factor
Blind mole	*Talpa caeca*	Endemic	Endemic to Mediterranean region; its habitat is fragmented within the Narta Lagoon area
Stankovici's mole	*Talpa stankovici*	Endemic	Endemic to Western Balkan region; typical habitats similar to the blind mole
Thomas' pine vole	*Pitymys thomasi*	Endemic	Endemic to Western Balkan region; favors cultivated areas and grasslands of the Pishe Poro forest
Felten's pine vole	*Pitymys felteni*	Endemic	Endemic to the Western Balkan region; habitat and distribution is the same as that of the pine vole, however it is not as abundant

Sources: Museum of Science and Biological Research Institute of Albania

IUCN 2000 Red List of Threatened Species

Dalmatian Pelican

The 2000 IUCN Red List classifies the Dalmatian Pelican as Conservation Dependent. This indicates that the species is at lower risk than those that are classified as Critically Endangered, Endangered or Vulnerable. However, the Dalmatian pelican was formerly listed as Vulnerable due to its small and declining population. Moreover, as a Conservation

Dependent species, the Dalmatian pelican is the focus of a continuing taxon-specific or habitat-specific conservation program, the cessation of which would be expected to result in the species qualifying for one of the more critical categories within a five-year period. Conservation measures have helped increase the population of the Dalmatian pelican in recent years.

The range of the Dalmatian Pelican includes the Balkans, Middle East, Eastern Europe, and Asia. Its primary habitats are freshwater or marine environments such as coastlines, lagoons, estuaries, freshwater lakes, ponds and dams. As such, the species is common in the Narta Lagoon area, especially during the winter season.

Lesser Kestrel

The 2000 IUCN Red List classifies the Lesser Kestrel as Vulnerable, which indicates that the species is not considered to be Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by IUCN criteria. This species has a wide global distribution but has undergone rapid declines in western Europe, South Africa, and possibly in parts of its Asian range. According to the IUCN, if these declines are representative of populations in all regions, the total population is likely to have declined by more than 20 percent in ten years, which qualifies the species as Vulnerable. It is predicted that similar declines will continue over the next 10 years.

The typical habitat of the Lesser Kestrel includes arable agricultural lands and crops, grasslands, shrub lands, tropical savannah woodlands, and some urban environments. The species is common in the Narta Lagoon area. The IUCN lists the major threats to this species as agriculture, development, hunting, natural disasters, and land/water pollution.

European River Otter

The European river otter, also referred to as the Eurasian Otter, is considered a Vulnerable species by the IUCN. Like the Lesser kestrel, this indicates that the species is facing a high risk of extinction in the wild in the medium-term future. The species is widely distributed throughout the European and Asian continent and parts of Africa and has recently increased its area of occupancy in several parts of Europe. However, this species has become extinct in large areas of central Europe and the risk of losing additional habitats, especially in eastern Europe, is increasing. The situation in the near East and in Asia is not well understood.

The Eurasian Otter is found in a wide variety of aquatic habitats, including highland and lowland lakes, rivers, streams, marshes, swamp forests and coastal areas. The species has also been found in brackish waters below sea level. It is very adaptable, using saltwater as well as freshwater habitats, and has even been found in sewage systems in urban areas. In most parts of its range otter distribution is correlated with bank side vegetation. Their distribution in coastal areas, as seen at the Narta Lagoon, is strongly correlated with the presence of freshwater. The species avoids deep water.

The aquatic habitats of otters are vulnerable to man-made changes, including many types of activities that take place at the Narta Lagoon. Canalization of rivers, removal of bank side vegetation, dam construction, draining of wetlands, aquaculture activities and associated man-made impacts on aquatic systems are all damaging to otter populations. Pollution is also a major threat to the otters. Coastal populations are particularly vulnerable to oil spills. Acidification of rivers and lakes results in the decline of fish biomass and reduces the food resources of the otters. The same effects are known to result from organic pollution by nitrate fertilizers, untreated sewage, or farm slurry. Fishing nets also pose a significant threat to the otter.

5.5 SOCIOECONOMIC CONDITIONS

5.5.1 Overview of National and Regional Socioeconomic Conditions

According to July 2001 estimates, the population of Albania is approximately 3.5 million, with an annual growth rate of 0.88 percent. The majority of the population (95 percent) is ethnic Albanian. The remainder is made up of Greeks (3 percent) and other ethnic groups such as Vlachs, Romas, Serbs, Montenegrins, Macedonians, Egyptians, and Bulgarians. Approximately 70 percent of the population is Muslim, 20 percent are Albanian Orthodox, and 10 percent are Roman Catholic.

Albania's economy is driven primarily by agriculture, which makes up nearly 53 percent of its GDP. The other components of the country's economy include industry (25 percent of GDP) and services (22 percent of GDP). The tourism sector in Albania has reportedly rebounded during the past two years as significant numbers of Albanians have returned to seaside resorts for the first time since the civil insurrection of 1997 and 1998.

Albania, with an estimated trade deficit of $814 million in 2000, is a net importer of goods and services. The country was recently admitted as a member of the World Trade Organization (WTO). Its major trading partners include Italy, Greece, Turkey, and Germany.

The labor force is reportedly young and literate and includes skilled workers, however unemployment is high, estimated at 18 percent in 2001. Per capita income is approximately $1,100 based on a 1999 estimate.

Albania's transportation, communication, and energy infrastructure is generally in poor condition and in need of capital improvements. The country's major airport, "Rinas" in Tiranë, has outgrown its terminal and is awaiting planned improvements. There are two major ports, both of which are in the process of being privatized. The port of Durrës handles 90 percent of Albania's maritime cargo and is currently being rehabilitated with funds provided by the World Bank and EBRD. The other major port is in Vlorë. The rail system in Albania consists of approximately 447 kilometers of track, is state-run, and is not connected to the railroad of any neighboring country. The country's road system is limited and major roads are narrow, damaged (potholed), and unlighted. Construction of new roads is a government priority.

5.5.2 Socioeconomic Conditions in Vlorë

Demographics

The city of Vlorë, with a population of approximately 120,000 inhabitants, is a district capital and Albania's second largest seaport.

There are seven small towns in the District of Vlorë: Nartë, Panaja, Trevllazëri, Varibopi: I.lakatundi, Peshkëpia, and Drashovicë. Nartë is a small farming and fishing town located south of the Narta Lagoon that is rapidly becoming a popular suburb of Vlorë. Varibopi, Lkatundi and Peshkëpia are all agricultural towns located in northeast, central, and eastern portions of the Vlorë District, respectively. Drashovica is an agricultural town built along the western bank of the Shushice River and the National Road to Gjirokastër and Greece.

In addition to the towns listed above, there are approximately 100 small villages or communes recognized in the Vlorë District. The villages in the Vlorë District are mainly concentrated along the National Road and along the base of the hills in the Vjose and the Shushices river valleys. Due to high rates of unemployment and poverty, most of the young people in these communes, often with their families, have migrated to urban areas within Albania or have emigrated abroad. Almost 90 percent of the families in Vlorë have at least one member who has emigrated. Most emigrants go to Italy and Greece.

Economy

Agriculture is the main economic activity in the rural areas of the Vlorë District. Olives, grapes, and citrus fruits are grown throughout the area, especially near the coast. Grains, vegetables, and forage crops are grown along the river valleys, and sheep, goats and cattle are grazed throughout the rural communes. Livestock production accounts for about 36 percent of the country's annual agricultural production. In addition, Vlorë is also the main fishing port in Albania.

Service industries, including construction, transportation, and telecommunication services are also an important component of Vlorë's economy. State and public sector enterprises include essential services such as road maintenance, water and electricity distribution, railroad and port facilities, public transportation and oil byproduct distribution. Transportation of goods and passengers is an expanding national sector, particularly in the Vlorë District. Two private firms, Grabove and Dukat Transport, are based in Vlorë.

Construction is also a very active sector throughout the area. A large construction firm, SIAC Construction, is based in Vlorë. This is a joint venture with the Albanian government and an Italian firm. Fourteen other private construction firms operate in Vlorë. Housing construction is particularly active in Babica, Peshkepia and Armen.

Rock quarrying and mining takes place in river valleys throughout the Vlorë area. Bitumen has been mined in the Vjose River valley and near the town of Selenice for many years. Production has recently stalled due to a lack of basic equipment and supplies, but reserves are estimated to be sufficient for several decades. The bitumen deposits are used for road paving and the manufacturing of roof shingles.

Sand and gravel extraction is common along the major river channels, especially near the larger cities. The most prominent sites are at Drashovice on the Shushices River and east of Mifol on the Vjose River. The limestone quarry near Drashovice is operating on a limited basis. The extensive gravel extraction and washing operation near Mifol was formerly state-owned, but is now privately controlled. The washed gravel is used as an aggregate material in concrete and as fill material for construction projects.

Lime and rock quarrying takes place at a location south of Kanina. This operation is connected to the cement plant on the southeast side of Vlorë via a 3.75 km overhead tramway, however the cement plant is not currently operating.

As discussed above, salt is produced on the north side of the Narta Lagoon at the Skrofotina Salt Works. Most of the salt produced is used in industrial processes or is exported for use as a de-icing agent on roadways.

Several manufacturing plants used to operate in the Vlorë area, however most have shut down over recent years. Engineering facilities were designed to produce spare parts and assist the country in eliminating imports, however none of them are currently operating. Light industrial facilities included textile plants, shoe factories, and bicycle assembly plants. Leather goods were also formerly manufactured at the Vlorë industrial area.

Food processing is done on a limited basis on Vlorë, though it used to be much more prevalent. Fish and frogs are currently exported to Italy and snails are exported to France. Seafood processing takes place in Novosela. Other food processing in the area includes two breweries (including non-alcoholic production) and milk processing, as well as three vegetable oil plants in the Qender Commune (Panaja, Bestrova and Babice). Dairies and a slaughterhouse operate in the Shushice Commune. Two smaller mills operate in Lubonje and Armen (Shushice Commune).

Roads

Less than 25 percent of Albania's 18,500 km road network is paved and most roads are in poor condition requiring major rehabilitation. Because Vlorë is an important transportation and shipping hub for southern Albania, it is linked to the country's other major cities via paved highways. However, the district of Vlorë's own transportation infrastructure is generally in poor condition and is not adequate for existing volumes of traffic, especially in remote areas. The poor condition of the roads is attributed to the fairly rugged topography, lack of maintenance funds, and increased traffic loads. Recent easing of border restrictions has lead to increased vehicle traffic throughout the country.

The government of Albania indicates that there are 18.8 km of asphalt highway (National Road) in the Vlorë area. In addition, there are 42.5 km of other paved roads, 70.3 km of improved gravel roads, 30.7 km of seasonal roads, and 111.7 km of pedestrian roads. Roads are considered adequate along the coastal plain near Vlorë and near the larger communities, but roads in more remote areas are in poor condition. In wet weather some of the smaller roads can be treacherous, and dust is often a problem during the summer dry season.

A number of existing roads are being rehabilitated and some new roads are being constructed. In particular, the road from Xhyherina to Beshishti (Shushice Commune) is being reconstructed and the World Bank is funding the construction of a new 11 km rural road from Novosela to Grykapishe (Novesela Commune). Additionally, a road to Trevllazeri (about 7 km) is reportedly being constructed by the Albanian Development Fund.

Port Facilities

Vlorë is Albania's second largest port after Durrës. The country's other principal port facilities are located in Saranda and Shëngjin. The port of Vlorë is used primarily for industrial purposes, though some passenger transport (via ferries) occurs as well. Ferries from Vlorë serve Brindisi and Otranto (Italy) and Patra (Greece). Freight shipping in Albania was generally stagnant throughout the 1980's due to the decline of oil and oil product exports. However, available figures indicate that freight traffic is once again growing as importing of food and oil becomes more prevalent. Albania's Institute of Statistics (INSTAT) reports that during the first quarter of 2001, the Port of Vlorë processed approximately 95,400 tons of freight, which amounts to about 15 percent of the country's total sea traffic. The Port of Durrës processed about 70 percent of the country's total sea traffic, or approximately 432,000 tons, during the same time frame.

In the northern portion of the Bay of Vlorë, adjacent to the Site, there is an offshore oil tanker terminal that connects to an oil and fuels storage facility situated near the town of Narta. The existing tanker terminal is located 3.4 km from shore and is connected via two parallel pipelines, 300 mm and 250 mm in diameter.

Communications

Mail services are offered only in the major towns and commune centers within the Vlorë area. Major newspapers are regularly delivered to Vlorë and the larger towns in the area. Some magazines are also available in towns along the major roads, but rarely in the center of the communes. Bookstores in Vlorë and the larger towns supply magazines and other reading materials.

The Vlorë area currently has access to television stations in Tirana, two local television stations, and several Italian stations. A private company, Trio Cable Television, is reportedly introducing a 20-channel cable system, but this is not available yet. Approximately 93 percent of families in the Shushice Commune have television, 37 percent of which have satellite dishes. Similar conditions exist in the Armen and Vllaine communes. Nearly all of the families in the Qender Commune have television.

There are over 2,800 villages, 330 communes and 36 administrative districts in Albania. In the year 1973, every village had access to at least one telephone line. The civil unrest in the 1997 witnessed the destruction of 60 to 80 percent of the rural telephone system. In 1995, there were approximately 14,000 rural telephone subscribers resulting in a telephone density of about 0.65 per 100 residents. Most of the rural telephones are located in commune post offices. Lines to individual homes and many villages are lacking or inoperative.

The telephone service in Vlorë is fairly reliable. There is a large public phone facility in the post office in Vlorë and three smaller post office phone centers in outlying towns. New telephone lines are being installed to expand the capacity of the system. The post office phone centers function as self-financed entities with some measures of independent control.

Telephone service is available at the post office in the Shushice Commune, but no telephone lines serve the village. The situation is improved in Qender Commune, where telephone service is available in Babice, Sherishta and Narte. Two telephone lines serve Novosela, but the villages in the commune do not have service. Similar situations exist in the Armen and

Vllaine Communes. A 1995 study of telephone infrastructure in rural Albania recommended that rural villages be connected using wireless phone systems. Wireless telephone antennae are commonly seen on houses and apartment buildings in these villages.

The Albanian Mobile Communication (AMC) Company was established in late 1995 to help develop wireless communication systems. In 2000, Vodafone began servicing the Albanian market as well, including areas of the District of Vlorë.

Water Supply and Water Resources

Vlorë's municipal water system is primarily of water wells, springs, reservoirs, and distribution lines. There are no water treatment facilities. Water is supplied to families in the city of Vlorë two to three times daily during set hours. Water is supplied by a spring at Uji I Ftohte and is stored at reservoirs at Kuz-Baba before it is distributed to consumers.

Outlying towns and villages have their own water supply and distribution systems. The water supply in the Shushice Commune includes a drinking water reservoir near Rrapi I Pashait and a water well that supplies the village of Risili. Many villages in the commune are supplied with water from local springs or from water transported to the villages by pack animals. A new water well is being completed at Tetshet.

Kanina in the Qender Commune is supplied with water from a water pumping station in the village. Babica is supplied from Vlorë, but often no water is available. Panaja, Nafte, Zverneci, Bestrova and Kerkova are supplied from a water station at Novosela, which occasionally malfunctions. Conflicts between the commune and the local government of Vlorë often arise over delays in supplying the commune drinking and irrigation water. Lack of available water has occasionally forced residents to purchase drinking water for approximately 200 Lek per 30 liters.

Water is supplied to half of the villages in the Novosela Commune from the central pumping station at Novosela. The other villages are supplied from local sources. Often the water in these local wells is salty and may contain harmful chemical substances. The water supply in the commune is under study by the World Bank.

A pump, presumably from a ground water source, supplies water to communities in the Armen Commune. No information is available concerning water supplies to the Vllaine Commune.

Sewage Treatment and Solid Waste Disposal

There are no sewage treatment or solid waste disposal facilities in Vlorë. The city of Vlorë discharges sewage directly into the Bay of Vlorë near the location of the abandoned soda chemical plant. Outlying towns and villages dispose of sewage and solid waste directly into rivers and streams. Sewer lines are typically old and poorly maintained. Much of the solid waste in Vlorë is dumped along the roadway leading to Zverneci. There are no provisions for the disposal of hazardous wastes.

