SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

ALASKA POWER AUTHORITY COMMENTS ON THE FEDERAL ENERGY REGULATORY COMMISSION DRAFT ENVIRONMENTAL IMPACT STATEMENT OF MAY 1984

VOLUME 5
APPENDIX III– THERMAL ALTERNATIVES TO SUSITNA

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Appendix III - Thermal Alternatives to Susitna

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX III

ALTERNATE THERMAL POWER GENERATION SCENARIO

SUMMARY

In this Appendix, the specific environmental impacts that would be caused by construction and operations of the coal- and gas-fired power plants under the thermal power alternatives are studied in detail. The assessment methodologies that were used are similar to the "worst case" analyses that would normally be required to obtain environmental permits for the power plants. All phases of the alternatives have been addressed. Under the coal-fired power alternative, the environmental impacts of the coal mining and coal transport operations are considered along with the impacts of the power plants themselves. Under the gas-fired power alternative, the impacts of the natural gas wells and the natural gas pipelines are considered.

The detailed analyses have revealed numerous environmental impacts that were either not discussed in the DEIS, or that were incorrectly analyzed in the DEIS. The key conclusions of these analyses are described in the following sections:

Air Quality - The air quality impacts of the three 200 MW coal-fired plants at Nenana and the two 200 MW plants at Willow were studied. Hypothetical power plant sites near both cities were assumed, to show the impacts that would be caused by power plants in the area. The impacts of the Lignite Creek coal mine expansion and the impacts of the required coal unit trains have also been investigated. The EPA approved PLUVUE computer model was used to estimate the visibility impairment caused by the power plant plumes from the coal-fired plants and the gas-fired plants. The results of the analyses are as follows:

- The coal mine expansion would create long-term fugitive dust impacts in the Lignite Creek valley, and in the Denali National Park.

- Fugitive dust from the coal-fired power plants would create long-term impacts near the power plants. The fugitive dust might cause exceedances of the PSD Class II increments near the power plants.

- Stack emissions from the power plants would cause long-term impacts in a large area around each plant. SO_2 emissions would create the most significant impact. The calculated worst case SO_2 concentrations near both the Nenana and Willow power plants are approximately 41 percent of the allowable PSD Class II increment. Stack emissions from the Nenana power plant would cause increases in the pollutant concentrations in Denali National Park.

- The visibility degradation caused by the power plant plumes would be long term and would affect many key vistas that are considered a valuable cultural resource in Alaska.

- Ice fog and steam plume formation from the gas-fired power plants could be a significant siting constraint. The gas-fired power plants near Anchorage could have a significant impact on carbon monoxide, nitrogen dioxide, and ozone concentrations in the urban area.

Noise - The noise impacts of the coal mine blasting, continuous mining operations, coal unit trains, and the power plants were estimated, using realistically worst case assumptions. The results of the analyses are as follows:

- Blasting noise from the mine would probably be audible in some parts of Denali National Park. The blasting noise would occur daily.

- The continuous mining noises would affect a large area in the Lignite Creek valley.

- The coal unit trains would create long-term noise impacts along the entire railway between Nenana and Willow. The coal trains would add significantly to the existing rail traffic along the Alaska Railroad.

- The power plants would create long-term noise impacts, affecting a large area around each facility. Noise impacts on residential areas would be a major siting constraint for the gas-fired power plants in the Anchorage area.

Aesthetics - The potential aesthetic impacts of the coal mine, unit trains, and the power plants were considered. The results of the aesthetic impacts evaluations are as follows:

- The unit trains would create very significant, long-term aesthetic impacts. The unit trains would add significantly to the existing rail traffic along the Alaska Railroad.

- The power plants would create long-term, significant impacts for ground travelers and air travelers along the Railbelt. The very large industrial facilities would probably be constructed in otherwise pristene areas. The disruption of the environment would be especially noticeable to air travelers.

Water Quanitity and Quality - The water quality impacts of the coal mining operations and the power plants would be long term. The estimated impacts are as follows:

- The coal mining operations would cause long-term and possibly irreversible groundwater impacts in the Lignite Creek area. Surface runoff from the mining operations would cause changes in streamflows and increases in suspended sediments in surface waters.

- The power plants would require long-term water supply sources. The power plants would continuously discharge treated wastewater to the receiving streams, causing long-term changes in water quality.

Terrestrial Ecology - The combined five coal-fired power plants would create long-term disruption of approximately 3,000 acres. Additional long-term terrestrial disruption would be caused by the access roads, railroad spurs, and gas pipelines. The Lignite Creek coal mine expansion would permanently disrupt a large area. Potential impacts on the terrestrial ecology would be a major constraint on the power plant siting.

Aquatic Ecology - The potential impacts of the gas pipelines, access roads, coal mine, and the power plants would be a major constraint on the thermal power alternatives. The facilities would have to be designed to avoid potential significant impacts on endangered or sensitive species, anadromous fish spawning grounds, and benthic organisms.

Socioeconomic Impacts - Construction and operation of the power plants could cause significant socioeconomic impacts in the small communities near the power plant sites. The communities could be faced with the need for more educational facilities, medical services, and social services due to the influx of temporary workers during the power plant construction.

1.0 INTRODUCTION

The Alaska Power Authority (Power Authority) concluded in its Federal Energy Regulatory Commission (FERC) license application that the Susitna Project, including both the Watana and Devil Canyon dams, is the best alternative available for meeting the future energy demands of the Railbelt area. Subsequently, the FERC prepared a Draft Environmental Impact Statement (DEIS) on the proposed project and its alternatives. Alternative scenarios that the FERC considered in the DEIS included:

1. Coal-fired generation with gas-fired peaking units (termed the "coal scenario" in the DEIS)

2. Gas-fired generation only

3. Combined coal-fired units with gas-fired base loaded and peaking units (termed the "coal/gas" scenario in the DEIS)

4. A mixture of gas and coal-fired units plus non-Susitna hydro

The type, number, and size of units for each of these scenarios is provided in Table 1-1. It should be noted that Scenario 1 also includes ten 70 megawatt (MW) gas-fired combustion turbines for use in peaking.

The FERC staff stated that they preferred alternative power generation scenarios to the Susitna project. From an environmental standpoint only, the staff concluded that "the thermal alternatives (natural gas and coal-fired generating facilities) would have the least severe consequences". The FERC staff also concluded that "based on considerations of engineering feasibility, economic characteristics, and environmental impacts . . . a mixed thermal-based generation scenario, with selected non-Susitna hydropower projects added as needed, appears to be the most effective approach to meeting the projected generation requirements of the Railbelt area."

Table 1-1

SUSITNA HYDROELECTRIC PROJECT
REQUIRED THERMAL RESOURCES--MEDIUM LOAD GROWTH

Scenario	Number of Units 70 MW Combustion Turbine	200 MW Combined Cycle	200-MW Coal-Fired
1. Coal	10	--	5
2. Gas	2	8	--
3. Coal/Gas	5	4	3
4. Hydrothermal			
With Chakachamna[1/]	3	3	1
Without Chakachamna[2/]	3	3	1

[1/] Johnson, Chakachamna, Keetna, Snow, Browne Hydroelectric Projects.

[2/] Johnson, Keetna, Snow, Browne plus one 200-MW combined cycle unit.

SOURCE: FERC 1984 (DEIS, Main Text Page 2-45, Table 2-6).

The Power Authority strongly disagrees with these conclusions. To support this position, the Power Authority developed this Appendix which specifically addresses major engineering and environmental aspects of the thermal alternatives. Economic aspects of the thermal alternatives are addressed in Appendix II. Appendix I addresses the engineering, environmental, and economic aspects of the non-Susitna hydro alternatives portion of Scenario 4.

Conclusions in Appendix II show that the alternatives are not as economically feasible as the Susitna project for fulfilling long-term energy needs of the Railbelt. It also concludes that, for long-term generation planning, there is considerable risk in relying on the availability of natural gas supplies from Cook Inlet after the year 2000 because such supplies have not been discovered and may not exist. FERC bases its gas generation scenario on these supplies and apparently accepts this risk. The Power Authority believes that this risk is too large to be acceptable, particularly when compared to the existing, available and renewable resource of the Susitna River.

Based on economic, environmental, and engineering considerations, Appendix I clearly shows that non-Susitna hydro projects are not viable options to the Susitna project. Also, it points out that these alternatives alone would not fulfill the energy needs of the Railbelt and additional thermal units would be needed to meet the demand. Therefore, the additional impacts of the thermal units would need to be added to the hydroelectric generation impacts to fully consider this scenario.

2.0 PURPOSE

The purpose of this Appendix is to evaluate the engineering and environmental parameters of the thermal power generation scenarios analyzed in the DEIS. The report provides additional data that should be incorporated into the Final Environmental Impact Statement (FEIS). Substantial concerns regarding the Draft Environmental Impact Statement are raised in this document.

3.0 SCOPE

The Power Authority believes that the FERC alternative scenarios which consider natural gas as a source of fuel are not viable, the reasons for this are:

1. As previously stated, these FERC scenarios are based on gas supplies in Cook Inlet which are currently undiscovered. This entails an unacceptable risk for planning long-term generation. Insufficient supplies negates all thermal alternatives which rely heavily on natural gas.

2. Section 212(f) of the Powerplant and Industrial Fuel Use Act of 1978 creates a legal bar to adding gas-fired units for base-load generation throughout the nation. While Alaska received a three-year exemption from the Act, the exemption expires in 1985. The Power Authority feels it imprudent to base long-term planning on further exemptions to the Act. In light of this, none of the Railbelt utilities, nor the Power Authority can legitimately provide for intermediate and long-term power supply based on gas-fired units; to do so would entail direct contradiction of the intent of the Act. This legal bar definitely negates Scenarios 2 and 3 which rely on base-load gas-fired plants.

3. The long-term economics do not favor the scenarios that include gas-fired generation (see Appendix II). Economics also do not favor coal-fired generation. Economics, therefore, negate all of the thermal generation scenarios.

4. The State of Alaska has chosen to invest a portion of its current revenues, which are being realized through the sale of nonrenewable resources, in the development of economically and

environmentally sound renewable energy sources to serve future generations which may be faced with declining revenues. (This reason applies to coal as well as gas-fired generation.)

For these reasons, the scenarios considering gas-fired generation are strongly rejected by the Power Authority and are not extensively considered in this Appendix. Instead, the primary emphasis is on an evaluation of coal-fired generation and its comparison to the Susitna Project.

Section 4.0 of this appendix describes potential sites for coal-fired and gas-fired plants and briefly describes major features of the plants that could be developed at those sites. In Section 5.0, the Power Authority examines the key issues that would be raised concerning these projects. Section 6.0 provides a comparison of the thermal alternatives and the mixed thermal non-Susitna hydroelectric alternative with the Susitna Project.

4.0 DESCRIPTION OF POTENTIAL SITES AND PROJECTS

4.1 COAL-FIRED POWER GENERATION ALTERNATIVE

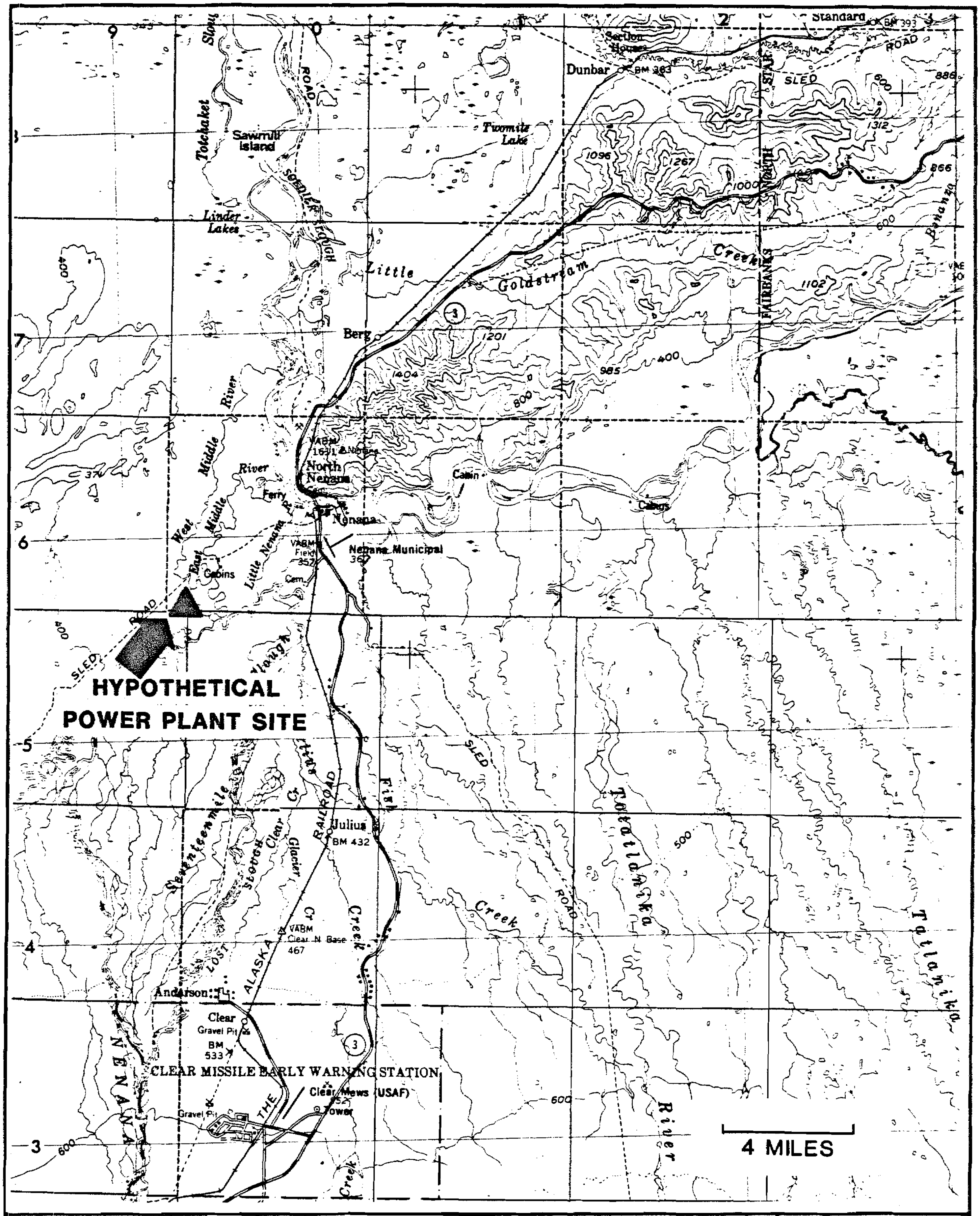
The coal-fired power generation scenario calls for the development of five, 200 MW coal-fired units and ten, 70 MW gas-fired combustion turbines, for a total generating capacity of 1,700 MW. Three coal-fired units would be located near Nenana and two units would be located near Willow (Figures 4-1 and 4-2). The power plant sites shown in those figures are hypothetical, and were selected only to demonstrate the potential environmental impacts of a power plant that was constructed in the general area. The locations of the ten combustion turbines were not specifically defined in the DEIS. It is stated that they would be located in areas appropriate for the load centers.