Education

Most of the labor force in the Vlorë District has completed secondary schooling. The schools include 19 elementary schools, three general high schools, one trade high school, one industrial high school and one artistic high school. Vlorë has one University, the Polytechnic University, which offers undergraduate degrees in business, tourism, engineering, teaching (elementary school level), English, and Italian. Vlorë also has two higher education institutions, the School of Aviation and the Marine Academy.

The Shushice Commune has one school offering secondary, elementary, and pre elementary education at Llakatundi. This school has about 1,000 students. There is one elementary school at Risili, one elementary school at Mekati, and one pre elementary school at Bunavija. Every village in the Qender, Novosela, and Armen Communes has an elementary school. There is also a high school at Novosela and Selenice.

Health Care

Vlorë is served by a large hospital in the suburbs and one central ambulance building. In addition, each zone of the city has its own small ambulance building. A psychiatric hospital and a dystrophic hospital (for children with delayed mental development) are also found in the suburbs. Vlorë has two orphanages: one for preschool-aged children (six years old and younger) and one for children older than six years.

The Shushice Commune is served by an ambulance building manned by three doctors, but there is no hospital. Health centers in the Qender Commune are located at Sherishte, Babice, Narte, and Kanina. Other villages in the commune have nurseries and doctors who are supervised by the health centers. There are four health centers in the Novosela Commune at Novosela, Poro, Fitore, and Trevllazeri. Every village in the commune has an ambulance building. There is a health center in Armen, which is manned by two doctors who serve the needs of the commune. The town of Lubonje has a nursery.

5.5.3 Cultural Resources

Detailed information and data concerning cultural resources and any potential archaeological sites in the Vlorë area are not available. The city represents a point of linkage between eastern and western Mediterranean cultures. The oldest traces of civilization in the area of Vlorë date back to the 6th century B.C. In ancient times, Vlorë was known as Aulon and became the main port of Illyria after the fall of Apolonia and Oricum. In modern times, Vlorë was the first capital of independent Albania. It was declared the first capital of the country in November 1912 after a five-century Ottoman rule was ended. The city has been captured and occupied by Italians on two occasions over the last century, once between 1914 and 1920 and more recently between 1939 and 1944.

An important landmark in the Vlorë region is the 14th century monastery on the island of Zverneci, on the south end of the Narta Lagoon. The monastery includes the Church of Santa Maria, which is a Byzantine-style church constructed in the 11th century. Other ancient ports and city centers are located throughout the Vlorë region.

6 IMPACT IDENTIFICATION AND PROPOSED MITIGATION

Environmental impacts can occur during both construction and operation of a thermal generation facility. This section identifies the primary activities that have the potential to cause significant environmental impacts during construction and operation of the proposed power plant. This section also provides a detailed analysis of potential impacts and specifies mitigation measures that will be used to eliminate or minimize environmental impacts. This analysis is performed based on the conceptual facility design discussed in previously in this report.

6.1 CONSTRUCTION PHASE: SOURCES OF POTENTIAL ENVIRONMENTAL IMPACTS

Activities that have the potential to cause environmental impacts during the construction phase of the project are summarized in the discussion below. These activities include improving site access, site preparation, material disposal, site dewatering, development of a material borrow and aggregate source, concrete or asphalt batch plant operation, and other activities.

6.1.1 Site Access

The existing dirt access road to the Site will require substantial upgrades and resurfacing.

6.1.2 Site Preparation

It will be necessary to raise the elevation of the present site by three to four m due to its proximity to the Vlorë flood plain. This should be accomplished primarily by trucking in material from a local borrow source.

6.1.3 Transmission Line Preparation

Approximately seven km of double circuit 220 kV transmission line will be constructed to transport the power from the plant to the new Babica 220 kV Substation. If the Babica substation has not been constructed by the time of the interconnection, a four and a half km line will be constructed to connect to the Vlorë substation.

6.1.4 Site Dewatering

It will be necessary to dewater excavations during construction of some of the facilities; the water from that operation will be tested and disposed of properly.

6.1.5 Disposal of Excavated Material

It may be necessary to dispose of some excess material from the site at an offsite location.

6.1.6 Inlet Structure and Outfall Construction

Methods used to construct the cooling water system for the plant will have a potential environmental effect. These facilities include the water intake structure, intake pipeline, pumping station, discharge pipeline, and out fall structure.

6.1.7 Delivery of Materials

Delivery of materials during the construction process will be by truck. Deliveries will include light duty utility vehicles, buses for worker transportation, heavy construction vehicles, dump trucks, and cement trucks. Paved roads and speed limits can be employed to minimize the dust generated from this activity.

6.1.8 Staging Area

An area near the plant site will be set up as an equipment and material staging area. This area will also have the project offices, construction phase fuel storage, and batch plant if required. The area will require temporary water, sewerage and power services during construction and startup.

6.1.9 Work Force

The project will require approximately 350 to 500 workers during the construction phase. The total expatriate staff necessary for the project will likely be an additional 15 percent of the work force. It is assumed that the region can meet the majority of the work force requirements because of the high local rate of unemployment (18 percent).

6.1.10 Handling, Storage and Disposal of Hazardous Materials

Materials used during construction that may result in generation of hazardous wastes include cleaning solvents, paints, and spent lubricating oils. Other hazardous materials include fuel for construction equipment.

6.1.11 Domestic Wastes

Temporary sewage and wastewater treatment facilities will be required during the construction phase.

6.2 CONSTRUCTION PHASE: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.2.1 Atmospheric Environment

Fugitive dust from construction activity may affect local or regional air quality by increasing the concentration of particulate matter, including total suspended particulates (TSP) and fine particulates. Fugitive dust may be emitted from general site work, road improvements, and truck traffic. Operation of a concrete batch plant, and diesel powered construction machinery and vehicles may also contribute to particulate emissions.

Fugitive dust emissions from roads and site work can be eliminated or minimized by applying water on an as needed basis to dirt roads and exposed construction areas during the dry season (oil will not be used as a dust suppressant). Emission points from concrete batching plants should be controlled with appropriate particulate control equipment (such as fabric filters or cyclone separators). And diesel powered construction equipment and vehicles should be well maintained to minimize tailpipe emissions.

Air dispersion modeling was performed to assess the impacts of fugitive dust resulting from construction vehicles on the site roadways. The modeling demonstrates compliance with the particulate matter less than ten microns (PM_{10}) standards established by the World Bank and European Union. The air quality requirements include:

- The project cannot result in an impact greater than 5 micrograms per cubic meters ($\mu g/m^3$) for PM_{10} (annual mean) for protection of the deterioration of the airshed
- The ambient air quality impacts cannot exceed the PM_{10} standards presented in Table 6. 1.

TABLE 6.1

PM_{10} AMBIENT AIR QUALITY STANDARDS

World Bank [a]	European Union [b]
150 $\mu g/m^3$ 24-hr ave.	50 $\mu g/m^3$ 24-hr ave.
50 $\mu g/m^3$ annual ave.	40 $\mu g/m^3$ annual ave.

The particulate emissions were calculated from anticipated construction equipment and duration of the equipment on the site to represent an "annualized" emission rate. The fugitive emission estimate is provided in Table 6.2. The resulting emissions from all construction activities are utilized in the dispersion model to predict the ambient impacts at and beyond the site fenceline.

TABLE 6.2

FUGITIVE ROAD DUST EMISSION ESTIMATES

Construction Activity	Equipment[1]	Number of Equipment[1]	Activity Duration (days)	Equipment Operation (hr/day)	Emission Factor (lb/on-site mile/day)[2]	On-Site Road Miles	PM_{10} Emissions (lb/hr)[3]	PM_{10} Emissions (g/s)[4]
Land Clearing/Grubbing	Loader	1.48	30	8	10	0.5	0.076	0.0096
	Haul Truck	1.48	30	8	10	0.5	0.076	0.0096
Grading	Bulldozer	1.48	30	8	10	0.5	0.076	0.0096
	Motor Grader	1.48	30	8	10	0.5	0.076	0.0096
	Water Truck	1.48	30	8	10	0.5	0.076	0.0096
Concrete Slab Pouring	Concrete Truck	1.48	30	8	10	0.5	0.076	0.0096
Portable Equipment Operation	Generator	1.48	90	8	10	0.5	0.228	0.0287
	Air Compressor	1.48	90	8	10	0.5	0.228	0.0287
Paving	Paving Machine	1.48	10	8	10	0.5	0.025	0.0032
	Roller	1.48	10	8	10	0.5	0.025	0.0032
						TOTAL	0.963	0.1213
						TOTAL ($/m^2$)[5]	2.2E-04	2.8E-05

Notes:

Reference for Calculations: El Dorado County California Air Pollution Control District. *Guide to Air Quality Assessment: Chapter 4 - Construction Activity - Air Quality Impacts and Mitigation*. February 2002.

1. Equipment Recommendation per Table 4.3; 1 piece of equipment per 10 acre project; Site = 6 hectares (14.8 acres)
2. Emission Factor for truck hauling/dirt hauling, Table 4.5
3. Calculation = emission factor (lb/mile day) * number of equipment * (activity duration (d) / 365 (d/yr)) * on-site road miles / equipment operation (hr/d)
4. Calculation = Emissions (lb/hr) / 3600 (sec/hr) *453.6 (g/lb)
5. Site Road Area (m^2) = 4,320

The air dispersion modeling is performed utilizing the United States Environmental Protection Agency model, Industrial Source Complex Short Term - Version 3 (ISCST3). A detailed description of the model and input parameters is provided in Appendix C. Variations from the input parameters provided in this appendix are presented in the following paragraphs.

The fugitive road dust ambient air quality impacts are modeled without the PRIME algorithm (version 02035); the PRIME algorithm is only applicable to point source emissions, such as the turbine stacks. Table 6.3 provides the modeling input parameters.

TABLE 6.3

FUGITIVE ROAD DUST MODELING PARAMETERS

Area Source	X Coordinate	Y Coordinate	Elevation (m)	Emissions ($g/s/m^2$)	Release Height (m)	Length (m)	Width (m)	Angle
Road 1	167.6	27.4	1.5	2.8E-06	0	210.6	6	147.4
Road 2	-7.2	-88.2	1.5	2.8E-06	0	220	6	57
Road 3	117.9	-270.3	1.5	2.8E-06	0	290.7	6	-30.6

The road dust is modeled as an "area source" which does not allow for buoyant plume rise. Therefore, parameters such as temperature and velocity are not included in the modeled input parameters.

The modeling results and applicable ambient air quality standards are presented in Table 6.4. The maximum annual impact from construction road dust is 2.9 $\mu g/m^3$ and the maximum 24-hour impact is 12.8 $\mu g/m^3$. The modeled impacts are within the air quality standards.

TABLE 6.4

FUGITIVE DUST AIR DISPERSION MODELING RESULTS

Model Year	Modeled Impact ($\mu g/m^3$)	PM_{10} Ambient Air Quality Standards ($\mu g/m^3$)			Modeled Impact ($\mu g/m^3$)	PM_{10} Ambient Air Quality Standards ($\mu g/m^3$)	
	Annual Average	World Bank[a]	European Union[b]		24-hour Average	World Bank[a]	European Union[b]
1987	2.6				7.8		
1988	2.8				9.8		
1989	2.7				12.8		
1990	2.9	50	5	40	8.2	150	50
1991	2.8				8.8		

Notes:

= Maximim modeled concentration

a. World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998

b. Limit values are effective January 1, 2005. All of these limit values include a maximum allowable occurrence of exceedance.

6.2.2 Noise

Noise from construction activity may be significant. All noise emitting equipment should be properly maintained to minimize the noise impact on the area. Noise emitting equipment should comply with the applicable EU noise standards for such equipment as found in EU Directive 2000/14/EC of the European Parliament and of the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. Noise complaints should be logged and kept onsite by the construction contractor. For more information on monitoring and mitigation see the EMP section of this report.

6.2.3 Ground and Surface Water

Minor short-term lowering of the groundwater table may occur in the vicinity of the site during dewatering of foundation excavations. However, groundwater resources in this area are limited and the groundwater is not typically used for domestic (potable) or other purposes. Therefore, the limited drawdown from dewatering activity is not expected to have a significant impact.

There are no surface water drainages that run through the site, and stormwater discharges will be managed to minimize water quality impacts to nearby surface water resources such as the Narta Lagoon, Bay of Vlorë, and the Vlorë floodplain. A site grading and drainage plan will be required by the construction contract to manage the flow of water offsite in a responsible manner. Sediment control measures such as retention weirs can be used, as necessary, to minimize sediment transport offsite. Measures such as seeding and silt fencing may also be implemented to minimize erosion of soil stockpiles.

Water from dewatering activities has the potential to contain suspended solids and oil and grease. Measures that may be taken to remove settleable solids prior to discharging water from the site include the use of sediment sumps or other sediment control structures. Any visible oil and grease can be skimmed off the surface using absorbent pads.

Accidental spills of fuels or other materials pose a potential for contamination of coastal or inland waters. Precautions should be taken to prevent spills and all workers should be trained in the proper handling, storage, and disposal of hazardous or toxic materials. A written emergency response plan should be prepared and retained on site and the workers should be trained to follow specific procedures in the event of a spill. There must be proper equipment available for workers to contain and treat a spill in the event of an emergency.

To prevent the release of liquid materials that can potentially contaminate surrounding surface water or groundwater resources, the following mitigation measures should be employed:

- Segregate all waste oils and lubricants from maintenance of construction equipment and dispose of these wastes properly

- Construct secondary containment structures for all storage tanks using an impermeable material capable of holding 110 percent of the volume of the largest tank
- Inspect secondary containment areas and other sumps regularly
- Construct and maintain facilities to remove rainwater from the secondary containment structures and properly remove oil from the surface of the accumulated material

The site drainage plan will address runoff from the batch plant and the equipment staging areas. Sediment control measures may also be required for road improvement activities, particularly at stream crossings. It is important that all culverts be sized to adequately pass expected streamflow under flood conditions. Exposed soil surfaces should be revegetated as soon as possible to further minimize the potential for erosion and sediment releases.

An offsite disposal contractor or a small package sewage treatment system can be employed to treat sanitary wastes. Under no circumstances should untreated sewage be discharged into local watercourses.

6.2.4 Terrestrial Environment

The generation facility will not directly affect critical terrestrial ecosystems. The site is relatively barren and has little vegetation or wildlife. Road improvements and construction of new transmission lines may also affect terrestrial environments. Clearing along the road and transmission lines should be minimized.

The location of the transmission interconnection has not been finalized. One option is for a seven km line from the planned Vlorë facility switchyard to the planned Babica substation. If the Babica substation is not constructed in time, the interconnection will be to the Vlorë substation, four and one half km away. Neither line will disturb productive agricultural land or displace residences. The width of the right of way for the line should be no more than 60 m.

If possible, the entire right-of-way for the transmission line should not be stripped. Stripping should be practiced only when there is no other option for performing the work. Vegetative removal should be done manually without the use of herbicides. In addition, when accessing the tower sites for the transmission lines, tree cutting should be minimized. Any woody vegetation on the site or transmission line corridor should be cleared and be made available to local residents.

Soil borrow sites should be carefully selected to assure that the sites can be properly regraded and revegetated after completion of the project. Factors such as terrain feature and ability to regrade and revegetate the borrow site should be considered during the selection process. Revegetation should utilize native plant species. For more information see the EMP section of this report.

6.2.5 Marine Habitat

Impacts to marine habitat during the construction phase are expected from the installation of the cooling water intake and discharge outfall pipelines. This work may involve dredging and disposal of excavated material. The work could potentially cause sediment release to the surrounding marine environment.

Any marine disposal of excavated material should be done away from sensitive fisheries or breeding grounds. Disposal should be timed to be outside of the upwelling period. Marine contractors utilized on the project will be required to demonstrate use of BMP's to minimize the environmental impact of their work. It is up to the EPC contractor to identify and avoid sensitive marine environments. In addition, the environmental performance of the contractor should be monitored during construction as described in the EMP.

6.2.6 Socioeconomic Resources

Land Use

The land on the Site is currently owned by the State and is not used for any agricultural or domestic purposes. Therefore, construction of the project will not result in the displacement of any land use activities.

Aggregate Sources

There are a number of stone and gravel quarrying operations in river valleys close to the site. These operations will provide sufficient resources for construction requirements without depleting the local resource. However, when actual aggregate requirements become known, further investigations of the aggregate sources should be undertaken. In addition, off site sources of fill should be identified and the appropriate approvals should be obtained prior to opening a borrow site. Such sites should be regraded and revegetated following use.