4.1.1 Coal Mining Operations

It was assumed that all of the coal for the Railbelt power plants would be mined from the Nenana coal field near Healy. The owners of the existing Usibelli mine have indicated that the existing mine would not be expanded (Usibelli 1984). Instead, the existing coal mining operations at Lignite Creek, north of Healy, would likely be expanded. The Lignite Creek area is shown in Figure 4-3.

Each 200 MW power plant would require 113 tons of coal per hour. The maximum coal demand for the five plants would therefore require 13,600 tons per day of coal from the Lignite Creek mine.

The coal quality in the Nenana coal field has been studied by the Alaska Department of Natural Resources (ADNR 1984) and by Fairbanks Municipal Utility System (Pers. Comm. with FMUS). The range of coal quality in the Nenana field is shown below:



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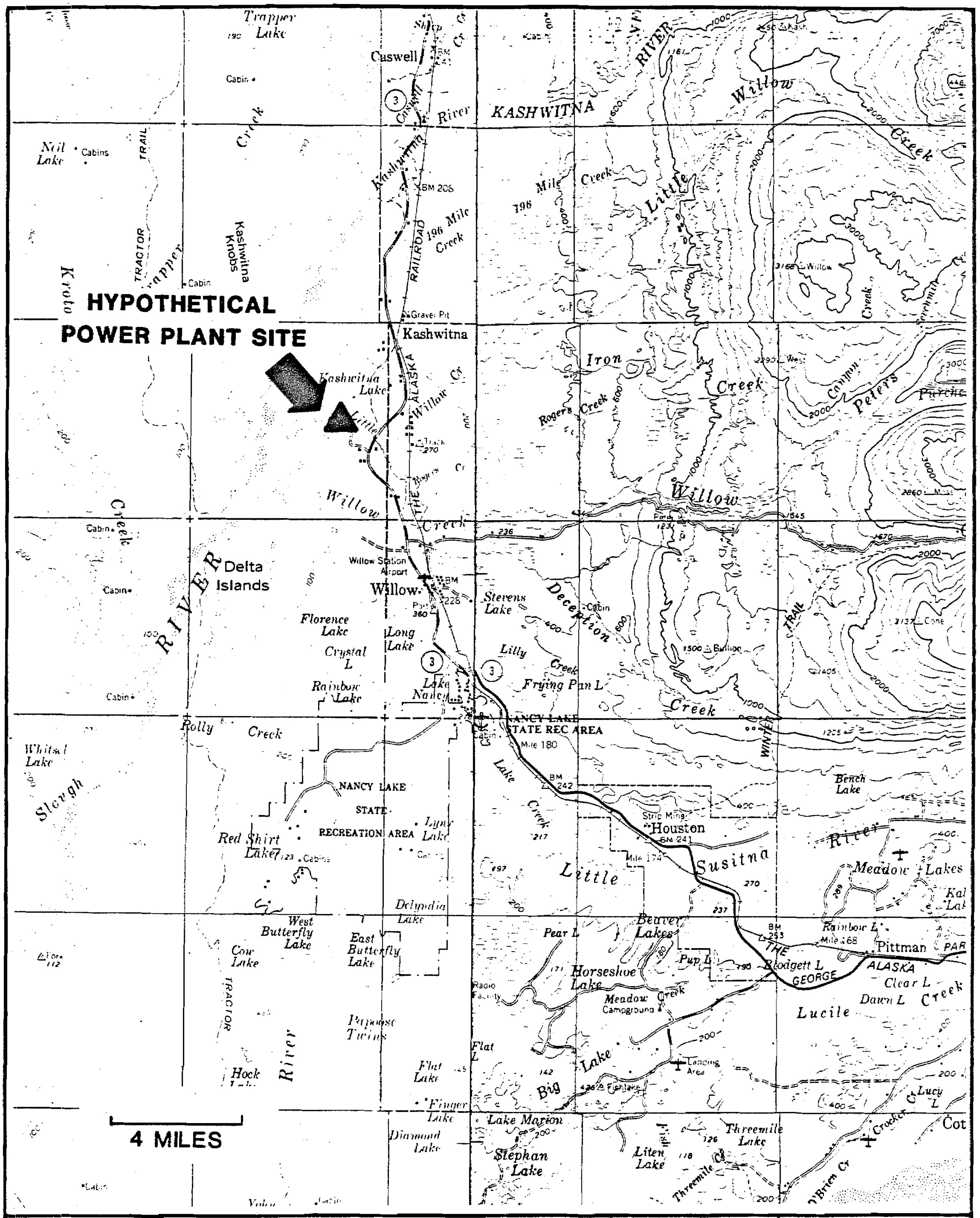
SUSITNA JOINT VENTURE

Location of Hypothetical Coal Fired Power Plant Near Nenana

FIGURE

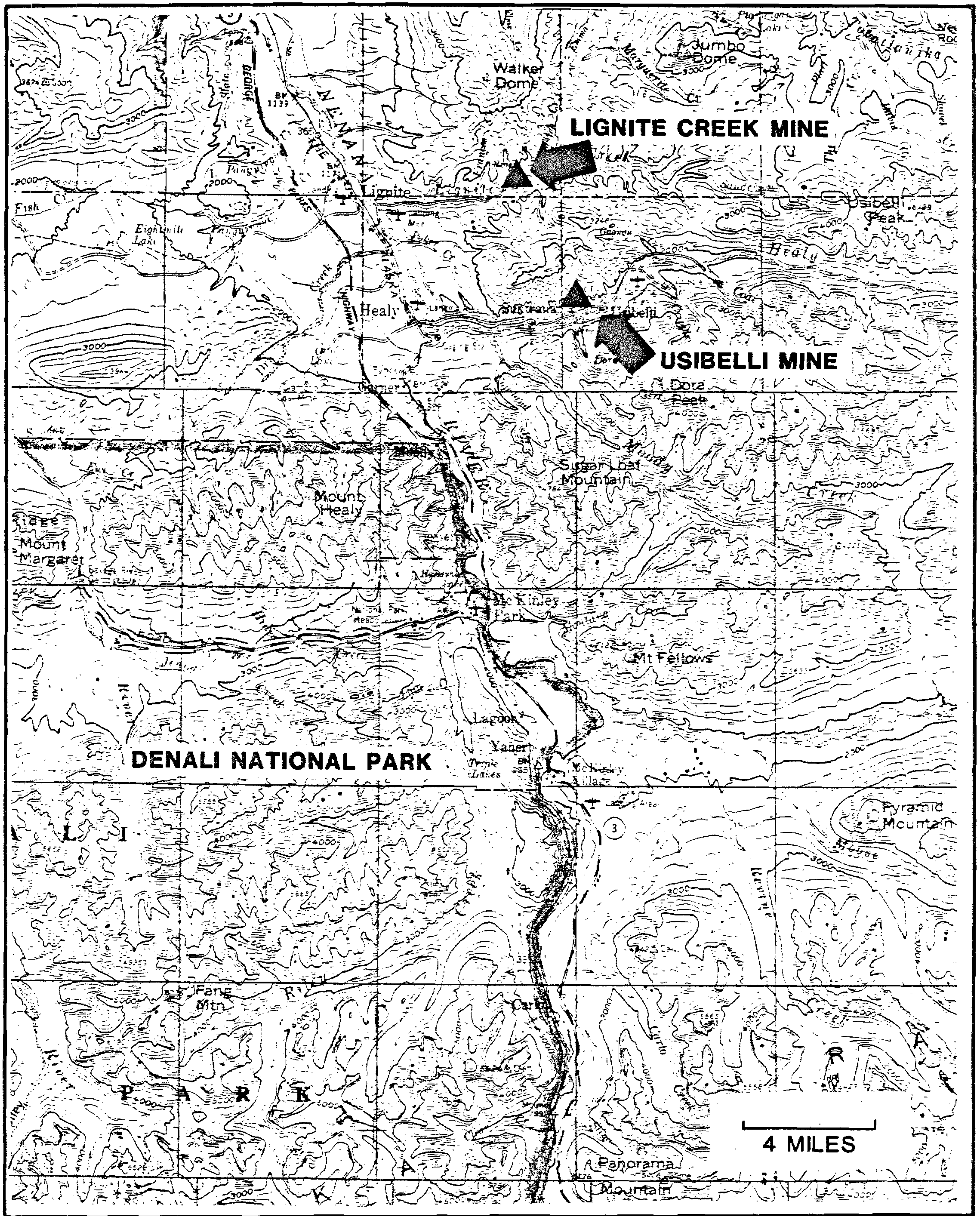
4-1



HARZA-EBASCO
SUSITNA JOINT VENTURE

Location of Hypothetical Coal Fired Power Plant Near Willow

FIGURE
4-2



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Lignite Creek Mine Area

FIGURE
4-3

	Representative Coal Quality (FMUS)	Worst Case Coal Quality (ADNR)
Heating Value (Btu/lb)	7,600	7,700
Sulfur, percent	0.2	0.5
Ash, percent	9.5-10.7	20

The "worst case" values listed above represent the coal quality that could be encountered for a one-year period. It is assumed that the power companies would specify allowable limits on the heating content and sulfur content of the coal that they purchased from the Nenana field. Considering the variable coal quality described above, much of the coal mined may be of insufficient quality to be sold directly to the power companies. It is therefore likely that major coal blending operations will have to be performed at the mine. To produce a consistent coal supply, lower quality coal would be temporarily stockpiled, then blended with coal that was of better quality than specified in the contract with the power companies.

The existing Usibelli coal mine has used an overburden stripping ratio of 3.8 tons overburden per ton of mined coal. Assuming that same stripping ratio would apply to the expanded Lignite Creek mine operations, the total daily excavation rate for the mine would be 65,300 tons per day.

The following operations would probably be conducted at the Lignite Creek mine:

- Excavation of overburden and coal seams
- Stockpiling and replacement of overburden
- Transport of unwashed coal to the processing area
- Coal washing to remove residual overburden material
- Landfilling of coal washing wastes back into the mine area
- Coal blending operations to provide a constant coal quality
- Loading of coal unit trains
- Reclamation of previously mined areas

4.1.2 Coal Transport

The coal would be shipped from the mine to the power plants by unit trains. One train per power plant would be run each day. Each train would consist of locomotives and 48 coal cars. Each coal car would have a 50-ton capacity.

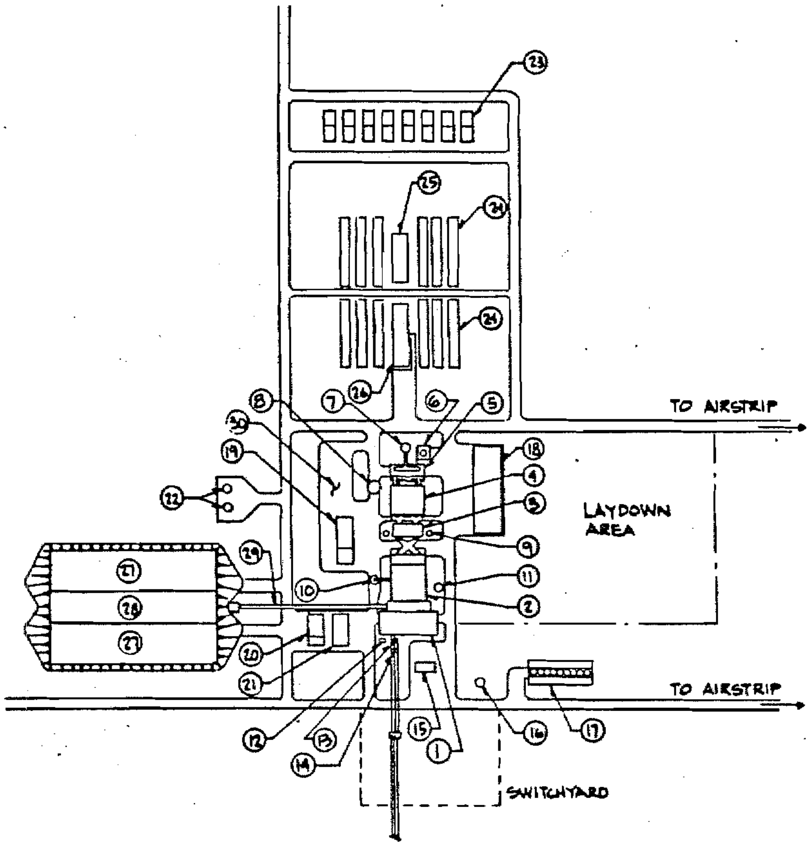
The Lignite Creek mine is approximately 60 miles from Nenana. Coal transport to the three Nenana plants would require roughly 66,000 train-miles per year of railroad usage. The mine is approximately 230 miles from Willow. Coal shipments from the mine to the two Willow area power plants would require approximately 97,000 train-miles per year of railroad usage. Coal transport to all five power plants would require 162,000 train-miles per year of railroad usage.

4.1.3 Coal-Fired Power Plants

4.1.3.1 Plant Layout. An approximate plant layout for a representative 200 MW power plant is shown in Figure 4-4. The plant layout for a two-unit coal plant will require approximately 300-acre site. Actual area requirements will vary based upon specific topography and site conditions.

4.1.3.2 Coal Handling and Storage. At the power plant site, bottom dump rail cars will discharge into a series of below-grade hoppers positioned directly beneath the rail track. From these hoppers, a conveyor tripper will distribute the coal over the length of the storage pile. One coal shipment a day will be required assuming a unit train consisting of 48 cars, each having a 50-ton capacity.

The coal storage pile for each 200 MW plant would occupy an area of approximately 250 feet by 1,500 feet or 375,000 ft^2. The dead storage pile will be 25 feet high. The coal will be reclaimed in the concrete reclaimer tunnel belowground.



PLOT PLAN

LEGEND

① TURBINE BUILDING
② BOILER
③ SPRAY DRYER
④ BAGHOUSE
⑤ FAN HOUSE
⑥ LIME SLAKER
⑦ EXHAUST STACK
⑧ FLY ASH SILO
⑨ HYDRATED LIME STORAGE TANK
⑩ BOTTOM ASH SILO
⑪ CONDENSATE STORAGE TANK
⑫ START UP TRANSFORMER
⑬ AUXILIARY TRANSFORMER
⑭ MAIN TRANSFORMER
⑮ ADMINISTRATION BUILDING
⑯ RAW WATER STORAGE TANK
⑰ COOLING TOWER
⑱ INDOOR STORAGE
⑲ MACHINE SHOP
⑳ GARAGE
㉑ CONSTRUCTION OFFICE
㉒ START-UP GAS STORAGE
㉓ FAMILY STATUS HOUSING
㉔ SINGLE STATUS CAMP
㉕ RECREATION BUILDING
㉖ MESS HALL
㉗ COAL-DEAD STORAGE PILE
㉘ COAL-LIVE STORAGE PILE
㉙ CONVEYOR
㉚ CONSTRUCTION EQUIPMENT PARKING

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Plant Layout For Representative
200 MW Coal Fired Power Plant

FIGURE

4-4

4.1.3.3 Generating Facilities. The coal-fired power plants would have design parameters of 2,400 psig pressure rating with 1000°F superheat and 1000°F reheat yielding a nameplate rating of 200 MW(e). The process includes the steam-generator being fed with 113 tons of coal per hour to generate steam in the furnace in the amount of 1.59 million pounds per hour (#/hr) with an energy of 1,462 British Thermal Units (Btu) per pound of steam. The coal is blown by primary air into the furnace and mixed with preheated air for complete combustion. Nitrogen oxide (NO_x) control can be accomplished by use of low NO_x burners or by recirculation of combustion gases. Other pollution controls are in the exhaust of the steam-generator; a limestone slurry scrubber for flue gas desulfurization, a baghouse for particulate collection and a 450-foot stack. The stack height is based upon 2.5 times the height of the tallest structure on site.

The steam from the steam-generator is expanded in the high pressure turbine and routed through the furnace reheater to be reheated and further expanded in the intermediate pressure turbine and subsequently the low pressure turbine. The low pressure turbine exhausts to the condenser which operates under partial vacuum, setting the pressure at which the steam condenses. Noncondensable gases are removed by vacuum pumps. The condenser is cooled by water which is recycled through a dry cooling tower.

4.1.3.4 Cooling Tower. The cooling towers would be of the wet/dry type, mechanical draft design of a material most suitable for very cold weather conditions as found in Alaska. The intent would be to have low water consumption, avoid visible tower plumes, and minimize icing conditions. The tower would have a far greater percentage of capacity in the dry portion of the tower than in the wet sections.

4.1.3.5 Liquid Waste Generation. The boiler feedwater makeup treatment system is designed to provide demineralized water for steam cycle makeup, including boiler blowdown and sootblowing purposes, as well as potable, and heating, ventilating, and air conditioning requirements. The entire treatment system will consist of three parallel, 50 percent duty trains producing 50 gallons per minute of demineralized water.

A prefabricated, aerobic, biological waste treatment unit will be provided to manage the power plant's sanitary wastes. The package treatment plant will consist of a screening-communitor chamber, an aeration tank, a clarifier and a chlorine contact chamber. Treated effluent will be discharged to the wastewater collection sump. Waste biological solids produced by the plant will undergo aerobic digestion. The system will be sized for a flow of approximately 6000 gallons per day and the aeration tank will provide a retention period of 24 hours.

The floor drainage treatment facility will provide treatment for the removal of suspended solids and oil/grease and will require both a primary and secondary treatment stage. The primary stage will consist of a gravity oil/water separator which will accomplish both suspended solids and floatable oil removal. The secondary stage will consist of treatment for the removal of emulsified oils utilizing either cartridge type separators or chemical coagulation. This prefabricated facility will be designed to handle an average daily flow of 10 gpm. The treated effluent will be discharged to the wastewater collection sump for reuse.

Wastewater from demineralizer regeneration and condensate polisher regeneration will be produced and conveyed on an intermittent basis to the equalization/neutralization tank having a corrosion resistant lining. The tank will have a pH monitoring and control system which consists of a pH sensing/control device to automatically add acid or caustic reagents as required to adjust the pH to within a range of 6.0 to 9.0. The wastewater will then be discharged to the wastewater collection sump. The tank will have a minimum 36-hour detention period for the wastewater flows generated on the maximum regeneration activity day. The capacity of the tank will, therefore, be approximately 10,000 gallons. This capacity together with the pH control system will provide adequate neutralization to enable wastewater reuse.

Runoff and filtrate from the coal storage pile will be directed to collection ditches located on the periphery of the pile and then conveyed to the coal pile runoff pond for treatment prior to disposal to the yard and area drainage system. The holding pond will provide gravity settling for coal fines (suspended matter) washed out of the pile, and pond effluent in excess of the design storm event will undergo pH adjustment, as necessary, to a range of 6.0 to 9.0 by the addition of caustic reagents.

The pond will be capable of retaining the one-in-ten-year, 24-hour rainfall event and, therefore, storms in excess of this event will be discharged. The capacity of the pond associated with the Nenana coal field plant will be approximately 700,000 gallons, encompassing approximately 9,400 ft^2 at a 10-foot water depth.

4.1.3.6 Air Pollution Controls

Sulfur dioxide (SO_2) emissions are a constraining aspect of power plant siting in the Railbelt. To ensure compliance with all SO_2 limitations, the power plants would probably utilize wet limestone flue gas desulfurization (FGD) scrubbers. For this study, the FGD scrubbers have been assumed to provide 90 percent SO_2 removal, based on anticipated regulatory stipulations (see Section 5.2).

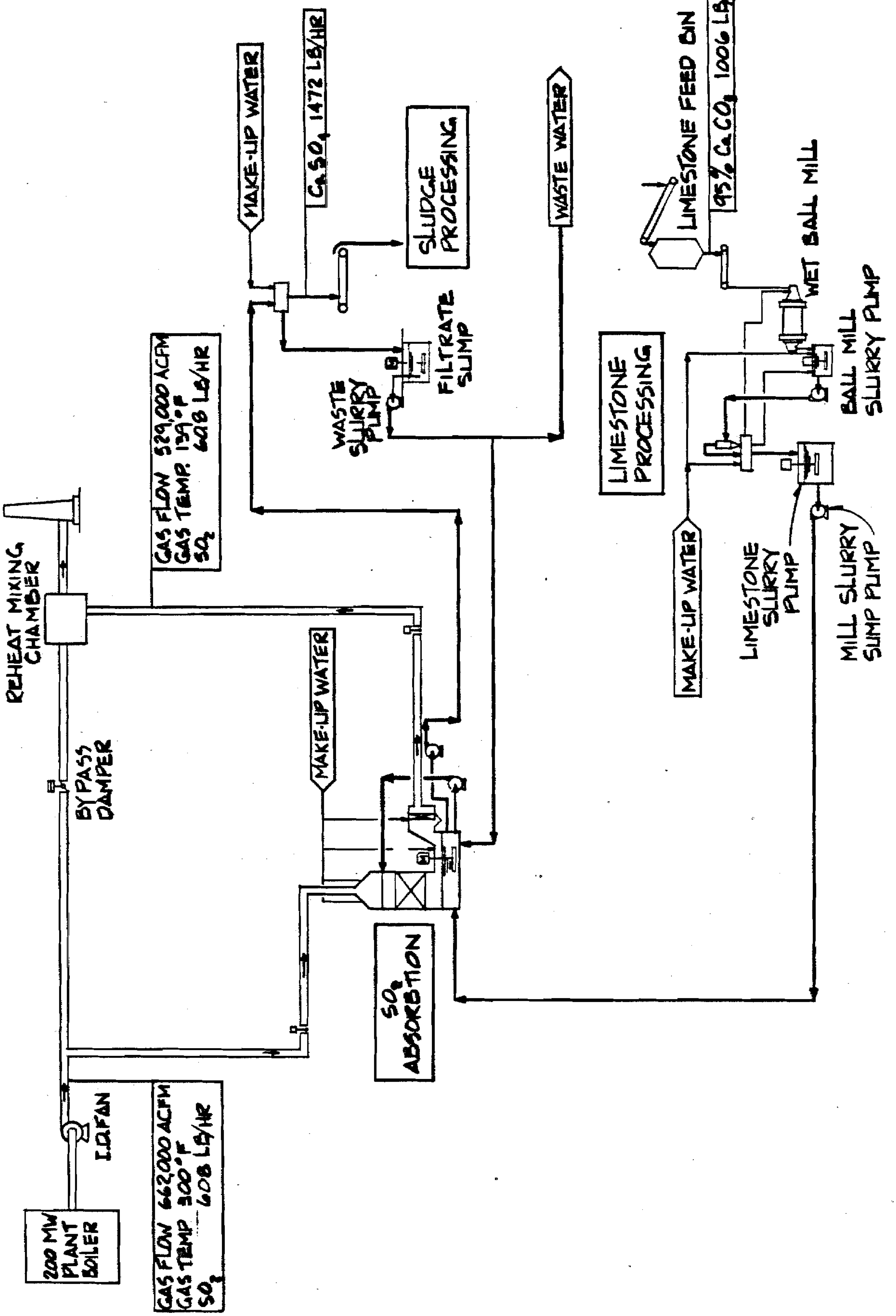
A schematic diagram of the FGD process is shown in Figure 4-5. The FGD process consists of three basic steps: limestone preparation; SO_2 absorbers; and scrubber sludge processing. The mass flows for all process streams associated with each of those steps are listed in Figure 4-5.

The use of a wet limestone FGD scrubber would significantly reduce the major ambient SO_2 impacts that were addressed in the DEIS. However, a wet limestone FGD scrubber (to achieve 90 percent SO_2 removal) would be more expensive than the spray dryer FGD (with 70 percent SO_2 removal) that was described in the DEIS. The estimated capital cost of a wet limestone scrubber for a 200 MW power plant in Alaska is $17 million (Mitsubishi 1984). A detailed cost study comparing wet scrubbers versus dry scrubbers in Alaska has not been conducted, so it is not possible to estimate the relative operating costs of the two FGD systems. However, a detailed cost analysis for FGD alternatives was conducted for the Creston Power Plant in Washington State (Washington Water Power 1982). That analysis concluded that the incremental busbar cost increase associated with increasing FGD efficiency from 70 percent SO_2 removal up to 90 percent SO_2 removal was 1.5 mils/kWh.

4.1.3.7 Solid Waste Disposal. Based on the assumed coal composition and the assumed use of a baghouse filter with a limestone FGD system, each 200 MW power plant would produce the following solid wastes:

Fly Ash - 68,900 dry tons per year
Bottom Ash - 29,600 dry tons per year
FGD Scrubber Sludge - 8,100 wet tons per year at 80 percent solids

There would be several other solid waste sources at the power plants, but the quantities of waste from those sources would be much less than those listed above.



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Schematic Diagram of Flue Gas Desulfurization System For 200 MW Power Plant

FIGURE 4-5

All of the power plant wastes would be disposed of onsite. The ash waste and the FGD sludge would be combined. From the storage silos located at the plant site, all plant solid waste would be trucked to a permanent solid waste disposal site, assumed to be situated in close proximity to the plant island. To permanently dispose of the waste quantities generated over the 35-year life of the plant, a site encompassing approximately 87.5 acres at an average depth of 20 feet will be required for each 200 MW unit. Hence the Nenana site would require approximately 260 acres and the Willow site 175 acres for waste disposal.

To ensure compliance with the provisions of the Resource Conservation and Recovery Act and the state's solid waste management regulations, the disposal area would be lined with an impermeable synthetic liner. The disposal site would also be developed through a series of expansions. Once an area has been completed it will be covered with topsoil and reseeded to minimize leachate and dust related problems.

4.1.3.8 Facility Construction Requirements. The construction and operation of a 200 MW coal-fired power plant would require a number of related services to support all work activities at the site. These site services could include the following depending upon the actual location of the power plant:

- Access Roads
- Construction Water Supply
- Construction Transmission Lines
- Airstrip
- Railroad Spur
- Construction Camp

Gravel roads with a 9-inch gravel base would be required to connect the plant site with the equipment landing facility. For both general locations it has been assumed that approximately 20 miles of access road would be required.

A complete water supply, storage and distribution system will be required. Due to the remote nature of any site developed at either general location, a one-million gallon water storage tank has been assumed with one-half of this storage capacity dedicated to fire protection purposes. Water supply to the project site should be by means of a 150 gpm well(s).

Power requirements during the construction phase will be supplied by constructing a 25 kV transmission line tapped from an existing transmission system. For the Nenana and Willow area sites, the 25 kV transmission line system is assumed to be derived from the existing Healy-Fairbanks intertie and be approximately 20 miles in length.

For either general power plant location, a 4,000-foot long, 60-foot wide gravel airstrip will be required.

The airstrip will be lighted using an above-ground distribution system to provide for the possibility of nighttime medical emergency traffic. No control tower will be required. All air traffic will be on a Visual Flight Rule (VFR) basis only.

A railroad spur will be constructed at the Nenana field site due to the proximity of the Alaskan railroad. The spur will be utilized to receive fuel from the mine and equipment shipments received in Anchorage. The length of this spur has been conservatively estimated to be approximately 20 miles.

A 500-bed labor camp will be required. All personnel housed in this camp will be on single status.

The camp will have its own well water supply. A sewage treatment facility, waste incinerator, and garbage compactor will also be provided. The complex will also have a dining hall and recreation hall.

Since it is unlikely that all personnel would be willing to come to the jobsite on single status only, a mobile home park will be provided for 16 supervisory personnel in family status. These mobile homes will be approximately 1,000 ft^2 each and could remain after completion of construction to house vendor personnel for repair work during plant operation.

4.1.3.9 Construction. The number of workers necessary for construction of a 200 MW station will vary over the approximate four and one half year construction period. Construction is estimated to peak in year two requiring a workforce of approximately 500 personnel.

When the coal-fired steam-electric power plant begins commercial operation, the facility will provide full-time employment for approximately 110 employees.

4.2 NATURAL GAS-FIRED POWER PLANTS

4.2.1 Sources of Gas and Gas Recovery

The DEIS has assumed that additional supplies of natural gas would be discovered in Cook Inlet. These gas supplies would be used to fuel based-load plants on the Kenai Peninsula and/or the Beluga area or peaking plants at unspecified locations. Based upon data in the FERC License Application, a portion of this undiscovered gas can be assumed to be found under water in the Cook Inlet. This would require special pipelines to transmit these supplies to shoreside transmission systems.

4.2.2 Gas Transmission Pipelines

Based upon the discovery of gas in the Cook Inlet, new gas transmission pipelines would be required to supply new and existing stations. The economic and environmental costs associated with the additional gas transmission line would need to be weighed in relation to the costs associated with an electrical transmission line.