Fisheries

Water construction activities associated with the pipelines for the cooling water intake and discharge systems should be performed during periods of low fish activity. Experienced marine contractors with environmental procedures in place should be contracted to perform all work.

Coastal Navigation

It is not anticipated that construction activities will significantly interfere with coastal navigation of shipping or passenger vessels. All barges, buoys, and watercraft associated with the construction project should be clearly marked and illuminated at night.

Transportation

Delivery of construction material to the site may put considerable pressure on existing roadways, particularly in the Vlorë area. To alleviate some of this pressure, the main access roads will be upgraded to accommodate the additional loading and traffic. Scheduling the delivery of major plant components for off-peak traffic times can also help to mitigate impacts on the local traffic flow. For more information see the EMP section of this report.

6.3 OPERATION PHASE: SOURCES OF POTENTIAL ENVIRONMENTAL IMPACTS

The generation facility will operate in base load mode. The plant will employ approximately 40 full-time staff. It is further assumed that the plant will experience up to 200 starts per year. The main components of the plant are the combustion turbines, the HRSG's, the steam turbine, and auxiliary equipment. Each CT will be connected to its own HRSG. Exhaust steam from the ST will be condensed on a surface condenser cooled by a once-through seawater cooling system.

Fuel for the plant is expected to be distillate fuel oil delivered by tanker to the existing offshore terminal in the Bay of Vlorë. A new 4,900 m^3 oil storage tank will be constructed to provide dedicated onsite 10-day storage.

The major sources of potential environmental impacts that could result from operation of the plant include air quality impacts from fuel combustion, seawater thermal impacts from the discharge of cooling water, and surface water quality impacts from the discharge of low volume wastes from plant operation, storm water handling and sewage treatment. Other potential sources of environmental impacts include spillage from fuel storage, and small volume solid and hazardous waste generation.

6.4 OPERATION PHASE: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.4.1 Atmospheric Environment

Air emissions will result from combustion of fuel for power generation. The plant will fire distillate fuel oil as the single fuel, however future operation on natural gas is possible if a dependable supply becomes available. A typical distillate fuel analysis is provided in Table 6.5. This fuel specification meets the EU directive on distillate fuels.

TABLE 6.5

TYPICAL FUEL ANALYSIS

Component	Value
°API	32
Specific gravity 60/60°F (15.5°C)	0.865
Kinematic viscosity, centistokes(cs) at 100°F	2.7
ASTM maximum kinematic viscosity, cs	3.4 (104°F)
ASTM water and sediment, max. vol. %	0.05

Carbon residue, wt%	Trace
Gross heating value, Btu/lb	19,489
Net heating value, Btu/lb	18,320
Sulfur, wt%	<0.5 as S

Actual fuel analysis will be based on the fuel contract negotiated by KESH.

The emissions to the ambient air from combustion of distillate fuel oil in a combustion turbine include sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), carbon dioxide (CO_2), particulate matter less than 10 microns (PM_{10}) and total suspended particulate (TSP). The particulates may contain small amounts of trace metals that are also emitted to the atmosphere. The generation facility will be designed to meet the more stringent of European Union (EU) or World Bank emission standards and ambient air quality impact limits. Albania does not currently have emission standards for thermal power plants. The applicable emission standards are summarized in Table 3.2.

SO_2 emissions will be controlled by limiting the sulfur content of the fuel. NOx emissions will be controlled through burner management and water injection to the combustion turbines. Particulate emissions can be reduced through good combustion control to minimize the products of incomplete combustion. Detailed emission estimates for the Vlorë Generation Facility are included in Table 3.2.

An air quality analysis is performed utilizing refined air dispersion modeling to evaluate the ambient air quality impacts from the proposed facility. The World Bank generally recommends the use of refined models for large thermal power facilities. However, to be conservative, refined modeling is performed for the Vlorë facility to obtain a more accurate estimate of impacts to ambient air quality.

The results of the air dispersion modeling are used to demonstrate compliance with World Bank, EU air quality standards. The air quality requirements for thermal generating plants include:

- The project cannot result in an impact greater than 5 micrograms per cubic meters ($\mu g/m^3$) for NOx, SO_2, PM_{10} (annual mean) for protection of the deterioration of the airshed
- The project cannot result in reducing the air quality to the "poor air quality" classification for NOx, SO_2, and PM_{10}
- The project cannot result in ambient air quality impacts in exceedence of the international standards:

The air quality impacts on the surrounding area resulting from the planned power plant are estimated through air dispersion modeling and the model output is compared to the ambient standards. In addition, because of limited data and the lack of nearby emission sources the facility is considered the baseline facility, and is the only emission source included in modeling to determine if the project reduces the area's air quality into the "poor air quality classification."

Ideally, if reliable data on background air quality and emissions from surrounding stationary sources were available, that data would be included in the air quality impact assessment. No such data is available so the analysis is based on the assumption of moderate air quality and no surrounding sources.

The combustion emission unit consists of two distillate fuel oil-fired combustion turbines, each equipped with a HRSG. There is no supplemental firing in the HRSG's. The exhaust discharge points include two stacks; one from each HRSG.

The facility emissions are calculated in accordance with the methodologies outlined in the World Bank Pollution and Prevention Handbook (*Handbook*). A facility heat balance was performed utilizing several ambient conditions and turbine operating conditions in a reduced load analysis. The worst-case emissions in combination with the lowest exhaust velocity and temperature resulting from the reduced load analysis are utilized in the dispersion modeling analysis because they represent the conditions with the highest potential air quality impact (See Heat Balance – Table D-1 in Appendix D). The emissions were modeled assuming 100 percent capacity factor. A summary of emissions utilized in the dispersion model is provided in Table 6.6.

TABLE 6.6

COMBUSTION TURBINE DISPERSION MODELING EMISSIONS

Pollutant	Turbine Stack Emissions (g/s)[1]
CO	12.7
NO_x	11.7
SO_2	7.0
PM_{10}	1.3

NA = Not Applicable

(1) Emission value per gas turbine stack; there are 2 stacks per power generation unit.

The hazardous air pollutants (HAP) emissions are provided in (See HAP Summary – Table D-2 in Appendix D). The total annual HAP emissions are 2.6 tonnes/year. The *Handbook* recommends that ambient air impacts be performed for facilities with the potential to emit more than fifty metric tons of hazardous air pollutants. Therefore, the HAP emissions are not considered significant and are not included in the air dispersion modeling.

The emission of unburned hydrocarbons and NOx may contribute to ground-level ozone formation. These pollutants participate in atmospheric reactions to form ozone in the presence of sunlight. To assess the impact of these pollutants in ozone formation, reactive plume modeling must be performed. No such reactive plume modeling is performed as part of this EIA. It is assumed that the plant will have no impact on local ozone levels and small, if any, impact on far-field ozone concentrations.

In addition, as of September 2003, the government of Albania has not ratified the Kyoto Protocol on global climate change. The CO_2 emissions from the proposed facility are approximately 76 tonnes per year. For calendar year 1999, the country of Albania emitted 151,417 tonnes of CO_2. The proposed plant represents less than 0.05% of that total. No modeling or further consideration is given for the facilities CO_2 emissions.

6.4.2 Model Selection

Refined modeling involves the use of Gaussian Plume Models that evaluate near-field (less than 50 km from the source) impacts. These models also assume that pollutants do not decompose in the atmosphere (non-reactive) and do not account for long-range transport or atmospherically reactive pollutants. The Gaussian models are expected to produce results close to monitored values.

The available models are similar in design and performance; however, each model has different flexibility in regards to input conditions (i.e. different terrain conditions, averaging periods, pollutants). The following are common Guassian models, as described in the World Bank Pollution and Prevention Handbook (*Handbook*).

- ISC3 (Industrial Source Complex) model – Has capabilities to model stack, area, and volume sources. The model addresses complex terrain (i.e. terrain greater than the stack height) in a simple algorithm. ISC3 is one of the “preferred models” by the United States Environmental Protection Agency (USEPA) because it has been field-tested and meets certain technical criteria. The model is available in two versions: short-term (ISCST3) and long-term (ISCLT3).
- CTDMPLUS (Complex Terrain Dispersion) model – This model is appropriate for areas with complex terrain. This model is also listed as “preferred” due to the validation of the model through field testing.
- UK-ADMS – Developed by the United Kingdom Meteorological Office Atmospheric Dispersion Modeling System.
- PARADE – Developed by Electricite de France
- PLUME5 – Developed by Pacific Gas & Electric Company in San Ramon, California. The model is applicable to NO_2 and SO_2, but not to particulate matter.

For the Vlorë project analysis, the USEPA model, Industrial Source Complex Short Term - Version 3 (ISCST3) with the Plume Rise Model Enhancement (ISC-PRIME) algorithms were used to estimate the maximum off-property concentrations of CO, NO_2, PM_{10}, and SO_2 at ground-level. ISCST3 is mentioned in the *Handbook* as a preferred model, has undergone field-testing, and does not require code modifications or calibration for the proposed facility. The PRIME algorithm is the next generation of building downwash modeling and accounts for buoyant plume rise of hot exhaust gas. The Electric Power Research Institute (EPRI) developed prime algorithm to ISCST3. The latest version of the model (dated 00101) is used for this impact assessment.

An independent evaluation of ISCST3 and ISC-PRIME was conducted by EPRI in November 1997. The model verification included a monitoring network, tracer studies, and wind tunnel studies under a variety of meteorological conditions (stable, unstable, neutral) including coastal environments. The findings of this evaluation showed that ISC-PRIME is generally unbiased and conservative in its results. Therefore, the model is protective of air quality[1].

Modeling is performed using the USEPA regulatory default option in the program. This option includes stack height adjustment for stack-tip downwash, buoyancy-induced dispersion, and final plume rise. Downwash may occur if the emission source is adjacent to a building or structure and may interfere with plume rise (i.e. cause wake effects). Therefore, direction-specific building parameters are determined for the downwash algorithms included in the model. These parameters are calculated using the Building Profile Input Program (BPIP) with the PRIME algorithm (BPIP-PRIME), version 95086. All structures and buildings with potential wake effects on the plume are included in the BPIP-PRIME run. In addition, the Good Engineering Practice (GEP) stack height are determined using BPIP-PRIME. All structures and buildings with potential wake effects on the plume were included in the BPIP-PRIME run.

The Industrial Source Complex Short Term - Version 3 (ISCST3) with the Plume Rise Model Enhancement (ISC-PRIME) algorithms was used to estimate the maximum off-property concentrations of NOx, PM_{10}, and SO_2 at ground level. ISCST3 is mentioned in the *Handbook* as a preferred model, has undergone field-testing, and will not require code modifications or calibration for the proposed facility. The PRIME algorithm is the next generation of building downwash modeling and accounts for buoyant plume rise of hot exhaust gas. The Electric Power Research Institute developed prime algorithm to ISCST3. The model version 99020 will be used for this impact assessment.

Modeling was performed using the regulatory default option in the program. This option includes stack height adjustment for stack-tip downwash, buoyancy-induced dispersion, and final plume rise. Direction-specific building parameters were determined for the downwash algorithms included in the model. These parameters were calculated using the Building Profile Input Program (BPIP) with the PRIME algorithm (BPIP-PRIME), version 95086.

Emission Source and Building Parameters

The modeling utilizes a site-specific metric coordinate system for defining stack, structure, and receptor locations. The emission source parameters for the combustion turbine stacks utilized in the dispersion model are summarized in Table 6.7.

TABLE 6.7

COMBUSTION TURBINE STACK PARAMETERS

Stack	X Coordinate	Y Coordinate	Elevation (m)	Height (m)	Temp. (K)	Velocity (m/s)	Diameter (m)
Stack 1	157.5	-142.5	1.5	46.9	399.4	24.7	2.67

[1] Electric Power Research Institute. *Results of the Independent Evaluation of ISCST3 and ISC-PRIME*. EPRI TR-2460026, November 1997.

Stack 2	187.5	-123	1.5	46.9	399.4	24.7	2.67

The dispersion of plume can be affected by nearby structures when the stack is short enough to allow the plume to be significantly influenced by surrounding building turbulence, known as structure-induced downwash. This condition causes the model to predict higher near-field, ground level concentrations. Therefore, facility stack heights are determined using the GEP stack height to avoid the modeled turbulent flow associated with downwash caused by nearby structures.

Additionally, structures and buildings with potential wake effects on the plume are included in the BPIP-PRIME run. Table 6.8 contains the detailed building parameters.

TABLE 6.8

BUILDING PARAMETERS

Building	X Coordinate	Y Coordinate	Elevation (m)	Height (m)	Length (x)	Width (Y)	Radius (m)
Air Intake Unit 1	97.5	-82.5	1.5	12	7.2	4.8	NA
Air Intake Unit 2	153	-50	1.5	12	7.2	4.8	NA
Equipment Service Building	81	-147	1.5	6	18	24	NA
Exhaust Duct 1	107.3	-76.4	1.5	5.5	7.2	14.4	NA
Exhaust Duct 2	147.4	-53.6	1.5	5.5	7.2	-14.4	NA
Inlet Elbow Duct 1	153.2	-50.1	1.5	9.5	7.2	-6.6	NA
Inlet Elbow Duct 2	101.7	-80	1.5	9.5	7.2	6.6	NA
Turbine Building	49.5	-96	1.5	18.3	27	36.5	NA
Water Treatment	63.8	-118.9	1.5	6.1	15.2	18.4	NA
Fire/Service Water	52.5	-124.5	1.5	12.2	NA	NA	6.4
Demineralized Water	42	-112.5	1.5	12.2	NA	NA	7.2
Fuel Oil Tank 1	66	18	1.5	12.2	NA	NA	11.6

Note: The buildings are on a 58 degree angle from the east-west horizontal datum

NA = Not Applicable

Meteorological Data

The World Bank guidelines for air dispersion modeling from a source of air pollutants of the size of the proposed plant suggest screening modeling as opposed to refined modeling. Screening modeling uses default meteorological data and predict pollutant concentration on a linear path from the source. Screening modeling does not incorporate receptor elevations to account for complex terrain. Refined modeling was performed in support of this EIA using the ISCST3 model. The ISCST3 modeling performed incorporates a 3-dimensional receptor grid, 5-years of hourly meteorological data, and a nested grid that ensures that the maximum predicted concentration in any direction from the source is included in the results. ISCST3 uses hourly meteorological data in a Fortran formatted input file. The data includes hourly wind speed, wind direction, and temperature, and upper air stability and mixing height data. One can build the formatted input file from raw meteorological data by writing and running a program that reads the raw data in whatever format it may exist, and creates a formatted output file. However, raw data from a location close to the site for use in this EIA was not found. The decision was made to use the San Francisco International Airport data based on the average wind speeds presented in Table 6.9.

Each receptor in the grid is evaluated based on a variety of wind conditions when using 5-years of hourly meteorological data. The variety in wind conditions and the conservative (over prediction) nature of the ISCST3 model results in appropriate concentration predictions. The model is conservative in itself and the modeling performed for the EIA is made more conservative by using the "worst case" emission rates coupled with the lowest stack flowrate and the lowest stack temperature - conditions that are a combination of different operating scenarios but result in the most conservative approach from a modeling point of view.

The maximum values predicted by the model, although spatially determined, are used for comparison to the standard. In other words, it is not important for the determination of an acceptable impact where the maximum predicted concentration occurs relative to the facility, the maximum predicted value is the value used to assess the impact.

As discussed above, air modeling for the Vlorë power plant project is performed using meteorological data sets from the National Weather Service stations at San Francisco International Airport (USA) (surface data – station #23234) and Oakland (upper air data – station #23230) for the most recent five consecutive years available (1987-1990). The raw data was processed utilizing PCRAMMET (version 99169) to import into the ISC-PRIME model.

TABLE 6.9

COMPARISON OF TEMPERATURE AND WIND SPEED DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temperature (°C)												
Vlorë	9	10	12	15	18	22	25	24	22	18	15	11
San Francisco	9	11	11	13	14	16	17	17	18	16	12	9

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Wind Speed (m/s)												
Vlorë	3.8	3.9	4.1	4.2	4.4	4.6	4.5	4.4	4.0	3.9	3.8	3.7
San Francisco	3.1	3.6	4.4	5.3	5.8	6.1	5.8	5.6	4.7	4.2	3.3	3.1

Data Sources:

San Francisco: temperature & wind speed: www.weatherpost.com, accessed July 25, 2002

Vlorë: temperature – Albanian Academy of Science, Hydrometeorologic Institute, 1931-1991

Terrain/Land Use Analysis

The modeling is preformed using a site-specific metric coordinate system for defining stack, structure, and receptor locations. The surrounding area consists of coastal lands, sea, foothills and mountains. Local topographic maps indicate that complex terrain (terrain above the stack height) occurs in the project impact area. Therefore, receptor elevations are obtained from topographic maps (Republika Popullore Socialiste e Shqipërisë maps) and incorporated into the air dispersion model.