4.2.3 Generating Facilities

4.2.3.1 Combined Cycle Power Plants. The natural gas combined cycle power plants for the Cook Inlet area are assumed to be similar to that stated in the License Application, with certain modifications to reflect the current developments. The plant design is based on using two currently available General Electric gas turbine generators, rated approximately 77 MW each in combination with a General Electric steam turbine generator rated at approximately 66 MW. Other manufacturer's turbines of similar size could be used within the general concept of the design, but it must be pointed out that the specific plant output and various specific design parameters may be expected to change accordingly. Plant output in the combined-cycle mode will be 220 MW. The output at average Cook Inlet temperature is 33°F is 237 MW. The heat rate of the station will be approximately 8,280 Btu/kWh. The simple cycle heat rate is 11,650 Btu/kWh. Nitrogen oxide (NO_x) control can be either by steam or water injection.

The natural gas supply is compressed to supply 250 psig inlet gas at the combustors of each gas turbine unit. Combusted gas is expanded through the gas turbine driving both the generator and the integral free-shaft gas turbine air compressor on each unit. Exhaust gas from each turbine flows through dual-pressure steam generators (one for each gas turbine, where the heat is utilized to generate 850 psig superheated steam used to drive the steam turbine generator, and 50 psig saturated steam for the building heating system. The gas is exhausted to the stack on exiting the steam generator. A bypass damper and stack are provided for each steam generator so that the combustion turbine can be operated independently of its waste heat boiler.

The combined main steam flow of at 850 psig and 900°F, is expanded through a common steam turbine driving a 66 MW generator. Exhaust steam from the turbine is condensed in a vacuum condenser, which in turn is cooled by a wet/dry tower.

4.2.3.2 Combustion Turbine Peaking Plants. The 70 MW combustion turbines would be identical to each of the turbines described for the combined cycle power plants. In the combustion turbine plants, the emissions from the turbine generator would be discharged directly to the stack. There would be no cooling tower in the combustion turbine plants.

5.0 MAJOR ISSUES

5.1 INTRODUCTION

Although numerous issues would develop over the implementation of the FERC thermal power generation scenarios, certain major issues are already apparent and must be factored into the evaluation. These issues must be examined carefully to determine if this scenario could or should be pursued. These issues must also be considered along with the economic analyses discussed in Appendix II.

One of the key issues would center on potential air quality, and visibility impacts, from stack emissions and fugitive dust that could preclude further development at the sites. This issue is extensively discussed in this section, particularly as it relates to the pristine visibility-sensitive area of Denali, National Park and Preserve. Estimates of impacts on ambient air quality are also provided for the proposed site areas near Nenana and Willow, both for long term and short term conditions. In addition, impacts due to project construction and operation on: socioeconomics (e.g., influx of construction workers and plant operators); aesthetics and visual resources (e.g., effects of visible plumes); terrestrial resources (e.g., loss habitat); water quality (e.g., plant discharges); and aquatic resources (e.g., alteration of aquatic habitat) are also discussed.

5.2 AIR QUALITY AND METEOROLOGY

This section reviews the nature of the affected environment and specific impacts of the selected thermal alternatives outlined in the DEIS. Specific site locations or general areas for proposed sites are addressed in this analysis. It must be remembered that these are basic generalizations, which are made in the absence of detailed data. The aim of this effort is to analyze the most suitable data sources and to make projections regarding environmental impact of proposed thermal alternatives. Certain analyses and environmental assessments were made in the DEIS based on a limited though broad-based data collection. This report, in a sense, extends the air resource analyses of the DEIS by incorporating additional data and performing additional analyses on issues not addressed in the DEIS.

5.2.1 Existing Environmental Conditions

Meteorological conditions in Alaska present distinct problems for siting a large thermal power plant. These problems are more or less unique to Alaska, in view of the dramatic seasonal changes in climate during each year. In this section, separate discussions are presented for the meteorology of the interior continental area near Nenana, the continental climate near Willow, and the maritime/transition climate near the Anchorage area. Meteorological conditions relevant to characterization of the environmental impact of thermal power plants are given primary emphasis.

5.2.1.1 Wind Conditions. Light winds would be a major siting constraint for the Nenana region. During the winter, winds tend to be very light or even calm for extended periods, sometimes covering several days. In addition, during the winter, extremely strong temperature inversions also develop and persist for days. This situation brings about stagnant conditions which greatly inhibit the atmospheric dispersion of pollutants. This concern has been analyzed in great detail for the Fairbanks area (Bowling et al. 1978). It is likely that for several coal-fired units located in this area, the common notions and threshold analyses of atmosphere conditions may not apply.

Table 5-1 shows the mean wind speed and percent occurrence of calms for stations located near the proposed sites. At Fairbanks and Nenana, the frequency of occurrence of calms is extremely high for the winter months and wind speeds tend to be very light. Table 5-2 gives a statistical summary of atmospheric surface-based temperature inversions at the

Table 5-1

SUSITNA HYDROELECTRIC PROJECT COMPARISON OF WIND DATA FOR LOCATIONS IN THE ALASKA RAILBELT

	Fairbanks[1]		Nenana[2]		Talkeetna[3]		Anchorage[1]	
Month	Mean Wind Speed (mph)	Calms (%)	Mean Wind Speed (mph)	Calms (%)	Mean Wind Speed (mph)	Calms (%)	Mean Wind Speed (mph)	Calms (%)
January	2.5	48.2	6.5	29.2	6.23	12.9	6.1	34.1
February	4.1	28.9	6.0	33.4	6.1	11.0	5.4	33.7
March	5.4	21.3	5.8	30.1	6.7	8.5	6.0	29.6
April	7.1	10.3	4.9	34.6	7.2	4.9	6.7	20.5
May	8.3	5.9	4.9	33.3	8.2	4.4	6.7	20.5
June	7.6	3.9	4.7	28.8	8.5	3.9	7.0	23.4
July	6.9	4.8	4.5	33.6	7.1	6.5	5.3	26.9
August	6.7	6.4	3.6	42.5	6.8	8.0	8.5	28.9
September	6.4	7.7	3.4	44.9	6.1	12.3	10.4	25.0
October	5.5	14.0	4.2	39.2	6.6	8.6	10.6	25.8
November	4.1	28.6	5.6	31.8	6.1	8.2	5.5	33.5
December	3.6	35.6	5.6	35.3	5.9	12.3	4.9	40.4
Annual Average	5.63	18.0	4.9	34.8	6.8	8.5	5.8	28.5

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[1] NOAA 1979.
[2] USAF 1983.
[3] Battelle 1966.

Table 5-2

SUSITNA HYDROELECTRIC PROJECT
STATISTICAL SUMMARY OF ATMOSPHERIC INVERSIONS BASED AT SURFACE[1]

FAIRBANKS AIRPORT

Month	PCT Frequency of Occurrence		Average Thickness(m)		Average Temperature Gradient (°C/100m)	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
January	81	84	690	640	2.6	3.4
February	56	83	480	560	1.8	3.0
March	30	86	190	420	1.3	3.0
April	6	80	120	310	0.8	1.9
May	-	72	-	240	-	1.5
June	1	62	150	280	1.1	1.4
July	1	62	180	320	0.6	1.3
August	1	69	170	310	0.7	1.3
September	5	71	130	290	0.7	1.5
October	28	67	230	350	1.4	2.1
November	66	78	440	500	2.6	2.7
December	82	82	680	610	2.6	3.2

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[1] Source: Billelo 1966.

Fairbanks airport. The frequency of occurrences of these inversions exceeds 80 percent at both observation times each day during December and January. The data also show that these inversions are quite deep, with an average depth of more than 600 m. The average inversion temperature gradient is over 2.5°C/100 m during these months. This places the average stability classification well within the most stable category considered for diffusion modeling. This shows that even under average December/January meteorological conditions, the dispersive power of the atmosphere is extremely poor.

In the Willow region, atmospheric conditions are less severe than those of the interior, but still deserve special analysis. Wind data, including mean wind speed and percent frequency of calms by month, are shown in Table 5-1 for Anchorage and Talkeetna. Mean wind speeds are greater and the percent frequency of calms is less than those of the interior stations. At a site near Willow, the frequency of calms should be more than that at Talkeetna, but less than that at Anchorage. Recurrent stagnant conditions at Willow will cause special problems for atmospheric dispersion of pollutants.

5.2.1.2 Temperature Conditions. Temperature would be a critical environmental consideration in the Nenana region. In the Nenana area in the winter, temperatures often drop below -30°F for extended periods. At these temperatures, the atmosphere can contain very little moisture before reaching saturation. As a result, virtually any source of atmospheric water vapor contributes to the formation of ice fog, especially if injected into the atmosphere at high temperatures. Because the air is very stagnant during the coldest periods, ice fog may develop and persist for an extended period, causing severe operational, traffic, and safety problems, as well as aesthetic degradation in the area of a power plant which is a source of water vapor.

Temperatures in the Willow area may also be quite cold during the winter months. Mean monthly temperature at Talkeetna airport for December and

January are below 10°F with extended periods of below zero temperatures during winter. Formation of ice fog or persistent fog may be a potential problem at Willow as well, through not so severe as at interior locations.

5.2.2 Regulatory Requirements. NEPA and the Federal Power Act require the Susitna Project EIS to analyze all significant impacts of the thermal alternatives. In addition, numerous statues and regulations provide more specific standards and limits.

5.2.2.1 Federal New Source Performance Standards (NSPS). The coal-fired power plant emissions must comply with the NSPS in 40 CFR 60, Subpart Da. NSPS limits are established for power plants burning low-sulfur, subbituminous coal. The maximum allowable emissions for particulates, SO_2 and NO_x are as follows:

Particulates	0.03 lbs/10^6 BTU heat input
SO_2	70 percent SO_2 removal
NO_x	0.50 lbs/10^6 BTU heat input

Emissions from the gas fired power plants must comply with the NSPS in 40 CFR 60, Subpart GG, Section 60.332(a)(1). That section limits NO_x emissions to a variable limit that is based on fuel nitrogen and the heat rate of the turbine. The NSPS also allow the water injection NO_x controls to be discontinued during periods of ice fog, provided that the increased NO_x emissions would not cause exceedances of the air quality standards.

The NSPS limits are not necessarily the emission levels that would be allowable for the thermal power plants in Alaska. The Alaska Department of Environmental Conservation can impose stricter emission limits based on a detailed Best Available Control Technology (BACT) review of the proposed power plants. The performance of a BACT analysis is a project unique task that involves a substantial effort.

5.2.2.2 Prevention of Significant Determination (PSD). The gas-fired and coal-fired plants would be subject to PSD review by the Alaska Department of Environmental Conservation (ADEC). The PSD review would include of the following steps:

1. The applicant must conduct an air quality analysis to show that the worst case emissions would not cause exceedances of either the PSD increments or the Alaska ambient air quality standards (see Table 5-3). The only PSD Class I area that could be affected by power plants in the Railbelt is Denali National Park.

2. A Best Available Control Technology (BACT) analysis must be conducted to show that the facility will include the most efficient pollution control devices that are economically feasible. The BACT analysis is site specific. The economic and engineering aspects of each individual facility would be considered. No BACT analyses for coal-fired power plants have been conducted in Alaska, so the allowable BACT SO_2 emission rate has not been established. However, the BACT emission rate is likely to be well below the NSPS limit for SO_2.

   An example of the difference between BACT and NSPS limits was shown in the permit application for the Tesoro oil refinery in Nikinski. Tesoro submitted a PSD permit proposing a 98.5 percent SO_2 reduction. The proposed SO_2 emissions would meet NSPS and would consume only 25 percent of the available PSD increment. However, ADEC ruled that the proposed 25 percent SO_2 increment consumption was unacceptable. Based on the BACT analysis, ADEC imposed a required 99.90 percent SO_2 removal for the process. By this example, it is clear that the BACT limit for SO_2 emissions from the coal-fired plants could be much lower, and much costlier than the NSPS limit.

BACT for NO_x control for gas-fired turbine generators in Alaska is currently considered to be by steam injection. There are indications that more stringent NO_x controls could conceivably be required in the future. The South Coast Air Quality Management District (SCAQMD) in California has recently ruled that the use of Selective Catalytic Reduction (SCR) could

Table 5-3

SUSITNA HYDROELECTRIC PROJECT
ALASKA AMBIENT AIR QUALITY REGULATIONS

	PSD Class I Increment (ug/m^3)	PSD Class II Increment (ug/m^3)	Alaska Ambient Standard (ug/m^3)
Particulates			
1. Annual	5	19	60
2. 24-hr.	10	37	150
Sulfur Dioxide			
1. Annual	2	20	80
2. 24-hr.	5	91	365
3. 3-hr.	25	512	1300
Nitrogen Oxides			
1. Annual	--	--	100
Carbon Monoxide			
1. 8-hr.	--	--	10,000
2. 1-hr.	--	--	40,000
Ozone			
1. 1-hr.	--	--	235

be economically feasible for NO_x control on large utility turbines (SCAQMD 1984). The required use of SCR for NO_x control (to achieve 90 percent NO_x removal) would add approximately 1.25 mils/kWh to the power cost for turbine generators.

5.2.2.3 Visibility. The federal guidelines for reviewing Class I visibility impacts are specified in the Federal Register (Vol. 45, No. 233, pp. 80084-80093). The National Park Service (NPS) has the authority to conduct an independent review of potential visibility reduction in Denali National Park that would be caused by emissions from any proposed industrial facility. The NPS can advise the state agency to deny the PSD permit for any proposed facility based solely on predicted visibility degradation.

The National Park Service (NPS) is currently drafting their own guidelines for evaluating visibility impacts in the National Parks (Malm, 1984). The NPS evaluation procedures will require considerable effort, and could prove to be a major constraint on power plant siting.

5.2.2.4 Fugitive Dust Analysis. The fugitive dust emissions from the power plants would be subject to PSD review, and the fugitive dust impacts could not exceed the allowable PSD Class I or Class II increments. The fugitive dust would be considered to be "secondary emissions" associated with the power plant operations. Since the power plants would be PSD sources, then their fugitive dust emissions would also be a PSD source.

The fugitive dust emissions from the Lignite Creek mine might not be subject to PSD review but are subject to analyses under NEPA.

5.2.3 Air Quality Modeling Approach

5.2.3.1 Stack Emission Characteristics. Table 5-4 shows the estimated emissions from the proposed Nenana and Willow power plants.

The estimated SO_2 emission rate from the coal-fired plant is based on an anticipated BACT requirement of 90 percent SO_2 removal (EPA 1984). The estimated NO_x emission rate is based on the NSPS standard for subbituminous coal-fired power plants.

5.2.3.2 Power Plant Fugitive Dust. Fugitive dust emissions from the coal-fired power plants were assumed to be generated by the following processes:

- Coal loading to and from the stockpile
- Windblown dust from the stockpile
- Road dust from unpaved areas

Fugitive dust emissions from other sources should not be significant. Emission factors for power plant operations were based on guidelines from EPA Region XIII. Meteorological conditions for Nenana/Fairbanks were assumed. In all cases, it was assumed that BACT mitigations for fugitive dust control would be provided.