ISCST3 requires a land use assessment using Auer's analysis to classify the site to determine the proper dispersion mode – urban or rural. Although the site is adjacent to an urban area, the rural dispersion mode provides less atmospheric mixing and is more conservative. Therefore, the site is classified as rural for the purpose of dispersion modeling.

Receptor Grid

Two Cartesian receptor grids, fine and coarse, are used in the modeling to cover the complete impact area. The fine grid is 1 km by 1 km, with the facility located in the center to include receptors with concentration peaks over 2/3 of the standard. A 100-meter resolution is incorporated for the fine grid and includes fenceline receptors. Additionally, the dispersion model contains a 10 km by 10 km coarse grid with a 500-meter resolution.

Initial screening modeling determined that maximum concentrations occur on the southwest edge of the coarse grid. The maximum concentrations are influenced by the complex terrain in this region. Therefore, the coarse grid was extended 1500 meters to the southwest of the facility to verify the location of the maximum concentration. Additional discrete receptors are placed at various mountain peaks to determine impacts at the maximum area elevations.

Modeling Results

Table 6.10 shows a summary of the dispersion modeling results. The detailed modeling results (results for all five meteorological years) are provided in Appendix D, Table D-3. The modeled impacts for CO, NOx, PM_{10}, and SO_2 are within the World Bank and European Union air quality standards. The results also display that facility impacts are within the 5 $\mu g/m^3$ standard to protect the quality of the airshed.

TABLE 6.10

SUMMARY OF DISPERSION MODEL RESULTS AND AIR QUALITY STANDARDS

Pollutant	Annual Averaging Period			24-hour Averaging Period			8-hour Averaging Period			1-hour Averaging Period		
	Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)		Maximum Modeled Impacts ($\mu g/m^3$)	Ambient Air Quality Standards ($\mu g/m^3$)	
		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]		World Bank[a]	European Union[b]
CO							40.9		10,000			
NOx	3.1	100	30[c], 40	16.2	150					89.3		200
PM_{10}	0.3	50	40	1.8	150	50						
SO_2	1.9	80	20[d]	9.7	150	125				53.4		350

Notes:

(grey box) = Not Applicable

a. World Bank Pollution Prevention and Abatement Handbook, Thermal Power: Guidelines for New Plants – July 1998

b. Limit values are effective January 1, 2005. All of these limit values include a maximum allowable occurrence of exceedance.

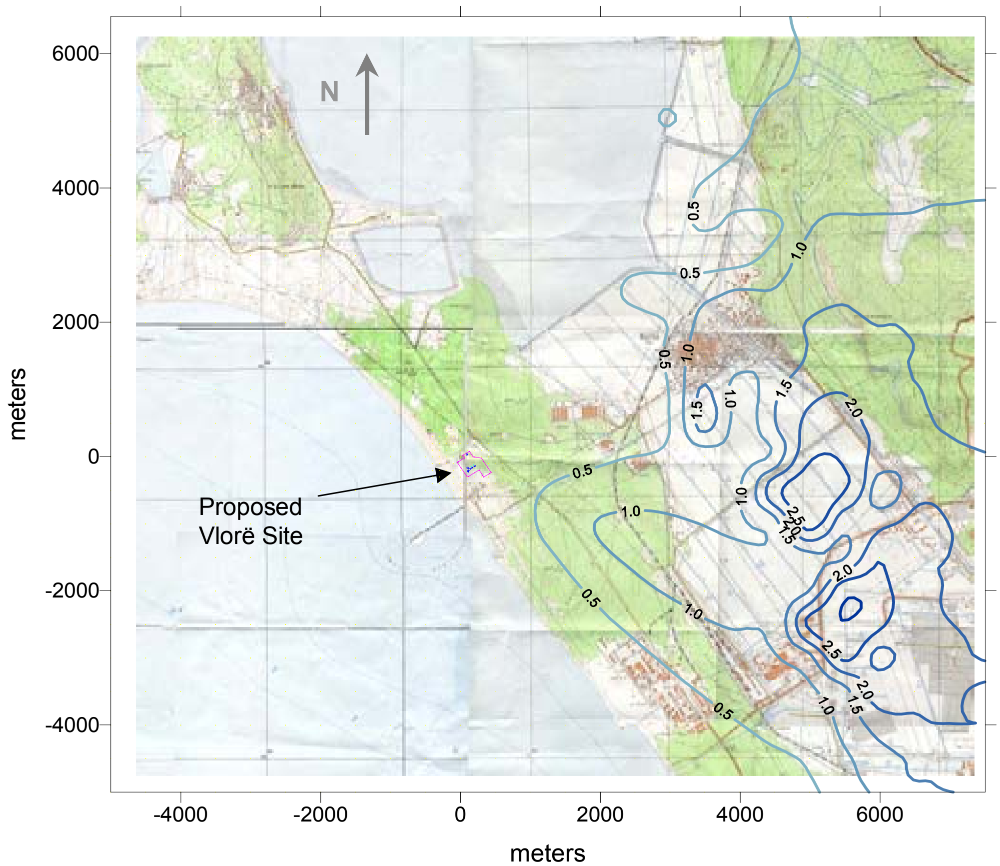
c. Limit to protect vegetation.

d. Limit to protect ecosystems.

Figures 6.1 to 6.4 display isopleths (lines of equal concentration) for the maximum meteorological year (1990) for NOx, PM10, CO, and SO2 (annual averaging period). The maximum receptors are located southwest of the facility where the terrain elevation increases. The elevation in the vicinity of the maximum receptor is 70 meters.

FIGURE 6.1

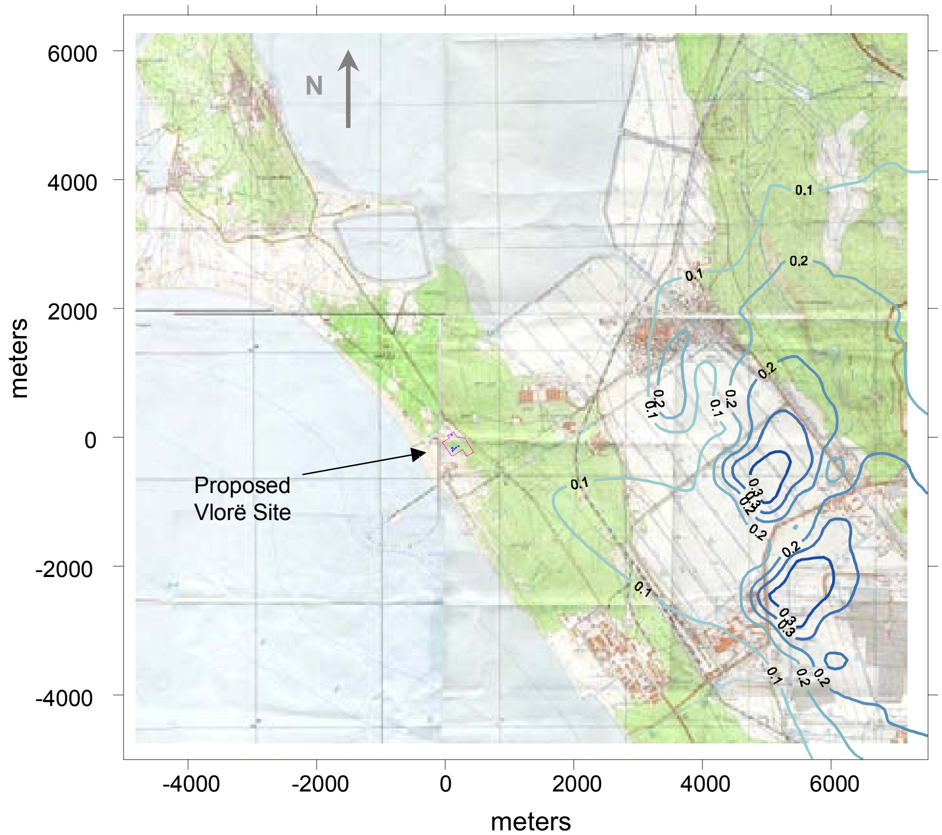
ISOPLETH PLOT – NO_X ANNUAL AVERAGING PERIOD MODELING RESULTS



Note: concentration units = $\mu g/m^3$, 1990 meteorological year

FIGURE 6.2

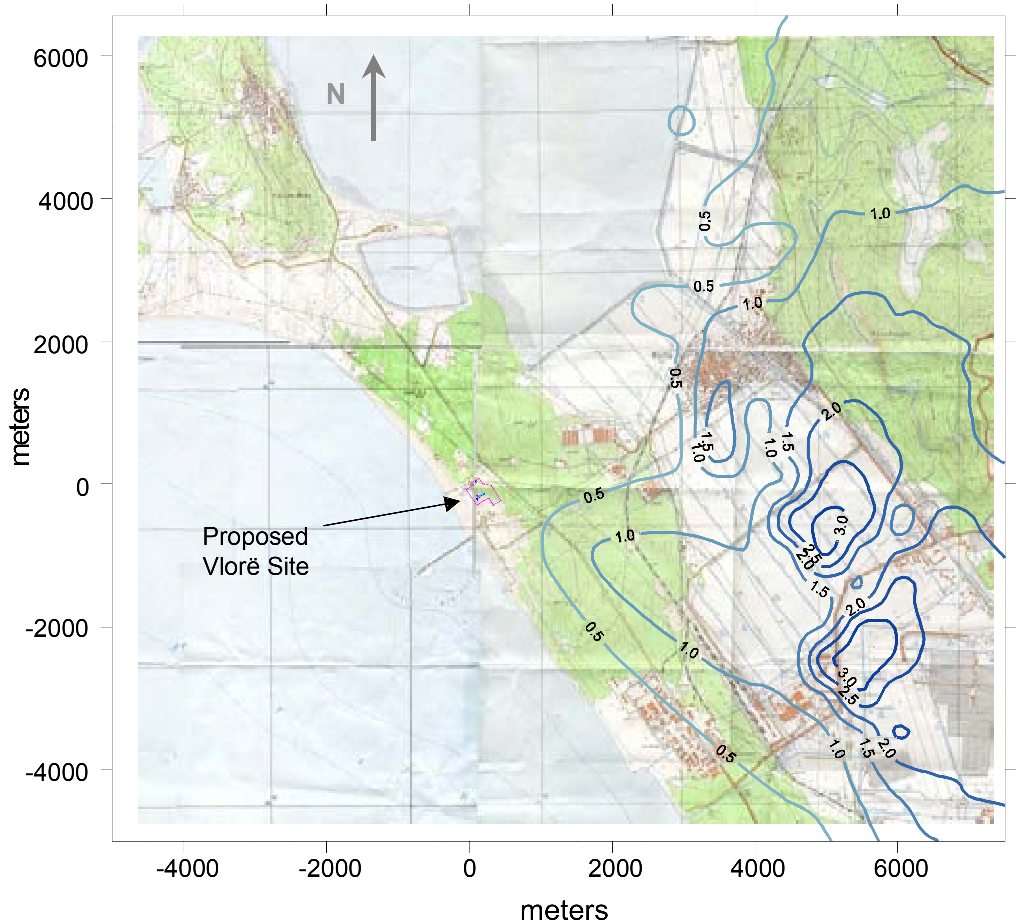
ISOPLETH PLOT – PM_{10} ANNUAL AVERAGING PERIOD MODELING RESULTS



Note: concentration units = µg/m³, 1990 meteorological year

FIGURE 6.3

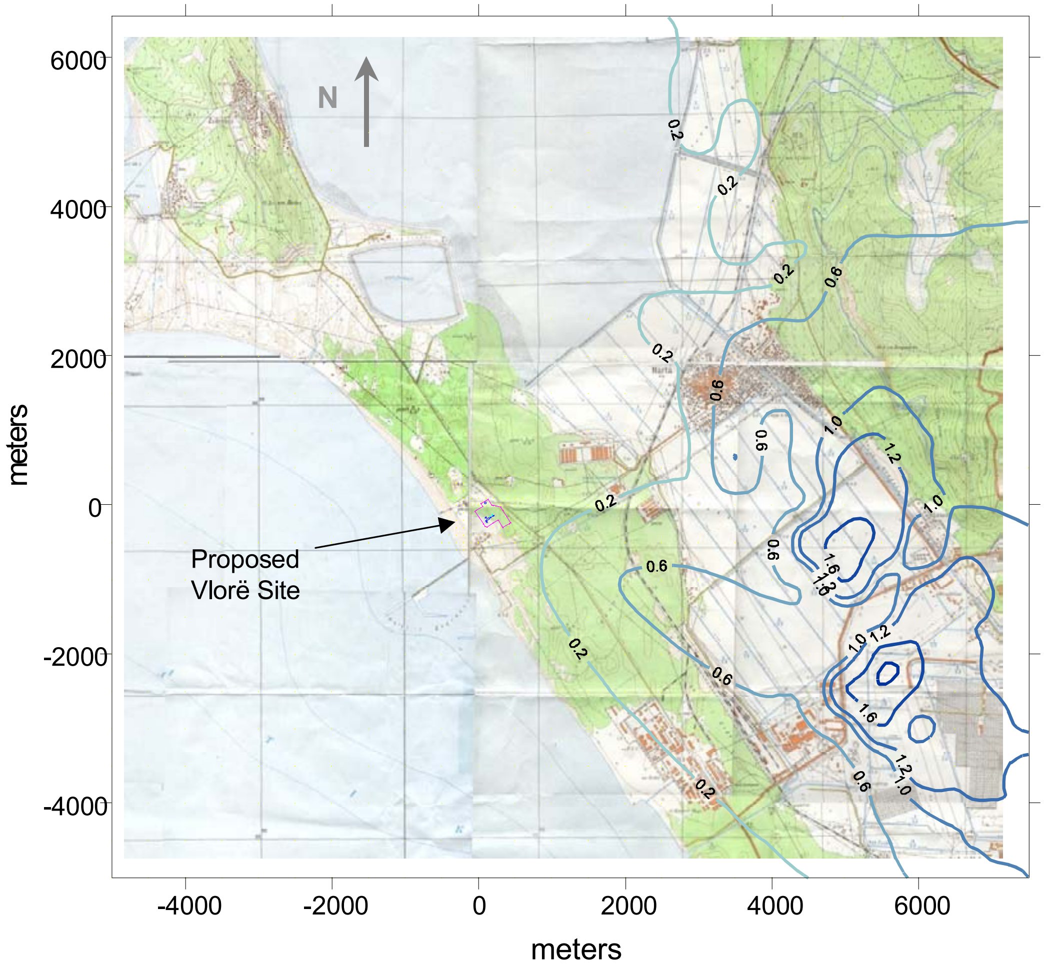
ISOPLETH PLOT – CO ANNUAL AVERAGING PERIOD MODELING RESULTS



Note: concentration units = µg/m^3, 1990 meteorological year

FIGURE 6.4

ISOPLETH PLOT – SO_2 ANNUAL AVERAGING PERIOD MODELING RESULTS



Note: concentration units = μg/m³, 1990 meteorological year

6.4.3 Ambient Air Quality

The World Bank, ERBD, and EIB air quality standards for thermal generating plants also require that the project cannot result in reducing the air quality to the "poor air quality" classification for NOx, SO_2, and PM_{10}. Table 6.11 lists the *Handbook* criteria for air quality classifications.

TABLE 6.11

AIR QUALITY CLASSIFICATIONS

Pollutant	Moderate Air Quality ($\mu g/m^3$)[1]	Poor Air Quality ($\mu g/m^3$)[1]
NOx	>100	>200
PM_{10}	>50	>100
SO_2	>50	>100

(1) Annual mean concentrations

There is no regular monitoring system for air pollution in Albania. Therefore, it is difficult to find accurate baseline data regarding background air quality. No data exists that indicates the presence of other heavy industries currently operating in the vicinity of the facility that contribute to the ambient pollutant concentrations.

The Regional Environmental Agency in Vlorë reported 2001 baseline data provided by the Vlorë REA can be seen in the following table:

TABLE 6.12

BASELINE AIR QUALITY DATA - VLORË

Pollutant	Annual Average ($\mu g/m^3$)
NOx	22
PM_{10}	NR
SO_2	15

NR = Not Reported

Note: Data regarding measurement criteria/frequency is not available.