Table 5-4

SUSITNA HYDROELECTRIC PROJECT PROJECTED EMISSION CHARACTERISTICS FOR COAL FIRED POWER PLANTS

	600 MW Nenana Coal-Fired Power Plant	400 MW Willow Coal-Fired Power Plant
Stack Gas Temperature, °C	88	88
Stack Diameter, meters	5.49	4.5
Stack Gas Velocity, m/sec	20.1	20.1
Ambient Temperature, °C	0	0
Stack Height (meters)1/	134	134
Pollutant Emissions, g/sec		
1. Particulates	3.6	2.4
2. SO_2	86	57
3. NO_x	441	294

1/ Actual stack height is a function of the tallest structure on site. Hence, the predicted value may vary from that shown here.

The calculated worst 24-hour fugitive dust emission rate for a 400 MW power plant is 938 lbs/day. Assuming natural dust mitigations by snow cover and rainfall, the overall annual fugitive dust emission rate should be approximately 87 tons per year.

5.2.3.3 Lignite Creek Mine Fugitive Dust. Fugitive dust from the coal mine was based on an assumed coal mining rate of 13,600 tons per day and an overburden removal rate of 54,000 tons per day. Fugitive dust was assumed to be emitted from the following operations:

- Overburden removal
- Coal removal
- Truck loading and unloading
- Coal blending
- Haul roads
- Train loading
- Windblown dust from exposed areas

Fugitive dust emission factors for surface mines were taken from AP-42 (EPA 1983). Meteorological conditions for Fairbanks were assumed. It was assumed that BACT mitigations for fugitive dust would be provided.

The calculated worst case 24-hour fugitive dust emission rate for the mine is 3,360 lbs/day. Assuming natural mitigations by snow cover and rainfall, the calculated overall annual average fugitive dust emission rate is 377 tons per year.

5.2.3.4 Modeling Approach for Stack Emissions. For this study, the Nenana power plant was assumed to be roughly 5 miles southwest of the town (see Figure 1-1). This assumed location is hypothetical, and was selected only to demonstrate the possible air quality impacts of a power plant located in the general area. There have been no actual siting studies that have recommended construction a power plant at the location shown in Figure 1-1.

The maximum 24-hour and 3-hour air quality impacts at Nenana were assumed to occur on the bluff northeast of the power plant. The simplified VALLEY screening calculation was used to estimate the worst case impacts (EPA 1977). That screening calculation assumes that the wind blows directly toward the bluff at 2.5 meters/sec wind speed, during poor atmospheric dispersion conditions, and for a persistence of 6 hours per day.

The annual average concentrations at Nenana were calculated using the COMPLEX I computer model. An annual average wind rose for Nenana airport was used to estimate wind speed and direction (Billelo 1966). Stability classes were estimated based on wind speed and slight incoming solar radiation (EPA 1977). The resultant annual average wind roses and stability classes are shown in Table 5-5. For this study, the wind rose was adjusted to account for periods of calm winds.

For this study, the Willow power plant was assumed to be roughly 5 miles north of the town (see Figure 1-2). This assumed location is hypothetical, and was selected only to demonstrate the possible air quality impacts of a power plant located in the general region. There have been no actual siting studies that recommended constructing a power plant at that location.

The maximum 24-hour and 3-hour impacts near Willow were assumed to occur in the elevated terrain east of the town. The simplified VALLEY screening calculation was used to estimate the worst case impacts (EPA 1977). That screening calculation assumes that the wind blows directly toward the elevated terrain at 2.5 mps wind speed, during poor atmospheric dispersion conditions, for a persistence of 6 hours per day.

The maximum annual impacts near Willow were estimated using the COMPLEX I dispersion model. No wind data for Willow are available. Therefore, wind data and stability classes for Anchorage were used to approximate the meteorological conditions at Willow. The assumed wind rose used to

Table 5-5

SUSITNA HYDROELECTRIC PROJECT
ASSUMED ANNUAL AVERAGE METEOROLOGICAL CONDITIONS AT NENANA POWER PLANT SITE

Wind[1/] Direction	Frequency of[1/] Occurrence (%)	Wind Speed[1/] (meters/sec)	Assumed Stability Class
N	3.1	2.7	D
NNE	2.3	2.6	D
NE	5.4	2.9	D
ENE	12.0	4.4	D
E	12.8	3.1	D
ESE	3.5	2.9	D
SE	2.3	1.9	D
SSE	1.4	2.2	D
S	3.4	2.3	D
SSW	3.5	3.2	D
SW	9.1	2.6	D
WSW	6.4	3.5	D
W	9.4	2.4	D
WNW	8.0	2.3	D
NW	9.5	2.5	D
NNW	3.7	3.2	D

[1/] Source: USAF (1966); data for Nenana Airport.

model the impacts near Willow is shown in Table 5-6. The wind rose was adjusted to account for periods of calm winds. The use of the Anchorage wind data for Willow may underestimate the air quality at Willow. This is because the wind speeds at Anchorage may be higher than those in the Susitna River Valley (see Table 5-1). Pollutant dispersion from tall stacks is generally better during high winds. Therefore, the use of Anchorage wind data may result in lower calculated pollutant concentrations at Willow.

5.2.3.5 Modeling Approach for Fugitive Dust. The worst case 24-hour impacts of the coal mine were assumed to occur during conditions of down-valley flow at 2.5 meters/sec wind speed, with F-class stability. It was assumed that the winds blew down-valley for six hours during the day. The annual average fugitive dust impacts were modeled by assuming that the wind speeds in the Lignite Creek Valley were similar to those at Nenana, except that wind directions were consistently either up or down the valley. The downwind dust concentrations were calculated using the ISCST computer model. The model assumed that the fugitive dust was generated in a 1 km x 1 km area. The computer model results were adjusted to account for particle fallout, based on measurements at coal loading facilities (EPA 1980).

The maximum 24-hour impacts for power plant fugitive dust were calculated by assuming that the wind blew at 2.5 meter/sec wind speed under F-stability for 6 hours per day in any one direction. The annual average impacts were based on the annual wind rose data for Willow. The ISCST computer model was used to calculate the fugitive dust concentrations. The dust was assumed to be generated from a 200 meter x 200 meter area. The computer model results were adjusted to account for dust fallout, based on measurements at coal loading facilities (EPA 1980).

Table 5-6

SUSITNA HYDROELECTRIC PROJECT
ASSUMED ANNUAL WIND ROSE FOR WILLOW

Wind Direction	Frequency of Occurrence (%)	Wind Speed (meters/sec)
N	13.7	3.5
NNE	8.6	3.3
NE	5.3	2.7
ENE	2.7	2.2
E	2.9	2.0
ESE	2.2	2.2
SE	2.6	3.3
SSE	9.4	5.2
S	13.1	4.1
SSW	3.4	3.0
SW	2.8	2.5
WSW	3.1	2.3
W	5.6	2.6
WNW	6.4	2.7
NW	4.5	2.7
NNW	5.2	3.1

Source: NOAA 1979.

5.2.4 Air Quality Impacts of Coal-Fired Plants

5.2.4.1 Impacts of Nenana Power Plant. The calculated worst case air quality impacts of the hypothetically located Nenana plant are summarized in Table 5-7. The calculations were based on the assumptions described in Section 5.2.3.4. Because the existing background pollutant concentrations are very low, compliance with the PSD increments would be much more constraining than would compliance with the ambient air quality standards. Based on the assumed 90 percent SO_2 emission controls, the emissions from the 600 MW plant would not cause the calculated worst case 24-hour SO_2 impact to exceed 57 ug/m^3, which is roughly 63 percent of the allowable PSD Class II increment.

Emissions from the Nenana plant (at 90 percent SO_2 control) would probably not cause exceedances of the PSD Class I increments in Denali National Park. The calculated worst case 24-hour SO_2 impact at the park is 1.4 ug/m^3.

The calculated annual average SO_2 concentrations near the Nenana plant are shown in Figure 5-1. The highest annual average concentrations would occur on the bluff northeast of the hypothetical power plant site.

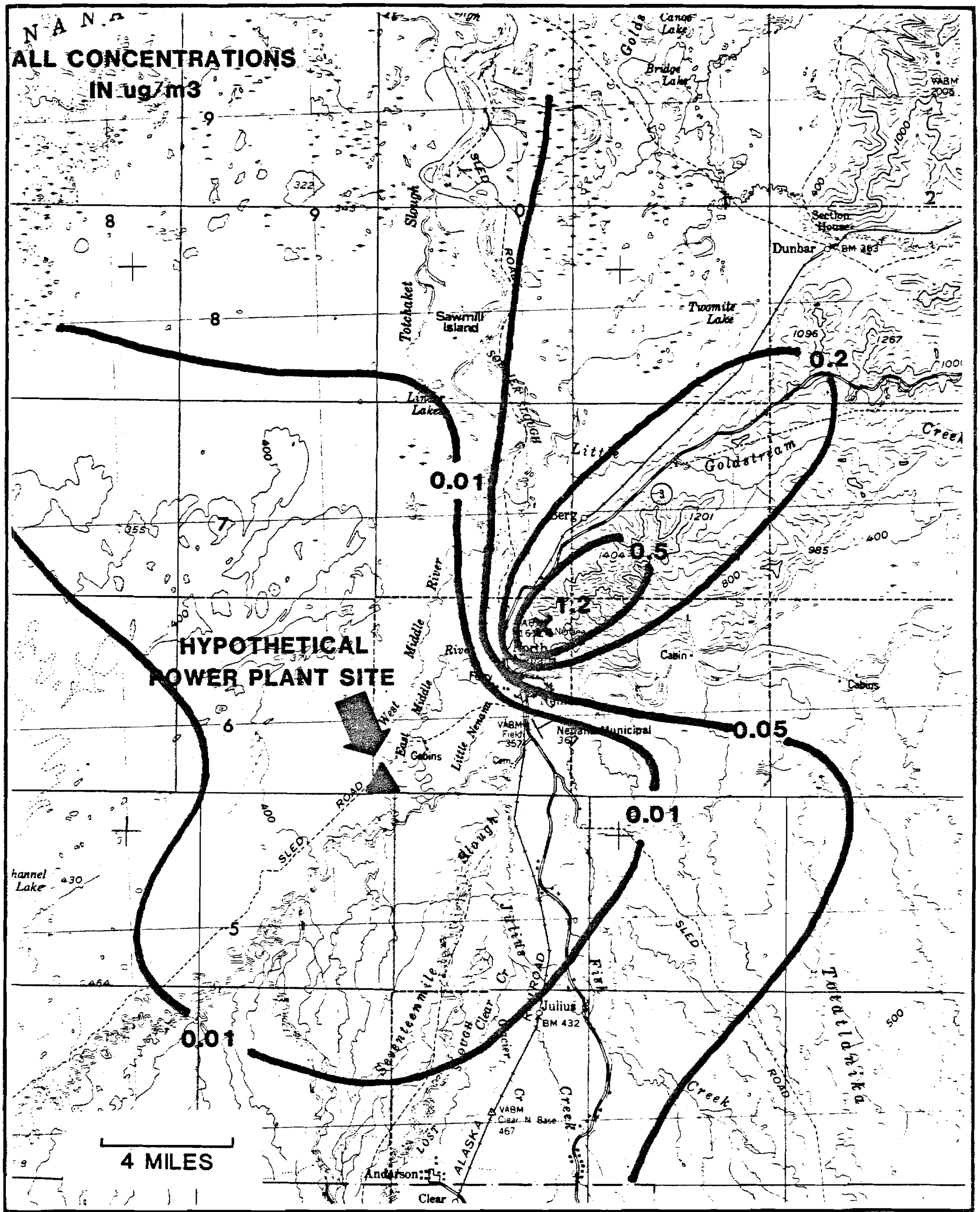
5.2.4.2 Impacts of the Willow Power Plant. The calculated worst case air quality impacts of the hypothetically located Willow plant are summarized in Table 5-8. The calculations were based on the assumptions described in Section 5.2.3.4 and 90 percent SO_2 control. Because the existing background pollutant concentrations are very low, compiliance with the PSD increments would be much more constraining than would compliance with the ambient air quality standards. Based on the assumed emission controls (90 percent SO_2 control), the emissions from the 400 MW Willow plant would not cause the calculated worst case 24-hour SO_2 impact to exceed 37 ug/m^3, which is roughly 41 percent of the PSD Class II increment.

Table 5-7

SUSITNA HYDROELECTRIC PROJECT
WORST CASE AIR QUALITY IMPACTS OF THE 600 MW NENANA POWER PLANT

Pollutant and Averaging Time[1]	Calculated Worst Case Impact (ug/m^3)
Sulfur Dioxide	
1. Annual	1.2
2. 24-hr	57
3. 3-hr	120
Particles	
1. Annual	2.5
2. 24-hr	

1/ Annual average values calculated using COMPLEX I computer model. Other averaging times were based on simplified VALLEY/F/2.5 screening calculations (EPA 1977).