The data in Table 6.10 indicates that the impact of the emissions from the planned facility will result in the air quality in Vlorë to remain within the "moderate" category. Facility emissions are acceptable and will not result in reclassification of the airshed air quality to the "poor" air quality classification. The input and output for the air dispersion modeling are included in Appendix C of this report.

6.4.4 Noise

Significant noise levels can result from operation of the turbines and be emitted at various points. These points include the turbines, the exhaust gas, the air intake system, and the air-cooling system. The transformers in the switchyard can also generate significant noise levels. There is no background noise data for the site. The Generation Facility is expected to operate in a manner that adheres to the more stringent of EU or World Bank guidelines for noise emissions.

When operated in combined cycle mode, the combustion turbines emit less noise than in simple cycle mode because of the silencing effect of the HRSG. A silencer for the HRSG stack is normally not necessary to meet the noise guidelines. The combustion turbines will be housed in an enclosure and the manufacturers information on such an arrangement is that the turbines will produce 85 decibel (A) (dB(A)) of noise.

The dB(A) scale measures the sound intensity over the whole range of different audible frequencies (different pitches), and then it uses a weighing scheme which accounts for the fact that the human ear has a different sensitivity to each different sound frequency. Table 6.13 shows the relative noise levels generated by various sources of noise.

TABLE 6.13

RELATIVE NOISE LEVELS

Sound Level	Threshold of Hearing	Whisper	Talking	City Traffic	Rock Concert	Jet Engine 10 m Away
dB(A)	0	30	60	90	120	150

The energy in sound waves (and thus the sound intensity) will drop with the square of the distance to the sound source. In other words, the sound level 200 m away from a noise source will generally be one quarter of what it is 100 m away. A doubling of the receptor distance will thus make the dB(A) level drop by six, assuming that sound reflection and absorption (if any) cancel one another out. Sound absorption and reflection (from soft or hard surfaces) may play a role on a particular site, and may modify this relationship.

If there are two noise sources located at the same distance from the receptor the sound energy reaching the receptor will double. This means that two turbines will increase the sound level by 3 dB(A). One would actually need ten turbines placed at the same distance from the receptor to double the perceived sound level (i.e. the dB level has increased by 10).

It is expected that the noise levels from the equipment planned for the Vlore project will meet the combustion turbine vendor guidelines of 85 dB(A). This level applies to enclosed turbines. This means that the combined noise level is 88 dB(A). There are no sensitive receptors within 100 m of the site; therefore, this is an acceptable level of noise impact.

The EPC contractor will be expected to meet stringent limits on near field and far field noise impacts. For near field noise the noise levels at any location on the plant site, whether indoor or outdoor, shall be specified to be limited to 85 dB(A) through acoustic mitigation at a distance of 3 feet or further from any equipment and 5 feet above grade or any personnel platform at 1 meter. Any specific areas in which the Contractor can demonstrate that the 85 dB(A) criteria will be either technically and/or economically prohibitive, or the area will experience very limited worker occupancy, the Contractor shall provide administrative control measures which include posting warning signs prescribing hearing protection.

Within any enclosure intended to suppress noise, it will not be necessary to achieve the 85 dB(A) noise criteria. The Contractor's design shall, however, include reasonable measures to restrict noise. In no case shall the noise level exceed 115 dB(A) if operating staff is able to enter the enclosure with the plant in operation, unless the Contractor has previously demonstrated that it is not practicable (either technically or economically) to satisfy this criterion.

Where it is possible that operating staff may enter the noise suppression buildings or enclosures for supervisory purposes or minor repair work with the plant operating, the access doors shall be clearly marked with a symbol designating a noise hazard and indicating that hearing protection is required.

For far field noise, the A-weighted sound pressure level resulting from the operation of the facility at base load steady state conditions, exclusive of start up, shut down, and all other off-normal conditions, shall be designed to not exceed a maximum of 70 dB(A) at any point along the main road east of the site. The sound pressure levels shall be corrected to exclude the contribution of the background noise and any other noise not associated with the normal operation of the facility.

6.4.5 Marine Environment

There are three significant areas of potential marine environment impact to consider during operation of the plant:

- The potential for oil spills during oil delivery via ship/barge
- The water intake structure entraining and impinging marine life
- The thermal discharge of the once-through cooling system

Oil Spills

The potential for oil spills during oil delivery can occur through the shipping, unloading, and transfer of the fuel to onsite storage. Unloading operations may result in limited oil spillage to the sea during unloading by employing BMPs. These releases can be minimized through operational procedures. A floating oil boom should be used to contain spillage during ship unloading and disconnection procedures. In addition, there is also a potential for failure of the transfer pipeline or the mooring buoy. This potential can be minimized through frequent inspection and maintenance of those facilities.

Water Intake

Water intake from the Bay of Vlorë for the once-through cooling system may affect a localized zone of the marine ecosystem where the intake structure is located. The primary impacts of concern are impingement of marine life on the intake screens and entrainment of marine species in the cooling water system. Planktonic organisms (phytoplankton, zooplankton), macroinvertebrates and the larval stages of fish and shellfish will be most susceptible to impacts.

Generally, the effects on planktonic organisms can be expected to be small and difficult to measure. Entrainment of larval fish and shellfish and juvenile shellfish can be significant and should be minimized through intake design. Design parameters that can be used to minimize the impact on fish communities are location, inlet spacing, and inlet velocity.

An intake bar screen will be utilized to prevent large fish from being entrained in the system. A traveling screen will be utilized prior to the circulating water pump suctions. Impingement of these fish on these screens can have adverse effects on both the marine life and plant operation. The water inlet velocity will be less than 1 m/s to minimize impingement of fish and other material on the screens.

Thermal Discharge

Once-through plant cooling water that is discharged to the Bay of Vlorë will increase water temperatures in the vicinity of the discharge location. Industry standards and international regulations concerning thermal discharges generally allocate a specific mixing zone for initial assimilation of process water discharge into a receiving body of water and prescribe maximum discharge temperatures and maximum temperature increases.

Modeling

In order to assess potential thermal impacts from the proposed facility, modeling is performed to determine the potential increase in water temperature to demonstrate compliance with the World Bank thermal liquid discharge limit of less than or equal to three degrees Celsius (^oC).

Thermal impact modeling is performed utilizing the Cornell Mixing Zone Expert System (CORMIX), developed by the United States Environmental Protection Agency (USEPA) and Cornell University. CORMIX was developed to predict pollution discharges into diverse water bodies (rivers, lakes, coastal waters). CORMIX can predict mixing for both conservative and non-conservative first-order decay processes (for toxic pollutants), and can simulate heat transfer from thermal discharges. The model is the USEPA-recommended and internationally accepted analysis tool for point source discharges and has been validated with field and laboratory data.

CORMIX can be used to analyze three different discharge scenarios: submerged single port discharges (CORMIX 1), submerged multi-port diffuser discharges (CORMIX 2) and buoyant surface discharges (CORMIX 3). The model is applicable to steady water body ambient conditions as well as tidal and reversal conditions. Predictions of the plume geometry and characteristics of the initial mixing processes are the emphasis of the model; however, the model can predict the behavior of the discharge plume at greater distances (i.e. distances beyond the initial dilution zone).

In general, the mixing behavior of the cooling water discharge is attributed to the ambient conditions of the receiving water, discharge conditions of the cooling water, and the outfall geometry.

The worst-case thermal modeling scenario was evaluated in accordance with the facility water balance (Appendix C). The worst-case scenario was selected for the operating condition resulting in the highest temperature differential between the effluent and the ambient water body temperature of the Adriatic Sea. This scenario was selected to demonstrate that the cooling water discharge produces acceptable thermal impacts during worst-case operating conditions.

The CORMIX modeling input parameters are presented in Table 6.14.

TABLE 6.14

CORMIX MODEL INPUT PARAMETERS

Input Parameters	
AMBIENT DATA:	
Ambient flow field	Steady
Water body type	Unbounded
Water body depth	2.6 m
Water body depth at outfall	2.6 m
Water body ambient velocity	0.257 m/s
Bottom friction Darcy-Weisbach "f"	0.025
Ambient water body type	Salt Water
Average water body density	1.0285 (13.8 ^{o}C)
Ambient density of water column	Uniform
Ambient wind speed	2 m/s
DISCHARGE DATA:	
Type of discharge port	Multi-port (CORMIX 2)
Side of bank in direction of current	Right
Distance from bank to first diffuser port	586.8 m
Distance from bank to last diffuser port	600 m
Diffuser length	13.2 m

Input Parameters	
Number of openings	12
Port diameter	0.15
Vertical angle of discharge (THETA)	0^o
Angle between current and port centerlines (SIGMA)	0^o
Alignment angle between port centerlines and diffuser (BETA)	90^o
Alignment angle between current and diffuser axis (GAMMA)	90^o
Height of outfall from ocean floor	0.15 m
EFFLUENT DATA:	
Total Diffuser Effluent Flow	1.93 m^3/s
Effluent type	Salt Water
Effluent density	1.0255 (25.26^{o}C)
Heated Discharge	Yes
Surface Heat Exchange Coefficient	17.3 W/m^2 ^{o}C
Effluent Temperature	11.4 ^{o}C
Region of Interest [1](distance out from discharge)	500 m
Output Grid Interval	50

[1]*Modeled distance out from discharge point.*

Ambient Data

The ambient data defines the geometric and hydrographic conditions in the vicinity of the outfall discharge. CORMIX analyses are performed under the assumption of a steady state ambient condition. Although an actual water environment is not truly in a steady-state condition, this assumption is typically adequate for most water bodies because mixing processes are rapid relative to the time scale of hydrographic variations.

CORMIX has the ability to compute plume dispersion in unsteady tidal reversing flows; however, the southern Adriatic Sea does not experience significant tides (rarely above 40 cm[1]). Therefore, it is unlikely that plume re-entrainment will occur due to tidal currents in the vicinity of the outfall. Additionally, re-entrainment is more of a concern for toxic pollutants than

[1] **Average current speed of the Adriatic Sea, Hydrographic and Oceanographic Data: www.planetadria.com.**

thermal discharges. As a result, a steady state ambient flow field is utilized for this thermal modeling analysis.

CORMIX describes the actual cross-section of the ambient water body as laterally bounded (river or stream) or unbounded (lake or coastal water), and uniform in the downstream direction (i.e. not meandering). The uniform, unbounded cross-section assumption utilized in CORMIX is acceptable for the planned Vlorë plant due to the consistent coastline geometry and within 1km off shore of the facility.

The facility outfall pipe is assumed to extend 600 meters offshore at a 45-degree angle from the shoreline. According to the Republika Popullore Socialiste e Shqipërisë map (K-34-123-D-b-1 and D-b-2), the ocean bathymetry shows a water depth of 2.6 meters at 600 meters offshore (slope 0.046 m/m). Therefore, 2.6 meters was utilized as the water body depth in the CORMIX model.

The average speed of the currents in the Adriatic Sea is 0.5 knots[1] (0.257 m/s). The Darcy-Weisbach friction coefficient "f" is utilized by CORMIX to describe the bottom characteristics of the water body. The *CORMIX User's Manual*[2] recommends a range of 0.020 to 0.030 (larger values for rougher conditions) for lakes or coastal areas. A value of 0.025 was assumed to describe bottom conditions in the vicinity of the outfall.

Salt water was specified for the ambient water, and the salt water density is a function of pressure, temperature, and salinity. The salt water density was calculated[3] utilizing a salinity of 38 parts per thousand (ppt)[4], pressure of 2.6 decibar (dbar) (pressure at a depth of 2.6 meters), and water body temperature of 13.8 °C. The density profile at the 2.6 meter depth is assumed to be uniform; the vertical variation in temperature at a depth of 2.6 meters is not expected to exceed 1 °C (vertical variations less than 1 °C can be neglected in CORMIX). An ambient wind speed of two m/s was utilized per the CORMIX *User's Manual* recommendations for a conservative design condition.

Discharge Data: CORMIX 2

CORMIX requires discharge geometry characteristics to establish a reference coordinate system. The geometry includes:

- Location of nearest bank in the direction of the current

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[2] G.H. Jirka, R.L. Donekar, and S.W. Hinton*. Users Manual for CORMIX: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*. September, 1996.

[3] R. Chapman. *A Sea Water Equation of State Calculator*. Johns Hopkins University. February 23, 2000.

[4] Average salinity of the Adriatic Sea, Hydrographic and Oceanographic Data: www.planetadria.com.

- Distance to the nearest bank
- Outfall diameter
- Height of outfall above the ocean floor
- The vertical and horizontal angles of discharge

The multi-port diffuser was designed assuming a port velocity range of 8 to 10 m/s. The total outlet circulating water flow was evaluated, and a conceptual design of 12 ports with a diameter of 0.15 meters was utilized to provide an adequate design velocity.

The modeled diffuser design consists of the following parameters: 13.2 meters long, 12 ports with 1.2-meter spacing, extends 600 meters from the shore at a 45-degree angle (horizontal angle), and 0.15 meters from the ocean floor. The diffuser design is for conceptual modeling purposes and may be revised for the final facility design.

Effluent Data

The outfall water density was calculated from a salinity of 38 ppt, pressure of 2.6 dbar, and a water temperature of 25.26 oC.

CORMIX allows for three types of pollutant discharges: conservative pollutant (pollutant that does not undergo decay/growth), non-conservative pollutant (pollutant that undergoes a first-order decay or growth process), or a heated discharge. For the purposes of this analysis, a heated discharge is selected. A heated discharge will experience heat loss to the atmosphere where the plume interacts with the water surface (usually occurs in far-field mixing). Therefore, a surface heat exchange coefficient is specified, and the coefficient is a function of ambient water temperature and wind speed. The heat exchange coefficient is 17.3 W/m2 oC (ambient water temperature of 13.8 oC and wind speed of 2 m/s)5.

CORMIX interprets the thermal effluent concentration as the excess concentration above the ambient background concentration. Therefore, the effluent concentrations utilized in the model represent the excess temperature of the discharge over the ambient water body temperature (35.4 oC – 24.4 oC = 11 oC).

The model region of interest is 500 m, which represents the region where mixing conditions are to be analyzed. The region of interest is the maximum analysis distance in the direction of mixed effluent flow. The edge of the mixing zone occurs at a distance of 23 meters from the multi-port diffuser; therefore a 500 m region of interest will provide analysis of the mixing zone and waters beyond (the mixing zone is described in the following section). The output grid interval ranges from 3 to 50 with the higher values providing the most detail. An interval of 50 was specified to determine final plume predictions, and provide detail for determining plume dimensions.

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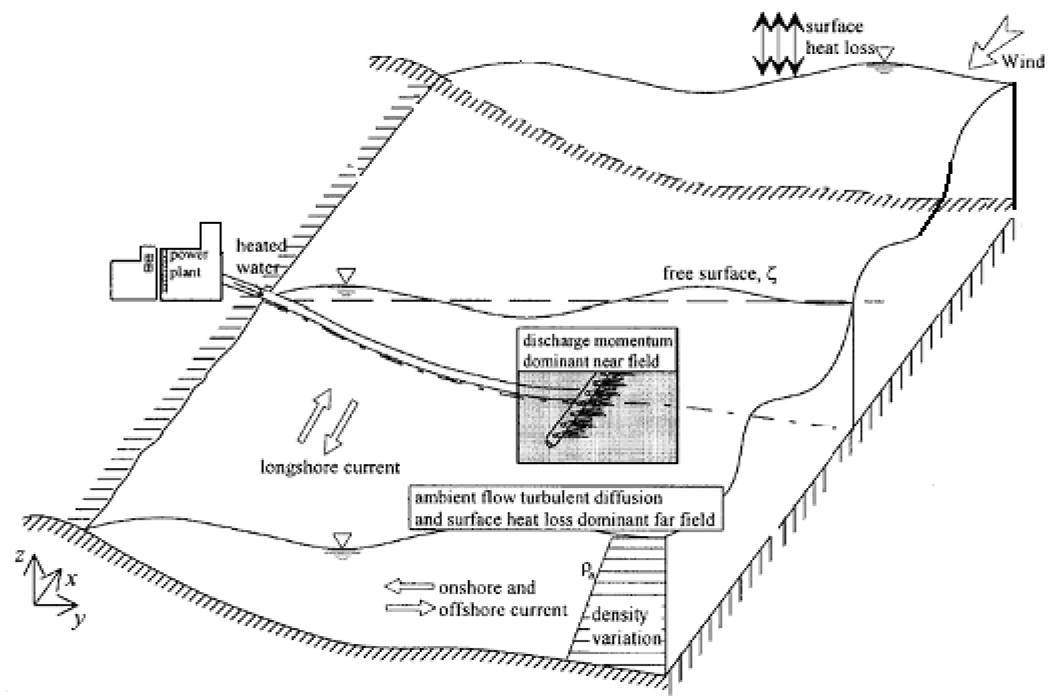
[5] E. Adams, D. Harleman, G. Jirka and K. Stolzenbach. *Heat Disposal in the Water Environment – Surface Heat Exchange Coefficient*. Course Notes, R.M. Parsons Library, Massachusetts Institute of Technology, 1981.