HARZA-EBASCO
SUSITNA JOINT VENTURE

Calculated SO_2 Isopleths Around the Nenana Power Plant

FIGURE
5-1

Table 5-8

SUSITNA HYDROELECTRIC PROJECT
WORST CASE AIR QUALITY IMPACTS OF THE 400 MW WILLOW POWER PLANT

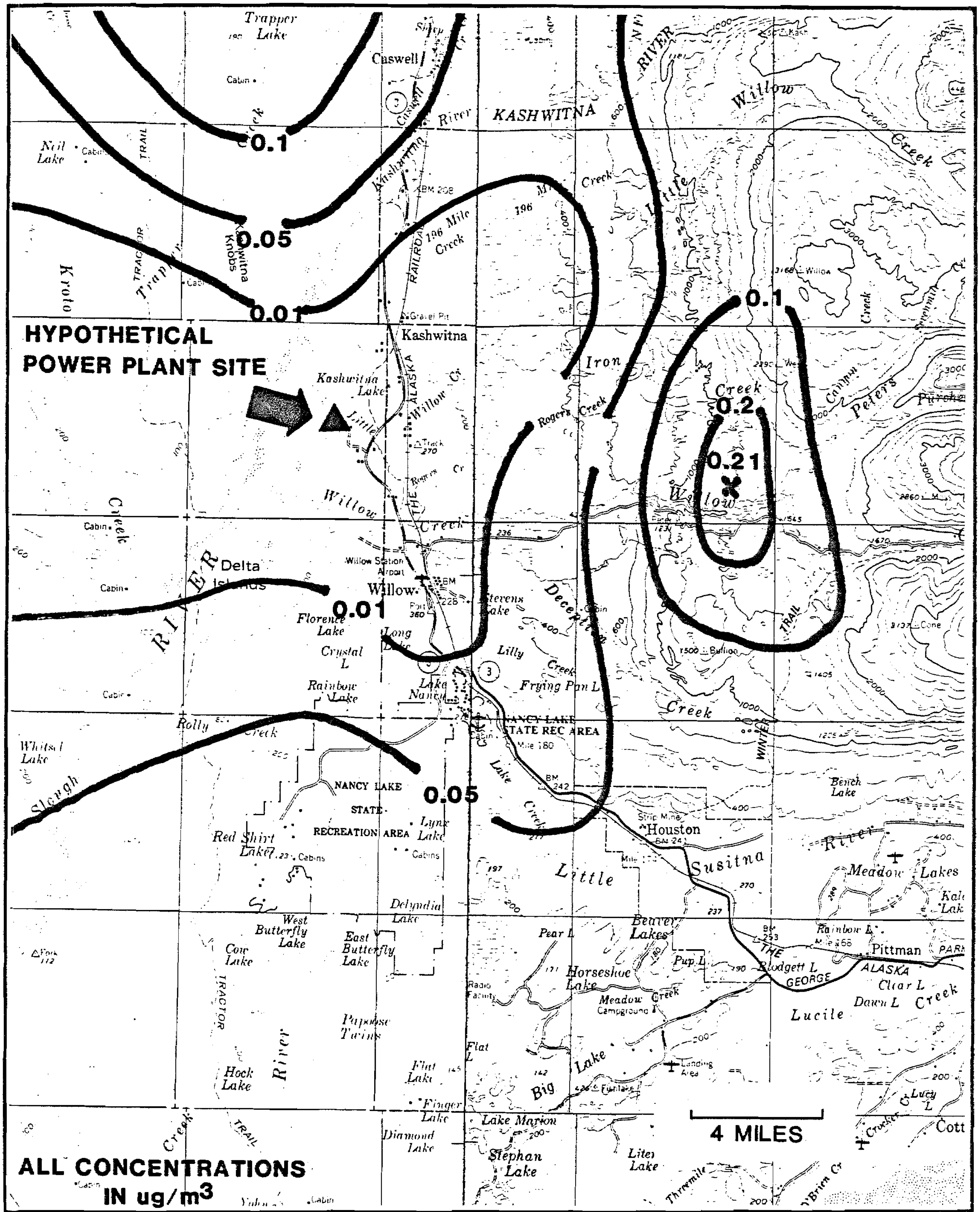
Pollutant and Averaging Time[1/]	Calculated Worst Case Impact (ug/m^3)
Sulfur Dioxide	
1. Annual	0.21
2. 24-hr	37
3. 3-hr	80
Particles	
1. 24-hr	1.7

[1/] Annual average values based on COMPLEX I computer model. Shorter averaging times were calculated using the simplified VALLEY/F/2.5 screening calculation (EPA 1977).

The calculated annual average SO_2 concentrations near the Willow plant are shown in Figure 5-2. The highest annual average concentrations would occur along the ridges to the east of the hypothetical power plant site. The most significant impact would be the short-term SO_2 concentrations. The calculated 24-hour SO_2 impact near Willow is 37 ug/m^3, which is 41 percent of the allowable PSD Class II movement.

5.2.4.3 Power Plant Fugitive Dust Impacts. Fugitive dust from the power plant operations could be a significant siting constraint. As discussed in Section 5.2.2.4, the fugitive dust emissions from the power plants would be subject to PSD review, so the dust impacts cannot exceed the allowable PSD increments. The fugitive dust emissions were calculated based on a 400 MW power plant. The worst case 24-hour dust emissions were based on an assumed dry, windy day with BACT fugitive dust controls being applied as appropriate. The calculated worst case fugitive dust impacts near the power plant are shown in Figure 5-3. Under the assumed worst case conditions, the maximum 24-hour fugitive dust concentrations would exceed the allowable PSD Class II increment for all locations within approximately 1 km of the center of the facility.

5.2.4.4 Coal Mine Fugitive Dust Impacts. The calculated fugitive dust concentrations downwind of the Lignite Creek mine are shown in Figure

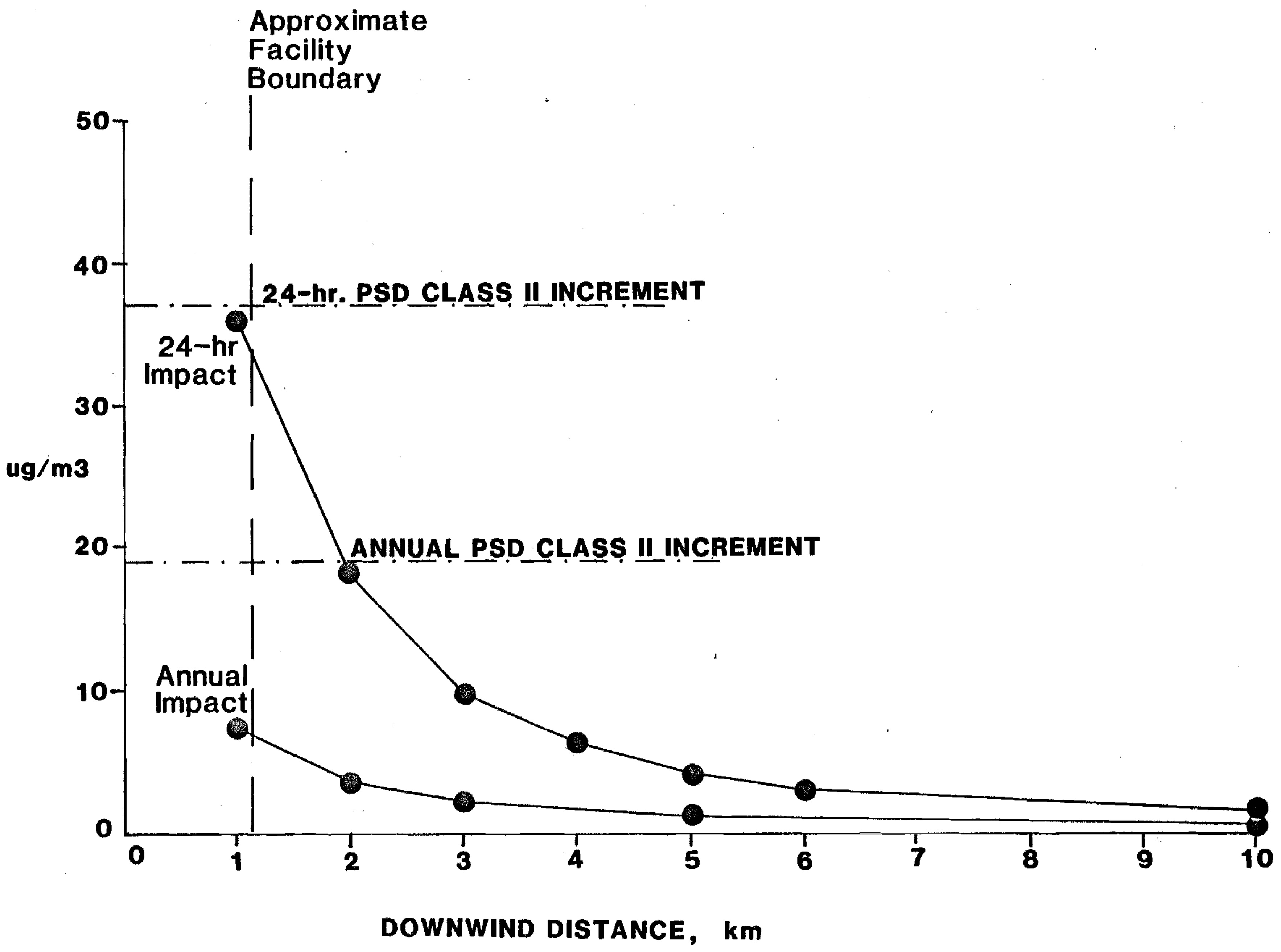


HARZA-EBASCO
SUSITNA JOINT VENTURE

Calculated SO_2 Isopleths Around the Willow Power Plant

FIGURE
5-2

HARZA-EBASCO
SUSITNA JOINT VENTURE



Calculated Power Plant Fugitive Dust Impacts

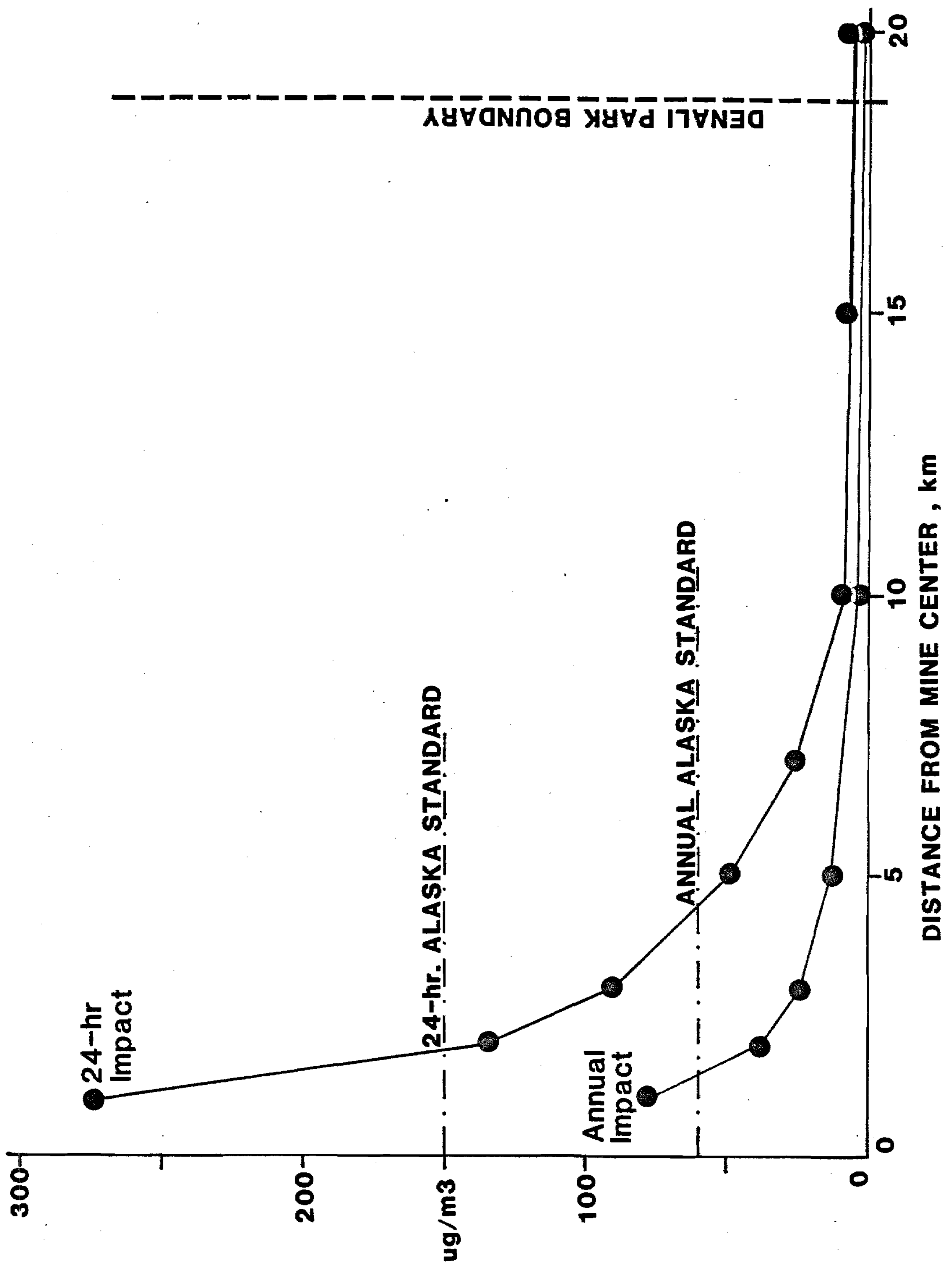
FIGURE 5-3

5-4. The calculated worst case mine fugitive dust impacts are shown in Figure 5-4. The calculated annual average dust concentrations would exceed the allowable Alaska ambient limit of 60 ug/m^3 for all distances within approximately 2.5 km of the mine center.

5.2.4.5 Unit Train Fugitive Dust. The coal would be transported from the Lignite Creek mine to the various power plants by unit trains. Fugitive dust emissions caused by loss of coal fines during transport would create air quality impacts. In-transit coal losses were estimated based on similar analyses for a major coal project (Long Beach Harbor Department 1983). The estimated in-transit coal losses are 7.7 tons of losses per million tons of transported coal. The five coal-fired power plants would require transport of roughly 5 million tons per year of coal. The total coal losses during transmit from Healy and Lignite Creek to the power plants would, therefore, 38.5 tons per year. Those dust impacts would be spread over the entire 300 miles of railroad between Nenana and Willow.

5.2.5 Acid Precipitation

For this study, the worst case sulfuric acid and nitric acid deposition rates (grams/m^2/yr) were calculated for SO_2 and NO_x emission rates for a 600 MW power plant using Nenana coal.



HARZA-EBASCO
SUSITNA JOINT VENTURE

Calculated Mine Fugitive Dust Impacts

FIGURE
5-4

The assumed conditions used for the calculations were as follows:

- SO_2 to SO_4 conversion rate = 0.25 percent/hr
- NO to NO_2 conversion rate = 10 percent/hr
- NO_2 to HNO_3 conversion rate = 1.0 percent/hr
- Ten percent wet deposition of acid particles
- Three meters/sec wind speed, with 50 percent annual wind persistence over a 22.5° plume

The pollutant conversion rates are typical for the continental United States(National Research Council 1983).

Based on the assumed plume chemistry conditions and the assumed plume trajectory, the acid formation rates and the downwind deposition rates were calculated. The calculated deposition rates are shown below:

Downwind Distance (km)	Sulfuric Acid Deposition ($g/m^2/yr$)	Nitric Acid Deposition ($g/m^2/yr$)
30	0.0014	0.0215
60	0.00136	0.0467
130	0.00132	0.0676
250	0.00123	0.115
520	0.00105	0.104

The ecological impacts of these acid deposition rates depend upon the geological, hydrological, and aquatic characteristics of the regions that would be affected.

5.2.6 Ice Fog

The potential for ice fog formation caused by water vapor emissions could be a major siting constraint for the coal- and gas-fired power plants. Ice fog is a frequent problem in the Fairbanks area, as shown in Table 5-9.

It might be difficult to obtain permits for a power plant in locations where ice fog would affect local communities. The Alaska air quality regulations (18 AAC 50.090) require that anyone operating industrial equipment in areas subject to ice fog must take steps to reduce water vapor emissions.