Figure 6.5 shows a schematic representation of the thermal diffuser for the power generation facility. The diffuser is a multi-port design with twelve diffuser ports. The diffuser rests on the seabed.

Figure 6.5

Schematic of Multi-Port Diffuser for Thermal Discharge



CORMIX Model Output

The CORMIX model output provides plume geometry as well as pollutant concentration at a reference distance from the outfall. CORMIX distinguishes two flow regions: near-field and far-field. The near field region mixing is caused by the initial flux of the discharge (volume, momentum, and buoyancy flux) and outfall geometry. This area is typically the jet subsurface flow and any surface or bottom interaction. The far-field region mixing is influenced by the ambient water body conditions (current, density).

In order to determine the plume region to demonstrate compliance with the thermal water quality requirements, a regulatory mixing zone is applied. A regulatory mixing zone is the region in which initial dilution of a discharge occurs (which can occur in the near-field or far-field mixing region). The USEPA established regulatory mixing zone definitions for discharges from diffusers. The mixing zone is established according to the USEPA guidance document Technical Support Document for Water Quality-based Toxics Control (EPA Publication EPA/505/2-90-001, 1991). The proposed mixing zone is 50 times the discharge length scale, which is defined as the square root of the cross-sectional area of the discharge port openings. The mixing zone calculation is as follows:

$[\pi(0.15\ m)^2 / 4] \times 12$ ports $= 0.21\ m^2$ <cross-sectional area of discharge port openings>

$\sqrt{(0.21\ m^2)} = 0.46\ m$

$0.46\ m \times 50 = 23\ m$

Therefore, for the purposes of this analysis, a rectangular mixing zone 23 meters in length is utilized to determine compliance with thermal water quality regulations. The mixing zone width will be determined by the plume half width dimensions provided in the CORMIX output file. The increase in temperature at the edge of the regulatory mixing zone is 0.87 ^oC.

The CORMIX results determined that during worst-case conditions, and the temperature increase at the edge of the mixing zone is within the liquid discharge limit of less than or equal to 3 ^oC. It is unlikely that the thermal impacts of the cooling water discharge will be greater than the modeled results given the conservative nature (over predicting impacts) of the modeling, however, if the impacts are found to be greater than predicted after operation of the facility begins, modifications to the diffuser can be made to enhance diffusion of the thermal plume. The contractor building the facility to confirm these results based on the final design should do final thermal impact modeling. The model results indicate that there will be no adverse impacts to the Bay of Vlorë or the Narta Lagoon from the thermal discharge.

Chemical Discharge in Cooling Water

Chemical discharge in the plant cooling water is expected to be negligible. The only chemical that will be directly added to the cooling system is sodium hypochlorite, which is added to prevent biofouling of cooling system components. Other than the hypochlorite addition, cooling water will simply be pumped from the sea, circulated once through the plant and discharged back to the sea. Chlorine concentrations in the process water will be maintained at or below 0.2 mg/l to minimize the effect of chlorine at the cooling water discharge point. The onsite membrane desalination system, demineralization system, and associated neutralization system will provide a brine concentrating effect for a very small portion of the total discharge flow. The World Bank discharge standard for residual chlorine is 0.2 mg/l. There are no EU or Albanian standards for such a discharge. There will be no adverse impacts on the Bay of Vlorë or the Narta Lagoon from the chemical discharge from the plant.

Wastewater Discharge

The low flow wastewater discharge from the Project's SWTP is expected to meet international discharge criteria and is not expected to significantly impact the surrounding aquatic environment. Wastewater discharges will be designed to comply with the World Bank standards found in Table 6.15. There will be no adverse impacts on the Bay of Vlorë or the Narta Lagoon from the wastewater discharge from the plant.

Table 6.15

World Bank General Effluent Guidelines

Parameter	Effluent Guideline (mg/l except pH)
PH	6-9
BOD_5	50
COD	250
TSS	50
O&G	10
Phenol	0.5
CN^-	Total: 1 Free: 0.1
N	NH_3: 10
P	2
F	20
Cl	0.2
Coliform	400MPN/100 ml
Temp. Increase	∗3°C
Sulfide	1.0

7 ANALYSIS OF ALTERNATIVES

To fulfill the Albanian Ministry of Energy's mandate to have a reliable supply of power and energy to its customers, the addition of new installed generation capacity is required. The 'without project' alternative would mean that Albania would not meet these commitments. The power project is greatly needed to meet the electrical demand in the country and to help to stabilize the electrical transmission system and minimize system losses.

The Albanian electric power system is predominantly hydro, with hydropower representing more than 98 percent of the total electricity production in the country. These plants rely on water sources with a high degree of hydrologic variability. The existing hydropower plants in Albania produced 4,586 gigawatt-hours (GWh) in 2000 and 3,541 in 2001. Electricity generation from thermal generating units amounted to 144 GWh in 2000 and 137 GWh in 2001. In addition, net imports were 1,002 GWh in 2000 and 1,750 GWh in 2001.The plant mix in Albania consists of three large hydropower plants with large reservoirs, a number of smaller hydropower plants, and two thermal power plants. The three large hydropower plants are Komani (600 MW), Fierza (500 MW), and Vau i Dejes (250 MW). Small hydropower plants are Ulza (26.2 MW), Shkopeti (24 MW), Bistrica 1 (22.5 MW), Bistrica 2 (5 MW), Lanabregasi (5 MW), and Smokthina (9 MW). As shown in Table 7.1, the total installed capacity of hydropower plants in Albania is 1,442 MW.

TABLE 7.1

EXISTING HYDROPOWER PLANTS

Hydro Plant Name	Installed Capacity (MW)	2001 Annual Generation (GWh)
Komani	600	1,521
Fierza	500	885
Vau i Deyes	250	779
Bistrica 1	23	88
Small HPP's	69	268
TOTAL	1,442	3,541

Source: NAE

The two thermal power plants are Fier and Ballsh. Fier has six units with a total installed capacity of 159 MW, while Ballsh has two units with a total installed capacity of 24 MW. The Ballsh power plant stopped producing electricity in 1996. Currently, it only provides process services to the refinery nearby. Both power plants are rather old and in very poor operating condition. The maximum continuous power outputs of generating units are significantly lower than their rated power. The total available capacity of all thermal generating units in 2000 was estimated at about 100 MW. The main characteristics of the Fier thermal generating units are presented in Table 7.2.

TABLE 7.2

EXISTING THERMAL GENERATING UNITS

Unit Name	Installed Capacity (MW)	Net Available Capacity (MW)	Heat Rate (kJ/kWh)	Fuel Type
Fier 1-2	2 X 12	2 X 7.5	12,700	HFO*
Fier 3-5	3 X 25	3 X 17.5	12,700	HFO*
Fier 6	60	37.7	12,700	HFO*
TOTAL	159	105.2	---	---

**Heavy Fuel Oil*

Source: NAE

Two studies were conducted as part of an in depth alternative analysis; The Final Siting Study and the Final Feasibility Study, both conducted by MWH and issued in October 2002. In the Final Siting Study, a number of alternative locations, fuels, and generation technologies for a new generation plant were examined. The evaluation criteria used in the study are as follows:

- Environmental remediation - Many of the identified sites were located in brownfield locations. MWH evaluated each site in terms of whether environmental remediation would potentially be needed. Due to the potential for large clean-up costs and the importance of environmental clean-up to multilateral financial institutions, this factor was given a high level weighting.

- Air quality concerns - MWH evaluated emission sources in the area of the proposed site and how the topography would affect air quality. Air quality, while important to the development of a generation facility, can be mitigated through different measures. Thus, this factor was given a medium level weighting.

- Levelized generation cost - While all of the other criteria have costs implicitly associated with them; MWH evaluated each site from an overall levelized generation cost basis as well. The levelized generation cost was based on initial capital costs, fixed and variable operations and maintenance (O&M) costs, fuel costs, net plant heat rates, capacity factors, and capital expenditures. The economics were also given a high level weighting due to their importance.

- Socio-Economic concerns - MWH also evaluated socio-economic issues including the location of residential areas, religious buildings, cemeteries, schools, wetlands, environmentally protected areas, etc. relative to the proposed site, as well as the generation facility's potential impact on these items. Noise was also evaluated here.

Once again, while important to the siting of a new generation facility, this factor does not necessarily present a fatal flaw, thus the medium level weighting.

- Reduction in transmission system losses and voltage profile improvement - Albania' power system has a low voltage profile. The development of a new plant in the system, whether its capacity is 100 or 300 MW, will affect the voltage profile of the power system. Any voltage improvement to the power system provides direct financial benefit to the owner of the system through lower fuel costs, less electricity imports, etc. Transmission is a critical factor in determining the viability of a new generation facility. As a result, it was given a high level weighting.

- Transmission availability and proximity - MWH also evaluated the transmission capacity of the site (100 and 300 MW) as well as its proximity to the nearest interconnection point. Since the development of new transmission lines and towers to the nearest interconnection point can be extremely costly, MWH gave this criteria a high level weighting.

- Fuel availability - MWH evaluated the accessibility of the following fuel sources: natural gas, distillate oil, and coal. Fuel sources were evaluated based on the location of oil and natural gas pipelines, coal mines, coal unloading facilities, oil storage facilities, etc. Through experience, MWH has determined that fuel availability is one of the key fatal flaw factors in the siting of a new generation facility. The high level weighting results from this.

- Water and sewer needs - Every generation facility requires water to meet its service, cooling, process, and potable requirements. As a result, MWH evaluated each site on the location, quantity, and quality of the water source, as well as water discharge requirements and infrastructure. Water availability is very important to a generation facility, and thus it is also given a high level weight.

- Transportation - MWH evaluated each site on the existing transportation infrastructure (roads, rail, navigable waterways) to support not only delivery of fuel and regular plant consumables, but initial construction equipment and supplies. Transportation tends to be a medium level factor, as many generation facilities can economically make transportation upgrades during the construction period.

- Property availability - MWH also evaluated each site in regards to property availability for current development and future capacity expansion. This factor typically does not become a fatal flaw in the development of a generation facility because land typically can be procured without major problems. Thus, this criteria was given a lower level weighting.

The original scope of services included the following locations: Durrës, Elbasan, Korçë, Shëngjin, and Vlorë (Site 6A). Vlorë (Site 6B) was identified as a potential site location during the site visits, due to it being a greenfield location and its close proximity to an offshore oil tanker terminal. The siting study concluded that the Vlorë site represents the most feasible option for a 100 MW nominal, distillate oil-fired, combined cycle unit from a transmission, environmental, social impact and cost point of view. Please read the Final Siting Study for further details.

Further study of the selected site was conducted and summarized in the Final Feasibility Study. That study confirmed that the least cost generation, most environmentally acceptable option for the site is a distillate oil-fired combined cycle unit. Please read the Final Feasibility Study for further information.

A combination heat and power (CHP) plant was not considered for the Vlorë B site because there is no steam host at or near the site to take steam for process or heating use. A combined cycle plant can easily be modified to divert steam for heating purposes (at the expense of electric generation). The capital costs of the modification vary based on the quantity and required conditions of the export steam. Currently, no potential steam users exist in the area surrounding the plant site.

The air pollution control for the proposed power generation facility includes state of the art equipment for control of all of the air pollutants emitted. Options available for control are limited because of adverse environmental impacts, and technical limitations. SO_2 scrubbing is never applied to distillate oil fired combustion turbine exhaust because of the impracticality of removing low concentrations of SO_2 and the adverse environmental impacts of a scrubber system – large quantities of solid waste and an additional waste water flow. Catalytic oxidation systems for CO, and NOx control are not effective on oil-fired systems because of catalyst fouling by particulates and poisoning by SO_2. Particulate control is impractical because of the low levels of particulates emitted by distillate fired turbines.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 MITIGATION

The planned Vlorë Electric Generation Facility will provide positive benefits to all of Albania. The citizens of Vlorë will have new employment opportunities including skilled tradesmen positions. As a result of the generation addition, the electrical transmission system stability and reliability will increase and electrical losses will decrease. The potential negative impacts posed by the facility can be minimized. This section discusses mitigation measures for potential negative impacts from construction through operation. A preliminary cost estimate for the measures is also presented in this section.

The mitigation measures for the construction and operational phases are summarized in Tables 8.1 and 8.2, respectively. These tables identify mitigation measures that should be implemented to minimize the predicted effect of each activity. All facets of the mitigation plan is included as good engineering practices and best management practices, and is therefore already included in the current project cost.

TABLE 8.1

CONSTRUCTION PHASE MITIGATION

Activity	Potential Effects	Mitigation Plan	Responsibility	Approximate Cost Impact*
Site Work – Clearing and Grading	Loss of Trees	There are few trees that are potentially affected by the Site work. No trees should be cut that do not interfere with the site work. The wood that is cleared will be made available to local residents.	EPC Contractor	$5,000
Site Work – Clearing and Grading	Interference with Natural Site Drainage – Soil Erosion	Final site grade will facilitate drainage and avoid flooding and pooling. A site drainage plan will be developed that protects against erosion. Protecting stockpiles through the use of silt fencing and reduced slope angles will also minimize soil erosion during construction.	EPC Contractor	$40,000
Site Work – Clearing and Grading	Noise from Equipment	Construction equipment shall meet the applicable standard in EU Directive 2000/14/EC of May 2000. This Directive applies to the manufacturer of the noise emitting equipment. Work involving nuisance noise should be minimized during locally recognized days of rest and at night. All equipment should be maintained in good working order.	EPC Contractor	Minor

Site Access Upgrades - Roadwork	Dust and Noise from Equipment	Watering of disturbed site areas on an as needed basis will minimize dust. No equipment noise should exceed the applicable standard in EU Directive 2000/14/EC of May 2000. This Directive applies to the manufacturer of the noise emitting equipment. Work involving nuisance noise should be minimized during locally recognized days of rest and at night. All equipment should be maintained in good working order.	EPC Contractor	$5,000
Dewatering	Sediment and Oil and Grease loading to Nearby Waterways	Where site excavations requiring dewatering, the excess water should be visually inspected for oil contamination prior to discharge to the site drainage system. Oil contaminated water will require treatment prior to disposal. Water potentially contaminated with oil will be routed to the onsite water oil/water separator (OWS). Package OWS typically remove oil below the manufacturers guarantee of 10 ppm.	EPC Contractor	$7,500
Borrow Site	Conflicts with Present Land Use	Borrow area should avoid agricultural areas.	EPC Contractor	Minor
Borrow Site	Disturbance to Local Community	All permits and approvals should be obtained from the appropriate authority prior to operating a borrow site.	EPC Contractor	$2,000
Borrow Site	Unsightly Area Finished with Borrow Activity	Borrow areas should be reworked to blend into the surroundings. Revegetation should be performed using local plants. All slopes and working faces should be returned to a stable condition.	EPC Contractor	$4,000
Disposal of Excavated Material if Necessary	Interference to Natural Drainage	The amount of material to be disposed of should be minimized by borrowing only as much as is needed.	EPC Contractor	Minor
Disposal of Excavated Material if Necessary	Disturbance to Land	Local authorities should approve the disposal site. It should not interfere with local land use. Vegetation should be performed using local plants. All slopes at a borrow disposal site should be graded to a stable condition.	EPC Contractor	$2,000
Transmission Interconnection	Disturbance to Land	The amount of land used for the transmission interconnection should be minimized. No agricultural lands should be disturbed by the transmission line. Private land acquisition should follow the procedures that are based on Albanian Law No. 8561, dated 12/22/99; Government Decree No. 126, dated 3/23/00; Government Decree No. 127, dated 3/23/03; Government Decree No. 138, dated 3/23/03; Government Decree No. 147, dated 3/31/00.	EPC Contractor	Minor
Provision of Potable Water	Reduced Water Supply to Area Residence	The water supply for use in construction of the generation facility must be monitored to ensure that it does not adversely affect other water uses in the area.	EPC Contractor	$5,000