Table 5-9

SUSITNA HYDROELECTRIC PROJECT
OCCURRENCE OF ICE FOG AT FAIRBANKS AIRPORT

Month	Average Number of Days with Observed Ice Fog
November	9
December	12
January	12
February	9

Source: USAF (1984). "Observed ice fog" indicates that fog (less than 7 miles visibility) was observed at any time during the day.

5.2.7 Potential Impacts of Gas-Fired Power Plants

Both the coal-fired power alternative and the gas-fired power alternative call for constructing natural gas-fired power plants in the Anchorage area. There are a number of air quality constraints that could restrict the use of the power plants in urban regions. These possible restrictions are described below:

Carbon Monoxide Emissions - The carbon monoxide (CO) emissions from the power plants could have significant impacts on the existing CO nonattainment area at Anchorage.

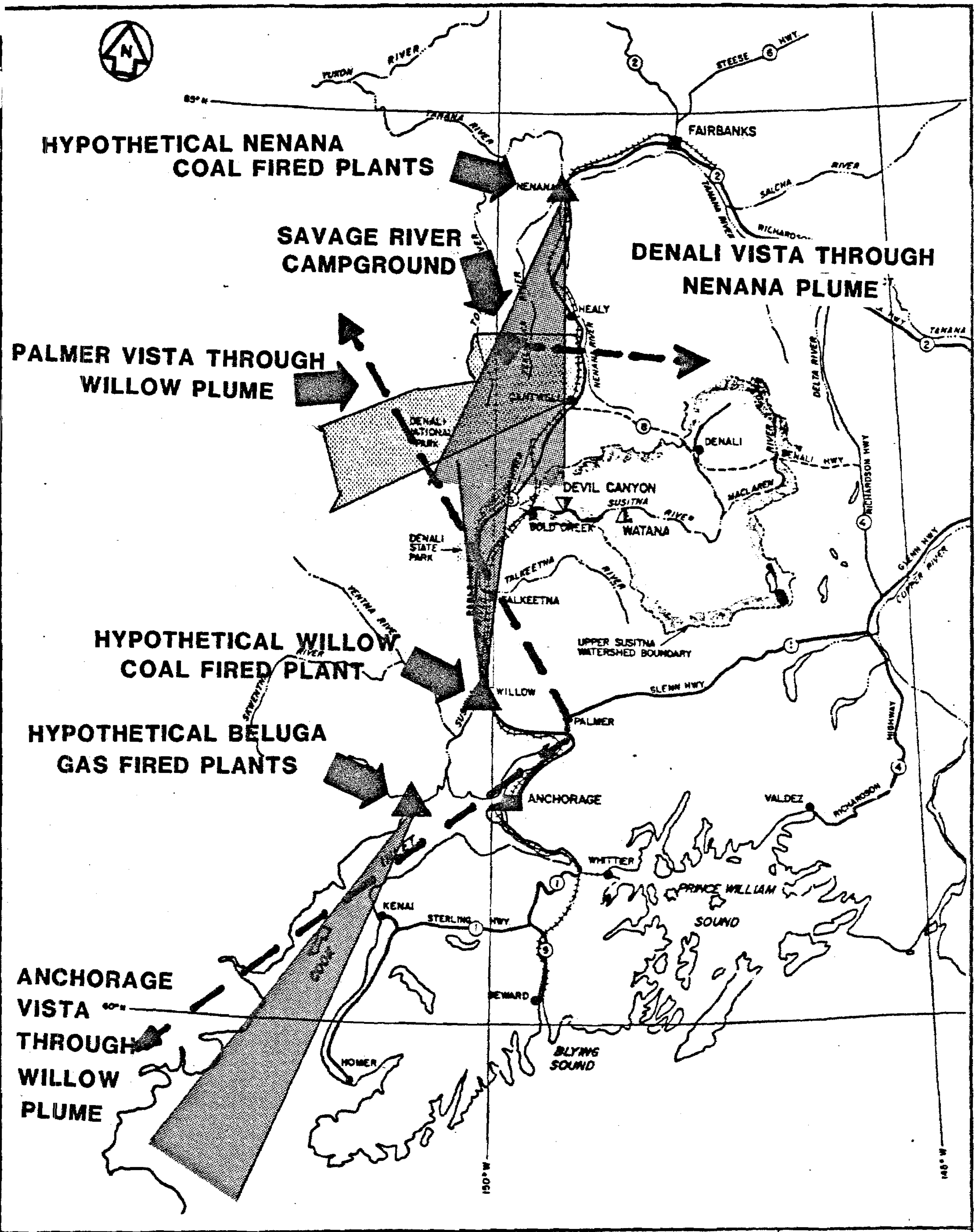
NOx Emissions- There are presently no ozone or NO_2 nonattainment areas in Alaska. However, the major NO_x emissions from the gas-fired power plants located near Anchorage would contribute to photochemical smog, thereby causing increases in both ozone and NO_2 concentrations in the area. The power plants by themselves would probably not cause exceedances of either the NO_2 or ozone ambient air quality standards (see Table 5-3). However, the increased NO_2 and ozone concentrations caused by the power plants could restrict the amount of industrial development that would otherwise be possible if the power plants were not constructed in the urban area.

5.3 PLUME VISIBILITY IMPACTS

Both the federal and the Alaska air quality regulations mandate that Denali National Park must be protected against visibility degradation caused by industrial air pollution emissions. Visibility degradation is a key issue in the Prevention of Significant Deterioration (PSD) air quality permit process and in the NEPA process. The Alaska PSD regulations specifically require an analysis of potential visibility degradation in Denali National Park. The Alaska DEC can deny the air quality permit for any facility if it determines that the emissions would cause unacceptable visibility degradation in the park even if no other exceedances of air quality limits would occur. Visual resources in the areas in Alaska outside of Denali National Park are not explicitly protected under the air quality regulations. However, the Council on Environmental Quality (CEQ) guidelines specifically require that a review of visual resource impacts be conducted for any Environmental Impact Statement under NEPA.

For this report, the air quality/visibility impacts of the coal-fired power plants and the gas-fired power plants have been predicted. The PLUVUE computer model was used to predict visibility impacts on key vistas under worst case meteorological conditions. The assumed conditions were chosen to study the impacts on actual key vistas under plume dispersion conditions that are likely to occur. The vistas and conditions chosen do not necessarily provide the highest numerical indicators of visibility degradation. Instead, the assumed plume trajectories and observer configurations were chosen to study the degradation of actual key vistas that are considered a valuable cultural resource in the Anchorage/Cook Inlet Regions. Degradation of those key vistas must be avoided.

The assumed emission sources, plume trajectories, observer locations and observer vistas are shown in Figure 5-5. The assumed emission rates and meteorological conditions are listed in Table 5-10.



HARZA-EBASCO
SUSITNA JOINT VENTURE

Assumed Power Plant Plume Trajectories and Observer Orientations

FIGURE 5-5

Table 5-10

SUSITNA HYDROELECTRIC PROJECT
ASSUMPTIONS USED FOR VISIBILITY CALCULATIONS

	600 MW Nenana Power Plant	400 MW Willow Power Plants	Beluga Gas-Fired Power Plants
Emission Rates			
NO_x, g/sec	441	293	133
SO_2, g/sec	86	57	0
TSP, g/sec	3.6	2.4	0
Plume Age, hrs	12 hrs	12 hrs	12 hrs
Wind Speed, meters/sec	1.94	1.74	2.31
Stability Class	D	D	D

Three 200 MW coal-fired power plants were assumed to be at Nenana. The plumes were directed toward Denali National Park, under otherwise pristine conditions. The observer was assumed to be at the Savage River campground near the north park boundary. Two assumed vistas were studied: looking westward toward Mt. Deborah and the Alaska Range, and looking northward away from the park. These vistas are seen by many visitors to Denali National Park. They are protected under the Alaska PSD regulations (18 AAC 50.021(c)(1)), and also represent an extremely valuable resource.

Two 200 MW coal-fired power plants were assumed to be at Willow. The plume was directed northward along the Susitna River valley, under otherwise pristine summertime conditions. One observer was placed near Anchorage, with an assumed vista toward Mount McKinley. This vista is not explicitly protected by the air quality regulations. However, it is obviously a very valuable cultural resource for the Anchorage area. A second observer was placed near Willow, looking northward along the Susitna River valley.

For simplicity, all of the 1,540 MW of gas-fired generating capacity that would be required under the gas-fired power scenario was assumed to be emitted from a single source at the Beluga River. The plumes were directed southwestward, down Cook Inlet. Minor existing SO_2 and NO_x pollution was assumed because of the refineries near Kenai. the observer was placed at Anchorage, and the assumed vista was along Cook Inlet toward the Aleutian Range.

The visibility estimation procedures calculate the optical properties of plume parcel that is subject to photochemical reactions. The major assumed causes of visibility impairment are as follows:

- Formation of particles that reflect and absorb sunlight

- Formation of gaseous NO_2, which is a yellowish gas that causes discoloration of the sky and white objects (e.g., snow covered mountains)

The PLUVUE model calculates a number of key optical parameters for the assumed emission conditions and the assumed plume/observer orientation. The model also accounts for the color of the background object being viewed, since the plume impacts are generally more significant for white objects (e.g., snow covered mountains) than they are for dark objects. The key optical parameters that are calculated by PLUVUE are as follows:

- Reduction in Visual Range - The reduction in visible range depends on the concentrations of pollutants in the air, the color of the object being viewed, and the visible range that would occur under otherwise pristine conditions.

- Plume Contract C - The contrast C is the relative brightness of the plume compared to either the background sky or to the viewing object. A high plume contrast relative to a viewing object will cause the object to look washed out or flattened. Visibility impairment is significant if the absolute value of the contrast is more than 0.10 (EPA 1980).

- Blue/Red Ratio (BRATIO) - This factor describes the "yellowing" of either the sky or a viewing object. The major cause of the "yellowing" is NO_2 gas in the plume. For any plume condition, BRATIO will depend on the color of the viewing object. Visibility impairment is significant if BRATIO is less than 0.90 (EPA 1980).

- Plume Perceptibility Parameter E (LAB) - This factor is similar to BRATIO. It describes changes in the apparent color and brightness of an object as viewed through an obscuring plume. Visibility impairment is significant if E (L*A*B) exceeds 4.0 (EPA 1980).

The results of the visibility calculations for the three assumed scenarios are shown in Table 5-11.

5.4 AESTHETIC IMPACTS

5.4.1 Coal-Fired Power Generation

The coal-fired generating scenario consists of siting three 200 MW generating plants in the Nenana area and two plants in the Willow area. Visual absorption capabilities of the natural landscapes to absorb the construction of a power plant were not addressed in detail in the DEIS and, therefore, the following paragraphs focus on those aspects of a coal-fired power plant development that are known to create visually intrusive impacts to viewers.

5.4.1.1 Environmental Setting. At Nenana, the proposed general site location is situated among the landscapes of Nenana River lowlands southwest of the community of Nenana. These landscapes are dominated by the braided river channels of the Nenana and Teklanika rivers that run their course over the characteristic flat terrain lacking of distinctive topographical features. Vegetative cover is characterized by thin to moderately dense spruce forests and tundra and wetland bog species. Views are generally open, directed across the river to the forested Tenana hills and south to the Alaska Range. The George Parks Highway connecting Anchorage and the state's second largest population center, Fairbanks traverses a generally northward course to Nenana across the Nenana River lowlands and then a northeasterly direction to Fairbanks. Existing transmission lines which parallel the highway throughout this entire segment are highly visible. The Nenana River lowlands have been

Table 5-11

SUSITNA HYDROELECTRIC PROJECT
SUMMARY OF PLUME VISIBILITY CALCULATIONS

	Impact of Nenana Plume on Denali Park		Impact of Willow Plume	Impact of Beluga Gas-Fired Power Plant Plumes
	Eastward Vista	Northward Vista	Vista of Mt. McKinley from Anchorage	
Reduction in Visible Range (percent)	0.29	0.28	0.55	0.38
Blue/Red Ratio BRATIO				
1. White Background	0.9978	0.9978	0.999	1.013
2. Black Background	0.9973	0.9974	0.998	0.9987
Plume Contrast				
1. White Background	-0.0040	0.0041	0.007	0.0014
2. Black Background	-0.0035	-0.0035	0.005	0.0009
Perceptibility Parameter				
1. White Background	0.2499	0.2522	0.326	0.073
2. Black Background	0.2456	0.2461	0.243	0.0514

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designated as having low aesthetic value with high absorption capability ratings due to its flat, expansive terrain characteristics and variety of vegetation patterns.

The proposed Willow area general site location is situated among the Susitna River lowland landscapes between the town of Willow and Kashwitna Lake just west of the Parks Highway. These landscapes are dominated by the extensively braided channels of the Susitna River. A number of lakes, varying in size, enhance the Willow area landscapes. The Nancy Lake State Recreation Area, a popular water-based recreation site, is situated less than five miles south of the proposed general site location. Vegetation in the Willow area is primarily spruce-hardwood and spruce-poplar forest. Visual quality of the Willow area is high (ADNR 1981). Data identifying the visual absorption capabilities of these landscapes are not presently available.

5.4.1.2 George Parks Highway Scenic Inventory. The George Parks Highway provides access to more than 350 miles of scenic landscapes located along its corridor between Fairbanks and its junction with the Glen Highway near Wasilla, Alaska. The ADNR inventoried the scenic resources along the Parks Highway (ADNR 1981), which resulted in first priority scenic highway designations and management recommendations for nearly 136 miles of the Parks Highway corridor.

Visual Resource Management (VRM) Unit No. 24 of the Parks Highway scenic resource inventory traverses 38.5 miles of the Nenana lowlands landscape character type from the Nenana River bridge crossing (milepost 275.5) north to approximately ten miles past the community of Nenana. The majority of this highway segment is characterized by a straight stretch of roadway with few distant or lateral views due to the visually restricting vegetation bordering the highway's corridor. Consequently, this segment was assigned high visual absorption capability ratings.

A one-mile segment, at the Tenana River bridge crossing, was designated as having high intrinsic and composite visual quality ratings. Views in this area include the confluence of the Tenana and Nenana Rivers. At this location (milepost 305.8), there are four undeveloped turnout sites. Visual quality management recommendations for this one-mile segment propose the development of a formal roadside rest area and interpretive center. The objectives of this rest area is to enhance the viewer's opportunity to visually experience the natural setting of the Nenana lowlands landscape character (ADNR 1981).

The nearest segment of highway in the general area of the proposed Nenana power plant site that is designated as a first priority scenic resource occurs between milepost 271.6 and 276.2 of the Parks Highway. This 4.5-mile stretch approaches and includes the Nenana River highway crossing. This road segment is characterized by very high intrinsic and composite visual quality ratings and landscapes adjacent to the highway have high visual absorption capabilities. The ADNR visual quality management actions recommend the development of a roadside rest area and interpretive center.