Handling and Storage of Fuels and Hazardous Materials	Potential Health and Safety Concerns	All employees should undergo health and safety training. Those dealing with hazardous materials should receive specific training in handling the materials. There will be no ash generated from the oil combustion. Hazardous waste generated will primarily be from waster lubricants and rags from clean-up and maintenance activity.	EPC Contractor	$12,000
Handling and Storage of Fuels and Hazardous Materials	Soil and Water Contamination from Spills	Fuel storage tanks will have secondary containment with sufficient volume to contain a spill from the largest tank in the containment structure. The containment area will have a means of removing accumulated water. Drains will be routed through the site oil/water separator. A spill and emergency response plan will be developed and put in place prior to commencement of construction.	EPC Contractor	$30,000
Aggregate Source	Reduced Local Resources	No new sources should be developed. Existing quarries will be utilized.	EPC Contractor	Minor
Batch Plant – Concrete and Asphalt	Noise, Dust, and Potential Runoff Concerns	Storm water runoff should be directed to the site drainage system. Noise should be controlled to an acceptable level. Dust bags should be installed as necessary. The EPC specification will require that the batch plant owner/operator must hold valid operating permits.	EPC Contractor	$2,000
Construction Work Force	Influx of Workers Creating Pressure on Housing and Other Resources	Influx of workers is not expected to exceed 350 to 500individuals. Workers will be housed in Vlorë and bussed to the Site. A first aid station will be provided for workers onsite.	EPC Contractor	$10,000
Delivery of Equipment and Materials	Increased Traffic and Dust	Upgrade of the main access road to plant will have positive effect on local traffic. Dust from the road should be minimized with water during construction and by providing paved surface. Trucks should be tarped when carrying load. Road speeds should be controlled to reduce the potential for accidents.	EPC Contractor	$200,000
Solid Waste Disposal	Potential Health Concerns	Solid waste should be disposed of using a licensed contractor.	EPC Contractor	$20,000
Liquid Waste Disposal	Potential Water Contamination	A packaged sewage treatment facility will be provided for the site. No direct discharge of untreated liquid waste will be allowed.	EPC Contractor	$95,000

Intake and Outfall Construction	Disturbance of Aquatic Resources	Main mitigation is in siting the exact location of the intake and outfall. Construction wastes will not be disposed of in the bay. Intake design should follow the USEPA Draft Guidance for Evaluating Adverse Impact of Cooling Water Structures on the Aquatic Environment and the European Commission IPPC reference Document on the Best Available Techniques for Industrial Cooling Systems.	EPC Contractor	$200,000
Intake and Outfall Construction	Interference to Coastal Fishing	Construction period should be scheduled to minimize impact on fisherman.	EPC Contractor	Minor
Intake and Outfall Construction	Interference to Navigation	All barges and buoys should be clearly marked and illuminated at night. Proper authorization should be obtained prior to commencement of offshore work.	EPC Contractor	$20,000
Intake and Outfall Construction	Sediment Release	Intake and outfall should be constructed with the intent to minimize the release of sediments to the bay.	EPC Contractor	$50,000
Final Site	Aesthetics	Topsoil will be graded and planted as appropriate.	EPC Contractor	$5,000

**Minor costs are less than $2,000*

TABLE 8.2

OPERATION PHASE MITIGATION

Activity	Potential Effects	Mitigation Plan	Responsibility	Approximate Cost Impact*
Distillate Fuel Oil Combustion	Air emissions of NOx, SO_2, CO, particulate matter, and volatile organic compounds that can adversely affect human health and the environment.	The combustion turbines will employ state of the art control technology for all pollutants. NOx will be controlled using water injection. SO_2 will be controlled by firing only low sulfur (<0.1% by wt.), distillate fuel oil. Employing good combustion control will control CO, particulate matter, and volatile organic compounds. The plant will feature stack heights that conform to good engineering practice (GEP) stack height to facilitate dispersion of emitted gasses. The stack height should be 47 m from grade.	EPC Contractor / KESH	$1,000,000
Equipment Operation	Noise from Equipment	The combustion turbines will be enclosed in an acoustic enclosure to ensure that noise does not exceed 85 dB(A) at 1 m. Workers in close proximity to this equipment should be required to use hearing protection. Offsite noise will not exceed 70 dB(A).There is no residential housing in the area of the site.	EPC Contractor / KESH	$180,000

Cooling Water Intake	Entrainment of larval fish, shellfish, and other marine fauna.	Final location to be made to minimize impact on aquatic environment. Bar screen intake screens will be utilized. Final screening with traveling water screens at cooling water pump suctions will be employed. An inlet velocity less than 1 m/s to should be used to minimized entrainment.	EPC Contractor	For Location see Table 8.1
Cooling Water Intake	Impingement of adult and juvenile fish and shellfish.	See Above		
Cooling Water Discharge	Thermal effects on marine fauna.	Thermal discharge modeling demonstrates that the thermal impact from the discharge is less than or equal to 3 ^{o}C after mixing zone. This ensures that there is minimal impact from the discharge. The discharge should be designed to minimize or eliminate re-suspension of sediment in the vicinity of the outfall.	KESH	Minor
Fresh Water Supply	Reduce water supply to the local community.	The plant will supply its own service water supply from the Adriatic Sea through a membrane desalinization system.	EPC Contractor / KESH	$1,000,000
Sewage Treatment	Discharge of nutrients and other contaminants to waterways	A sewage treatment facility will be provided at the plant and discharge of treated effluent will be combined with the cooling water discharge.	EPC Contractor / KESH	See Table 8.1
Local Community Services	Stress on the local infrastructure	The infrastructure of the city of Vlorë will be able to accommodate the amount of new residence of new workers in the plant even if all workers come from outside the city. However, it is anticipated that many of these workers will be from the Vlorë area.	KESH	Minor
Handling and Storage of Fuels and Hazardous Materials	Delivery of fuel oil could result in a spill that would impact the aquatic and coastal environment	A spill response plan and necessary response equipment should be provided. It is anticipated that as many as 30 deliveries will be made per year. Monitoring and enforcement of sea conditions under which a vessel may make deliveries should be part of the plant procedures and implemented through the delivery contract.	KESH	$50,000
Handling and Storage of Fuels and Hazardous Materials	Pipeline between the terminal and the site could rupture and impact the aquatic and coastal environment	The pipeline should be regularly inspected and maintained. An inspection and maintenance program should be developed as part of the plant operating procedures.	KESH	$15,000
Handling and Storage of Fuels and Hazardous Materials	Oil storage tanks could fail and result in adverse impacts on the soil and groundwater resources	Oil storage tanks will include secondary containment of sufficient size to contain 110% of the contents of the largest tank. A means of removing rainwater will be included. Drains will be routed through the plant oil/water separator.	EPC Contractor / KESH	See Table 8.1

Transmission of Power	Disturbance to Land	Clearing for transmission lines should be minimized. Lines should be routed to minimize the impact on residential areas. The electromagnetic field (EMF) emitted by the line will be checked.	KESH	Minor
Aesthetics	Aesthetically displeasing appearance may affect the tourist appeal of the coast.	Some disruption is unavoidable. The plant will be shielded by trees and set back from the ocean. Landscaping will be used to enhance the appearance of the generation facility.	KESH	$20,000

**Minor costs are less than $2,000*

The major environmental concerns requiring mitigation, arising from construction and operation of the proposed plant, can be grouped into three areas:

- Air emissions
- Effects on the marine environment
- Social requirements

8.1.1 Air Emissions

The best available technology for controlling air emissions will be used at the Generation Facility in order to meet applicable air quality and emission control standards. The combustion turbines will employ good combustion control and water injection technology to control the emission of nitrogen oxides (NOx). In addition, the combustion turbines will also use good combustion control to reduce emissions of carbon monoxide (CO) and volatile organic compounds (VOC). The combustion turbines will use low sulfur distillate fuel oil to control emissions of sulfur dioxide (SO_2). All emissions will meet the World Bank and EU standards and ground level impact concentrations will meet World Bank and EU air quality standards as well.

The NOx control equipment requires that water be injected into the combustion turbines at a maximum rate of approximately 325 liters per minute for each unit. This amount of water is available from the planned desalinization system at the plant. The incremental cost of this mitigation measure has been estimated at approximately US$ 2.5 million.

8.1.2 Effects on the Marine Environment

Further marine investigations are required by the EPC Contractor to select the exact locations for the intake and discharge portals. The major mitigation costs will be from monitoring at the intake and discharge location.

Location of Intake

The intake will be fitted with a velocity cap, and raised off the sea bed. Buoys shall be placed to indicate the location of the intake. Detailed preconstruction marine investigations will be required to select an intake location that does not inflict undue impacts. These studies will include physical and biological components. At this time, it is not considered that the environmental requirements will affect the cost of the Intake construction, which is estimated at $2.0 million.

Location of the Discharge Outlet

Field studies will be required to determine the most suitable location for the discharge outlet. Generally, the outfall must be located off shore of the most distant 6-m contour and away from important shellfish beds and fish concentration areas. It is expected that only a nozzle will be required but the exit velocity of the water must not be less than 2 m/s to ensure more rapid mixing of the discharged water. The outfall shall extend a minimum of 600 m from shore. Cost of the outfall construction is approximately US $2.0 million, which includes provision of the nozzle. The field investigations required to select an appropriate discharge location will be undertaken at the same time as the intake site selection studies.

Existing Oil Tanker Ship Offloading Facility

The existing oil tanker offloading facility is a single point mooring (SPM) approximately 3.4 km from shore. The SPM will be inspected during construction of the facility and upgraded to meet safety requirements and minimize the potential for oil spillage into the bay. Warning lights should be installed on the SPM

Oil Spill Response/Recovery Mitigation Plan

It is assumed that there are currently no dedicated oil spill response teams or oil recovery equipment in Vlorë and spillage or leakage may potentially occur at the SPM. Therefore, the plant should work with the Vlore Port Authority to develop an action plan to provide an initial response capability. The goal of the initial response would be to stabilize the situation, and contain a spill or release to as small an area as possible, preventing further dispersal along the shoreline or out to sea. The minimum equipment considered necessary for the initial response includes the following:

- A vessel capable of operating in in-shore waters and carrying 50 m of floating, oil containment boom,
- 50 m of oil containment boom
- Oil recovery pump to transfer oil on water's surface to barge/tanker
- Sorbents/dispersants to collect/disperse oil outside boom enclosure to acceptable levels

To counteract chronic small-scale spills at the SPM, the generation facility should stipulate in the oil purchasing contract that the supplier employ a "designated crew." In this way the crew would become familiar with local conditions and off-loading procedures. The contract should require that the supplier be financially liable for any environmental damage of spilled oil and that the tanker deploy a floating oil containment boom during all oil transfer and connect/disconnect operations. Training sessions and drills should be undertaken with tanker crews and other emergency response personnel to ensure that everyone is aware of his responsibility. A procedure should be developed by the plant to oversee the oil transfer at the SPM.

Training of personnel would be required for the proper and timely response to oil spills and releases. Training should address vessel operation, boom deployment, and operation of the oil recovery pump, as well as the most efficient methods of restricting and/or collecting oil on the sea surface. The plant should develop an oil spill response and contingency plan in sufficient detail to ensure that proper initial responses are implemented. The plan should include the following information:

- The names and responsibilities of the spill response coordinator and team members
- The procedures for notifying the spill response coordinator and team members of oil spills and release
- The procedures for notifying off-site agencies and organizations of spills and coordinating the response of these groups with on-site personnel;
- A list and the location of all spill response equipment and materials
- The general procedure to be followed for responding to spills depending on size
- (i.e.. large or small) and location (i.e. SPM, near-shore, full storage tanks, and other on-shore fuel handling and storage facilities)
- Record keeping and reporting requirements
- Decontamination procedures of personnel and equipment after a clean up or other spill response have been completed.

In regards to spill response, the plan should present the procedures to accomplish the following:

- Identify and secure the source of the spill
- Identify the quantity and state of the spilled material - especially with reference to the potential for combustion
- Determining the size (area) of the spill and predicting the spill movement
- Containing the spill until clean-up and recovery are initiated.

The oil spill response and contingency plan developed by the plant for the initial response should describe how that plan is to be integrated into any existing national response plan.

The use of chemical dispersants may be necessary in some situations. Chemical dispersants have the potential to spread the toxic components of oil while helping to break-up a spill. Because dispersal may increase the potential for the biological exposure to the toxic components of oil, the plant should minimize the use of chemical dispersants in spill responses. Natural, locally occurring materials should be used as adsorbents to the extent that is possible.

Different responses should be employed depending on the direction of movement of the oil spill. If the spill is moving on-shore, containment and recovery followed by shoreline clean-up may be appropriate. If the spill is moving off shore, monitoring of the spill movement and dispersal may be the course of action. The plant's plan should identify the conditions under which spills need to be contained and recovered.

8.1.3 Social Requirements

Loss of Land

The land to be used for the generation facility is currently owned by the Albanian government. There are no issues with displacement of residence or land use.

Loss of Fisheries

As yet, this is an unknown factor. It is not anticipated that there will be a major change in fisheries. However, monitoring is required.

Influx of Non-Local Workers

It is expected that most of the construction work force will be from the Vlorë area, while the remainder will be from other parts of Albania. It is not anticipated that an influx of workers to support the project will put excessive pressure on the existing social services. The construction supervisory staff will not likely be local and will be temporarily housed in Vlorë.

Residual Impacts After Mitigation

There will be some unavoidable impacts that cannot be completely mitigated. These include the following:

- Air emissions
- Entrainment and impingement of marine organisms at the cooling water intake
- Change in marine environment at outfall
- Visual appearance of area
- Potential for new housing and permanent population of up to 50 families

8.2 COSTS OF MITIGATION MEASURES

The major mitigation costs are associated with air quality control and the effort to select the exact cooling water intake, and discharge locations, and to perform monitoring. In addition, a number of social impacts are forecasted, the full extent of which has not as yet been fully determined. Social issues primarily deal with the operational impacts of the station on the local communities and the surrounding area and the provision of a community impact agreement. It is recommended that a provisional sum be set-aside for the first three years of operation to address potential community impacts. After that time, the situation should be reassessed and an action plan developed as required for future operations.

Environmental mitigation costs are estimated at approximately 1.25 percent of the total project costs ($1.25 million).

8.3 MONITORING

The monitoring program will be used to verify that predictions of environmental impacts, developed in the design phase, are accurate and that unforeseen impacts are detected at an early stage. This allows corrective measures to be implemented before significant damage has taken place. Monitoring programs for each of the major environmental components are identified and defined in separate sections below, it is necessary that one agency or individual maintain a coordinating role to oversee and report on the outcome of all the studies.

8.3.1 Preconstruction

No preconstruction monitoring will be done. Monitoring will be part of the plant construction and operation.

8.3.2 Construction

Each of the parameters identified in the construction mitigation plan will be monitored during construction. Table 8.3 identifies the monitoring parameters and responsibilities during construction. More specific information is given for various monitoring later in this section.

TABLE 8.3

MONITORING PLAN FOR CONSTRUCTION

Activity	Monitored Parameters	Responsibility
Site Work – Clearing and Grading	The practice of sharing the wood that is cleared with the local residents should be monitored.	EPC Contactor
Site Work – Clearing and Grading	Protecting stockpiles through the use of silt fencing and reduced slope angles to minimize soil erosion during construction should be monitored to ensure that the practice conforms to site drainage plan.	EPC Contractor
Site Work – Clearing and Grading	See detail provided later in this section.	EPC Contractor

Site Access Upgrades – Roadwork	See detailed discussion later in this section.	EPC Contractor
Dewatering	Maintain a record of visual inspection of excess water from dewatering activity.	EPC Contractor
Borrow Site	Monitor and document that borrow areas avoid agricultural areas.	EPC Contractor
Borrow Site	Obtain and maintain applicable permits.	EPC Contractor
Borrow Site	Document final condition of borrow areas to ensure that they have been reworked to blend into the surroundings and are safe.	EPC Contractor
Disposal of Excavated Material if Necessary	Monitor and document the use of borrow material.	EPC Contractor
Disposal of Excavated Material if Necessary	Obtain and maintain applicable permits. Document final condition of borrow areas to ensure that they have been reworked to blend into the surroundings and are safe.	EPC Contractor
Transmission Interconnection	Document the amount of land used for the transmission interconnection and that no agricultural lands are disturbed.	EPC Contractor
Provision of Potable Water	Monitor water supply to ensure that it does not adversely affect other water uses in the area.	EPC Contractor
Handling and Storage of Fuels and Hazardous Materials	Document health and safety training.	EPC Contractor
Handling and Storage of Fuels and Hazardous Materials	Spill Response Plan	EPC Contractor
Aggregate Source	Records will be kept on quarries utilized	EPC Contractor
Batch Plant – Concrete and Asphalt	See Noise detail later in this section. Visible inspection of dust emissions should be performed daily with records of results.	EPC Contractor
Construction Work Force	A first aid station will be provided for workers onsite.	EPC Contractor
Delivery of Equipment and Materials	Visible inspection of dust from road construction should be ongoing and application of water should be employed to suppress dust during periods of high dust generation. Road speeds should be clearly posted.	EPC Contractor
Solid Waste Disposal	Contact for proper disposal of solid waste should be kept onsite. Records on the date of disposal and the amount and type of solid waste disposed should be maintained.	EPC Contractor

Liquid Waste Disposal	Monitoring of the appropriate operational parameters should be performed as per the manufacturer's requirements.	EPC Contractor
Intake and Outfall Construction	Documentation on the siting study performed to locate the intake and discharge should be maintained onsite.	EPC Contractor
Intake and Outfall Construction	Documentation on the siting study performed to locate the intake and discharge should be including a construction schedule and information on historic fishing activity. A copy of this report should be maintained onsite.	EPC Contractor
Intake and Outfall Construction	Documentation of construction authorization should be maintained onsite	EPC Contractor
Intake and Outfall Construction	The construction technique and means of minimizing sediment releases should be documented and a copy maintained onsite. Monitoring of mercury in sediments should be carried out if excavating and dredging are performed as part of the intake and outfall construction.	EPC Contractor
Final Site	A plan for final grading and landscaping of the site should be developed and maintained onsite.	EPC Contractor

Air Quality

The following parameters are to be monitored during the construction period:

- Hi-Vol dust
- Traffic dust

Hi-Vol dust sampling for a 24-hr period, once per month, throughout the construction period. The Hi-Vol samples will be used to monitor the impact of emissions from the batch plant. Dust from traffic movement will be spot-checked throughout the construction period to determine whether dust control measures are effective, or if further measures are required. Air quality will be monitored in confined spaces for worker safety when necessary.

Noise

Noise will be monitored once, at both day and night, for an eight-hour period at the perimeter of the site during the peak of construction activity. In addition, spot monitoring of various pieces of construction equipment will take place to ensure that noise emissions are not excessive. The site construction manager will maintain records of any noise complaints received during the construction process.

Terrestrial Environment

No specific monitoring of the terrestrial environment is proposed during the construction stage. It is assumed that site supervisors would be responsible for implementing best management practices and ensuring that disruption does not occur to site resources.

Site Drainage

In order to ensure that storm water discharge from construction site is effective, the drainage swales will be inspected on a weekly basis.

Marine Environment

No specific program is proposed to monitor construction activities in the marine environment. However, there should be on-going environmental inspections. Impacts related to the construction of the intake and discharge points, and work on the oil offloading terminal and SPM anchor will be local, and of short duration. Adherence to Best Management Practices, in terms of marine construction and disposal of waste materials, by the contractor involved in these activities should be stipulated in contract tender documents. Offshore disposal of excavated dredged material, if needed, will be as directed by the Albanian Ministry of the Environment. If monitoring of suspended solids is stipulated as part of their approval, it will be undertaken.

8.3.3 Operations

Each of the parameters identified in the operation mitigation plan will be monitored during construction. Table 8.4 identifies the monitoring parameters and responsibilities during operation of the facility. More specific information is given for various monitoring later in this section.

TABLE 8.4

MONITORING PLAN FOR OPERATION

Activity	Monitored Parameters	Responsible Party
Distillate Fuel Oil Combustion	Fuel Sulfur content will be monitored to ensure that it is less than or equal to 0.1% by weight. Sampling and analysis should be performed on each delivery received. An initial performance test should be performed to confirm the emissions from the plant do not exceed the amounts listed in this report. The stack should include continuous monitoring of NOx and opacity emissions.	KESH
Equipment Operation	Baseline noise monitoring should be conducted prior to operation of the plant, both at the plant and at predefined receptor locations. Then, offsite, far field noise monitoring should be performed at those locations once during operation of the facility to confirm that the operation conforms to 70 dB(A) limit.	KESH

	Workers inclose proximity to the turbines or other noise emitting equipment should wear hearing protection in accordance with a writted health and safety plan. A copy of the health and safety plan should be maintained onsite.	
Cooling Water Intake	Documentation should be maintained onsite concerning the final design of the water intake including the inlet velocity.	KESH
Cooling Water Intake	See above	KESH
Cooling Water Discharge	The condenser discharge temperature should be monitored to ensure the operation of the facility meets the maximum temperature discharge described in this report. Quarterly monitoring of the temperature at the discharge should be performed to confirm the maximum discharge temperature used in this analysis. In addition, pH and residual chlorine levels should be monitored on a continuous basis. Suspended solids and oil and grease should be measures semiannually.	KESH
Fresh Water Supply	The use of water from the desalinization plant should be confirmed through maintaining the pertinent plant design documents onsite.	KESH
Sewage Treatment	Monitoring of the appropriate operational parameters should be performed as per the manufacturer's requirements.	KESH
Local Community Services	Maintain record on complaints concerning stress on the local community services created by the plant operation.	KESH
Handling and Storage of Fuels and Hazardous Materials	Maintain records to demonstrate adherence to the spill response plan.	KESH
Handling and Storage of Fuels and Hazardous Materials	Maintain record of pipeline inspections.	KESH
Handling and Storage of Fuels and Hazardous Materials	Maintain the pertinent design information onsite. Records on the date of discharge, approximate of discharge, and final disposition of the discharge. Oil water separators should be equipped with an oil level indicator and inspected regularly.	KESH
Transmission of Power	The EMF emitted by the interconnection line should be monitored once at four locations along the line.	KESH
Aesthetics	The property maintenance records should be maintained onsite.	KESH

Air

The air quality-monitoring program developed to assess ambient air quality conditions will be implemented following operation of the plant. The program consists of continuous monitoring of meteorological parameters including wind speed, wind direction, and ambient temperature and ambient pollutant concentrations of SO_2, NOx, and PM_{10}. The results of the monitoring should be used to assess the air quality relative to the air quality standards. Since local, site-specific meteorological and background pollutant concentration data was not available at the time this EIA was prepared, data from a site that exhibits similar characteristics was used in the analysis. While we do not anticipate the results of the air quality analysis in the current EIA to significantly change, we recommend that the project owner gather site-specific meteorological and air quality data for a period of one year in order to perform a more detailed air modeling analysis in the future to determine the exact impact of the plant on local conditions.

In addition, the flue gas characteristics of each generation unit will be determined after commencement of operation to ensure that emission performance criteria are met. Records to support analysis of this information (hours and times operational, fuel use, fuel characteristics, etc.) will also be maintained at the plant.

Noise

A noise-monitoring program will be undertaken during the operations phase to ensure compliance with noise emission specifications and predicted noise level impacts. One of the daytime monitoring periods will be scheduled to coincide with a high noise event so as to record the impact of that event at a downwind location on the site perimeter.

Marine Environment

The operational monitoring program is designed to assess the impacts of station operation on the marine environment.

Physical Parameters

The condenser discharge temperature should be monitored continuously to ensure that the cooling water discharge temperature is in compliance with design criteria. Quarterly spot measurement of the cooling water discharge plume should be conducted to verify the modeling input parameters.

Site wastewater discharges, including runoff and discharge from the packaged sewage treatment plant should be monitored four times a year to verify compliance with design criteria.

Biological Parameters

A specific study should be undertaken downstream of the diffuser to delineate the area impacted by the plume. This study could be undertaken by diving and supplemented with sampling. Records of fish impingement, including number and weight by species, should be kept. KESH is responsible for conducting this biological monitoring.

Oil

A routine monitoring program should be implemented for the SPM, pipeline, and on-shore oil storage and handling areas. A plant representative should be present during fuel deliveries to monitor the connection/disconnection and fuel transfer operations at the SPM for leaks and releases. The condition of the SPM should be inspected routinely between fuel deliveries to ensure the facility is in proper operating order.

The entire length of the underwater-buried pipeline should be monitored periodically, preferably during fuel delivery periods, for signs of leakage, such as oil percolating into the water column. Gauges should be installed to monitor flow in the pipeline, as an additional aid to identifying fuel losses.

The on-shore oil storage and handling facilities should be inspected on a weekly basis. The inspections should note any deterioration of equipment and containers and signs of oil leakage or spills. All gauges and monitoring equipment should be inspected to ensure that the equipment is functioning properly. All repairs should be implemented as the need is identified. Records will be maintained of all oil spillage/leakage at the SPM, including estimated quantity spilled and cleaned up. KESH is responsible for all of these activities.

Fisheries

If complaints are received from local fishermen regarding decreasing catches after the plant is in operation, a survey of fishery impacts is should be conducted. A survey should be conducted prior to construction of the water intake and discharge to provide a baseline for the area of the intake and discharge structures.

8.4 CAPACITY DEVELOPMENT AND TRAINING

Formal training programs in all aspects of the plant operation should be developed and implemented for the plant staff. The programs are to commence prior to plant start-up and will be conducted for new employees. The training programs will be designed to enable staff to become fully competent in the operation and maintenance of the generating facility. As this will be the first combined cycle facility in Albania, the staff will have limited work experience in operating and maintaining this type of facility and the training programs should reflect this. This training is to be provided in country and be of two weeks duration.

Environmental training will be incorporated into these overall training programs. It is important that all plant employees are aware of environmental requirements and that proper operation of the plant reduces negative environmental impacts. It is to be impressed that sound environmental management is in everyone's best interest besides conforming to lending and permitting requirements.

A detailed environmental management and training program must be developed. The major components of this program must incorporate the following:

- General information
- General understanding of the concept of sustainability and reasons for sound environmental management

- Understanding of potential environmental impacts that can be expected from the two main phases of the power plant development
- Construction
- Operation
- Reasons for proposed mitigation measures
- Establishing chain of responsibility and decision-making
- Specific training
- Air and water quality monitoring
- Criteria for establishment of monitoring stations
- Methodology to be used for field sampling
- Training in the use of field equipment and correct techniques for sample preservation
- Training in required laboratory analyses and the importance of quality assurance and quality control methods
- Training In identification of noncompliance situations and procedures to be followed in such instances
- Reporting requirements
- Training for inspectors/supervisors during construction, emphasizing the major environmental areas where their effort should be concentrated
- Handling, transporting, and disposal of hazardous materials, including used oil
- Procedures for off loading oil, specifically to eliminate spillage during plant operation
- Health and safety requirements
- Noise monitoring
- Emergency and spill response, especially for oil at sea and on site
- Good housekeeping

8.4.1 Environmental and Health and Safety Procedures

Environmental and health and safety procedures are to be developed for both the construction and operation phase of the project. These procedures will provide management with the necessary guidelines for both environmental protection and the protection of the workers' health and safety. KESH should prepare the plans and base them on any existing health and safety procedures that they have. Existing procedures should be expanded as appropriate for the plant. The proper Albanian authorities should be approached and consulted for approval with respect to health and safety issues, as appropriate.

Besides detailed procedures, a simplified handbook should be developed for all employees outlining the importance of environmental and health and safety practices. A tentative list of procedures is provided below:

- Health and safety procedures
- Administration and organization
- Project emergency practices
- Tunnel rescue
- Work over or near water
- First aid and medical services
- Control measures
- Safety officer
- Site security
- Safety tagging and lock out
- Training and orientation
- Accident investigation, reporting and record keeping
- Workplace hazardous material information system (WHMIS)
- Specific safety requirements
- Confined space entry
- Employer safety programs
- Project health and safety committees
- Use of personal protective equipment
- Personal decontamination practices.
- Environmental Procedures
- Noise and vibration plan
- Contacting outside agencies
- Handling, storage, and disposal of fuels and hazardous materials

- Site aesthetics and restoration
- Site drainage, dewatering, erosion and sediment control
- Waste management plan
- Dust control
- Spill response plan
- Water monitoring
- Air monitoring
- Community relations
- Environmental inspection
- Oil handling plan.

8.5 EMP/PROJECT INTEGRATION

To ensure that the provisions of the EMP are fully integrated into the project, contracts and other means will be used with the appropriate organizations. The elements of the EMP that deal with activities during construction will be the responsibility of the construction contractor. These items include the following:

- Impact mitigation during construction
- Study to support location of intake and discharge structures.
- Oil spill response/recovery mitigation plan
- Social impacts from influx of workers
- Monitoring during construction
- Health and safety training
- Capacity development and training

KESH or an affiliated operating company will be responsible for operation of the plant and will bear the responsibility for implementing the operational elements of the EMP. The heart of this responsibility will be for development of the detailed environmental management and training program. This program is a comprehensive means of building the awareness and capacity for plant personnel to implement the mitigation and monitoring elements of the EMP.

9 PUBLIC CONSULTATION AND DISCLOSURE PLAN

9.1 INTERAGENCY CONTACTS AND PUBLIC INVOLVEMENT

Three public consultation meetings were held in Vlorë regarding the project. The first meeting, held in the Fall of 2002, was to introduce the project to the public and to begin the EIA public consultation process. The second meeting, held on April 2, 2003, sought public input on the scope of the EIA. The third meeting was held September 3, 2003, in Vlore to discuss the Draft EIA. The Draft EIA was made available to the Public more than thirty days prior to the meeting. All of these meetings were attended by a number of agencies, university personnel, non-governmental organizations (NGO) and the public. During these meetings, the Public provided input on any major concern or issue. The Public was able to provide concerns or issues either in general or with respect to specific effects of the proposed plant. These meeting were covered by Albanian television stations and broadcast through a segment on the nightly news. Minutes of the second and third meetings are provided in Appendix E along with a copy of the presentations given and a partial list of attendees. Over 100 people attended the second meeting, however, not all of them signed the attendance sheet.

Additional meetings have been held in execution of the public consultation aspect of this project. The most important of these meetings include the following:

- Meeting on August 15, 2002 between the Ministry of Environment and representatives of MWH in Tirana, Albania
- Meeting on March 31, 2003 between MWH and the Minister of Environment in Tirana, Albania

A public consultation meeting was held on September 3, 2003, in Vlorë to discuss the Draft EIA. At that time, additional details about the project and the EIA were disclosed to the public. Participants will have the opportunity to discuss the project impacts and to provide further input to the EIA process. The meeting will be well publicized through local news media outlets. Non-Governmental Organizations (NGO's)

The main environmental NGO's engaged in environmental issues in Albania are: the Society for the Protection and Preservation of Natural Environment in Albania (PPNEA); the Albanian Society for the Protection of Birds and Mammals (ASPBM, Designated Birdlife Partner; the Albanian Association of Biologists (AAB); the Forestry Progress, and the Albanian Ecological Club (AEC). The only local environmental NGO in Vlorë that information is available on is the Eco-Counseling Center. Their mission is to promote environmental awareness through education, information dissemination, cleaning actions, and conferences.

The MedWetCoast Project involves NGO participation. The countries participating in the project include Albania, Egypt, Lebanon, Morocco, the Palestinian Authority and Tunisia. The overall initiative is aimed at ensuring the sustainable management of the biological diversity of coastal areas and wetlands in the six Mediterranean countries. The MedWetCoast Project is a collaboration of the Global Environmental Facilities (GEF), United Nations Development

Program (UNDP), and the Albanian Committee of Environmental Protection (NEA). GEF is an organization that brings together 175 member governments, working in partnership with the private sector, NGO's, and international institutions to address complex environmental issues while supporting national sustainable development initiatives. Their work in Albania includes study and protection of the Karaburuni Peninsula, the Llogara National Park, Sazani Island, and the Orikumi and Narta Lagoons. The NEA has a lead local role in this process. UNDP Albania actively promotes a range of development partnerships with both national and international stakeholders including the MedWetCoast project. An individual representing the NGO's involved in the MedWestCoast project attended the public meeting on April 2, 2003, in Vlorë.