In the vicinity of Willow, visual resource management Units Nos. 6 and 8 traverse the Little Susitna River-Susitna lowlands character types. When traveling north, the first views of Mt. McKinley and Mt. Foraker are possible from this roadway segment (ADNR 1981). Good views of the Talkeetna Mountains are also possible in a northeasterly direction. VRM Unit No. 6, from the Big Lake Road turnoff to Nancy Lake, "includes approximately 17 miles of some of the most scenic portions of the Parks Highway . . . the result of a very diverse landscape with numerous views to distant mountains and constantly changing panoramas . . ." It also contains "the only extended views from the highway out across the broad lower Susitna Valley" (ADNR 1981). This segment of the highway is subject to extensive use, due to its proximity to Anchorage and popular recreation attractions at Nancy Lake and Willow Creek.

The ADNR VRM Unit No. 8 includes 7.5 miles of highway segment between Willow Creek north to approximately two miles beyond the Kashwitna Lake area. This segment is characterized by very high scenic resource values and intense recreation use. Views across Kashwitna Lake are possible while traveling south and near Willow Creek; excellent views are possible toward Mt. McKinley, the Alaska Range, and Talkeetna Mountains.

5.4.1.3 Visual Impacts. The construction of a 200 MW coal-fired power plant in a natural setting will significantly disrupt the visual integrity and compositional harmony (unit) of the natural landscape environment. The visually dominating linear features of the plant facility (stack, building structures) and ancillary structures (access roads, transmission lines) contrast in line, form, and texture of the landscape elements (waterforms, landforms, vegetation patterns).

A significant portion of natural landscape will be disturbed during the construction, development, and life of the power plants located at Nenana and Willow. The degree of visual intrusion upon the natural landscape character would therefore be significant. The significance of the visual intrusion to the viewer, the visual impact, relates to site-specific environmental characteristics (e.g., the visual absorption capability or the landscape's ability to absorb visual modification), the viewing potential of the site from viewpoint locations, and the frequency and duration of viewing activity.

The high visual absorption capabilities of the Nenana and Willow landscapes are likely to lessen the visibility of the plant structure. This high visual absorption capability is attributed to the low visual magnitude (the slope of the visual land in relation to the viewer) of the flat terrain and high vegetative screening potential of both site locations. However, as discussed earlier, significant viewpoint locations do occur along the Parks Highway with very high viewing potentials. Data relating to viewer frequency and viewing duration is insufficient in the DEIS. It will be necessary to examine this data in the FEIS to fully analyze the potential visual impacts of the coal-fired generating plants. The effectiveness of the landscape's visual absorption capabilities will be directly related to the proximity of the plant facility or its ancillary structures to these important viewpoint locations. At a minimum, the visibility potential of the stacks, transmission lines,, and possibly the cooling towers is likely to be very high. It should also be noted that the sunlight reflective capacities of some of the plant structures will contribute significantly to the degree of visual impact experienced by potential viewers of the plant site.

The air quality implications of the coal-fired plants and subsequent relationship to visual impacts (the potential for a reduction in the visual range and color contrasts as perceived by the viewer) are discussed in Section 5.1. Visual impacts created by plume emissions are less restricted to site-specific parameters and are likely to be experienced by a greater number of viewers and for longer periods of time than visual impacts relating to actual plant structures and associated facilities.

Railcar transport of coal would also result in aesthetic impacts. Transport to the Nenana plant would result in an increase of railroad activity where the railroad crosses the Parks Highway at milepost 276.2 four miles south of the Clear Mews Military Reservation. The 48-unit railcar would actually cross the highway at this location six times per day enroute between the mine and power plant locations.

The aesthetic intrusion upon the natural setting created by the length of the railcar, noise levels associated with railroad transport activity, and frequency of crossing the Parks Highway could be particularly significant. The segment of the highway between mileposts 271.6 and 276.2 that has been recommended for management as a first priority scenic resource (ADNR 1981) would be directly impacted.

Similarly, coal transport to the Willow site would potentially impact 24.5 miles of highway proposed for scenic resource management. Four times per day (two separate trips), coal transport to the plant site would visually intrude upon these scenic landscapes. Due to the nature of the railroad alignment which parallels the Parks Highway at the Kashwitna Lake area, viewing of the coal transport activity, would occur for longer periods of time during each separate viewing occurrence. The compatibility of increased rail transport activity in this area with ADNR management recommendations should be further investigated in the FEIS.

5.4.2 Gas-Fired Alternative

The Beluga and Chuitna sites are generally characterized by moderately flat terrain; extensive areas created from the deposition of glacial fluvial wash. Numerous small lakes occur throughout the area. Beluga Lake, the most prominent inland freshwater lake within the general area, is drained by the Beluga River which flows an undulating southeasterly course before emptying into Cook Inlet. The vast Susitna River drains the nearby Susitna lowlands approximately 10 miles northeast of the mouth of the Beluga River. Approximately 20 miles northeast of the mouth of the Beluga River lies the scenic Mt. Susitna, the dominant topographic feature of the Beluga area, towering more than 4100 ft. above the coastal flatlands bordering Cook Inlet. Mt. Susitna is a noted scenic attraction from numerous vantage points including views taken from commercial aircraft approaching the nearby Anchorage metropolitan area, from viewpoints throughout the entire Anchorage area, and from occasional viewpoints located along the Seward Highway.

There is little variation in vegetation cover from the spruce-hardwood forests dominating the inland areas and the sedge-grass vegetation characterizing the coastal terrain. The small Native Alaskan village of Tyonek located one mile south of the Chuitna River is the nearest community in the vicinity of the proposed power plant sites. Alaska's largest population center, Anchorage, lies approximately 40 miles directly southwest across the waters of Cook Inlet. Access to the Beluga site area is currently only possible by way of air or boat traffic.

The intrinsic visual quality of the Beluga and Chuitna landscapes is relatively high due to the uniqueness and variety of its characteristic features: Mt. Susitna; westward panoramic views of the Aleutian Mountain Range; the variety of waterforms, including the vast panoramic seascape views offered by Cook Inlet.

The visual absorption capability of the Beluga/Chuitna landscapes is a factor of site-specific parameters. Vegetative screening by the natural forest vegetation, although greatest in the inland forested areas, may serve to protect land or water-based views of some of the actual plant structures and ancillary facility structures. The most visible features of the gas-fired generating plants are likely to be the stacks, possibly the cooling towers, the transmission line and transmission corridor routed from the Beluga and Chuitna plants to existing transmission lines, associated local access or haul roads, and the plumes emitted from both the cooling tower and boiler plant stacks. These plant structures and most of the ancillary structures are likely to be viewed by recreationists, hunters, and local Tyonek residents. Other than the resident population of Tyonek, specific data of numbers and frequency of recreation and hunting activity in the area is not readily available.

Additional visual impacts of the Beluga/Chuitna gas-fired power plant development would result from the visibility of stack emissions. Visibility of the plume is likely to occur from most of the previously mentioned viewpoints in and around the Anchorage area. Plumes may visually intrude upon the scenic Mt. Susitna landscapes and upon the residents of Tyonek that are accustomed to experiencing views of an undisturbed natural setting.

Refer to Section 5.2 for a detailed discussion of the potential for visibility degradation in the form of visual range reduction and color contrast reduction due to plume opacity and plume discoloration.

The visual impacts resulting from locating gas-fired generating plants in the Kenai area could present visual impacts of a similar nature and of equal significance to those of the Beluga/Chuitna siting alternatives. The proposed Kenai/Nikinski plant site would be located within five miles of the Kenai National Forest. The coastal terrain in this area and northwest of the Moose Range is relatively flat varying little more than 100 feet. Less than ten miles west across Cook Inlet lies the Aleutian Chain. The growing populations of Kenai and Soldotna, as well as the smaller Salamatof community are within 35 to 40 road miles of the general proposed plant site location. As noted in Section 3.3.9 of the DEIS, views in this area are highly scenic.

5.5 WATER QUALITY AND QUANTITY

5.5.1 Coal-Fired Power Generation

5.5.1.1 Coal Mine Expansion. Each 200 MW coal-fired power plant will require approximately 900,000 tons/year of 7,600 Btu/lb heating value coal as mined. The associated overburden is approximately 3.8 to 4.0 times the above quantity, 3,400,000 to 3,600,000 tons/year. Additional surface water runoff collection systems, settling basins and reclamation plans must be developed to maintain existing water quality and prevent significant erosion and subsequent sediment loading and turbidity increases in nearby receiving waterbodies. Additional water requirements may be necessary for potential coal washing activities to meet power plant specifications. Wastewater from coal beneficiation processes must be treated prior to discharge to receiving water bodies, thus affecting coal cost. Such treatment would include pH adjustment, precipitation/ flocculation techniques, and possibly filtration. Any resulting treatment sludges would likely be disposed in the waste overburden area. Leachate collection systems may be required in the overburden disposal area.

5.5.1.2 Unit Trains. The construction of additional railroad spurs would mainly impact water quality through increased sediment loading and turbidity related to vegetation removal, soil grading and disturbance, and filling activities. Mitigation of these impacts would require appropriate sediment and erosion control plans and facilities, thus affecting coal cost. Some potential exists for alteration of surface hydrologic patterns (alteration of flow regimes) with railbed construction in the Susitna lowlands (Willow) area, where there are significant wetlands.

A small risk also exists from a potential coal spill due to a rail accident. Such a spill (e.g., several rail cars of coal) could have a localized effect on water quality if spilled into or adjacent to a water body. A change in pH, a localized increase in dissolved ion and metal concentrations, and increased sediment/turbidity would be expected.

5.5.1.3 Coal-Fired Power Plants. Water supply requirements for a 200 MW coal-fired facility employing a wet/dry coolig tower would be approximately 4 cfs during wet tower operation. Wet FGD scrubbing would increase this figure slightly. Special consideration must be given to intake structure location as freezing and ice related problems can significantly affect operational reliability. The implementation of control systems to mitigate freezing problems will affect both the capital and operations and maintenance cost associated with the plant. Consideration of stream morphology and geometry is another siting constraint necessary to award local flow reduction effects during low flow periods.

Water quality issues revolve around surface runoff, groundwater infiltration, and wastewater; in relation to fuel storage, plant wastewater discharges, and solid waste disposal. For a 200 MW plant, two coal storage areas, a live storage and dead storage area, are envisioned. They are sized, equally, to provide 60 days storage (70 percent plant capacity), or approximately 183,000 tons. A runoff/leachate collection system must be designed for these piles, sized using the site specific local meteorological data. Presently, capacities required appear to be approximately 3-4 cfs for the worst case. Depending upon exact location, the piles may be required to be imperviously lined to prevent groundwater infiltration and contamination of shallow, unconfined aquifers. The collected runoff will be routed to a holding basin for treatment prior to discharge. Treatment will include settling, and as required to meet standards pH adjustment and flocculation/precipitation. Treatment sludges will be routed to the ash disposal piles.

Typical plant wastewater flows are presented in Table 5-12. These waste streams must be treated prior to discharge, in order to satisfy state and federal standards. Proven technology treatment systems, which may include a package sanitary waste system, flow equalization-neutralization ponds, flocculation/precipitation, waste stream recycling, and boiler injection will impact capital cost and O/M costs.

The combined fly ash, bottom ash, and scrubber sludge disposal area, similar to the fuel pile area, must have a runoff/leachate collection system. The volume of this solid waste material is expected to exceed 315 tons/day, and hence would require an extensive area for runoff control. In addition, an impervious liner (e.g. bentonite clay), may be required to prevent degradation or infiltration to underlying surficial groundwater aquifers or surrounding wetland areas.

Table 5-12

SUSITNA HYDROELECTRIC PROJECT ESTIMATED PLANT WASTEWATER FLOWS

Wastewater	Frequency of Occurrence	Flow or Volume
Cooling Water and Auxiliary Cooling Water	Continuous	Seasonally variable; maximum 200 gpm
Makeup Water Treatment System	Continuous	75 gpm
- Condensate Polisher Waste	Intermittent	regen 24 gpm (daily avg)
- Boiler Blowdown	Intermittent	Max 20 gpm Avg 4 gpm
Floor Drainage and Oily Wastewater	Intermittent	500 gpm (wet) 100 gpm (dry)
Sanitary Wastes	Variable	5,000 gpd
Coal Pile Runoff	Intermittent	5×10^6 gpd
Metal Cleaning Wastes		
- Boiler Cleaning Organic Phase	Intermittent, once per 3 years	500,000 gallons
Inorganic Phase	Intermittent, once per 9 years	750,000 gallons
- Boiler Fireside Cleaning - Furnace Wall Wash	Intermittent, once per year	200,000 gallons
- Air Heater Wash	Intermittent, twice per year	1,000 gpm for 12 hours
Laboratory and Battery Room Wastes	Intermittent	2 gpm average daily flow
Dust Suppression Systems	Intermittent	10,000 gal./week

5.5.2 Gas-Fired Power Generation

Both simple cycle combustion turbines and combined cycle units present many of the siting constraints and environmental impacts associated with coal-fired units, especially water supply and wastewater discharge considerations. Additional consideration must also be given to ancillary facilities related to the development of a gas-fired power plant. These would include drilling activities, and transport pipelines. Offshore drilling has the potential for localized effects to water quality, including increased turbidity and spills associated with drilling effluents. Penetration of overlying surficial groundwater aquifers may require additional protection measures to assure aquifer integrity. If gas quality should decline, conditioning facilities could be required, resulting in additional wastewater streams requiring treatment. Such conditioning facilities could add significant amounts to overall facility cost. Construction of pipelines may require river or stream crossings, resulting in temporary impacts to water quality; primarily increased turbidity and sediment loading associated with disturbance of surface cover and soil erosion. Depending upon site-specific routing, flow regimes or streambeds may be altered, either temporarily or permanently.

5.6 SOCIOECONOMIC IMPACTS

The three communities that would be most impacted by the five coal-fired units proposed for the coal-fired scenario would be Nenana, Willow, and Healy. Increased mining operations at the Usibelli Mine near Healy would require a permanent workforce of 210 new workers, resulting in a total projected influx of 1,100 persons to the area. Since most of these people would be expected to reside in and around Healy, severe problems would be created for housing, sewer and water services, schools, fire, police, transportation, and health facilities.

In Nenana and Willow, where 500 workers would be needed for the two to five-year successive construction of each of the five proposed coal-fired units, peak population influxes of 3,600 and 3,100 persons, respectively, would be expected. These influxes would also cause severe rapid growth impacts on housing and community services in the two communities, although the impacts to Willow might be less severe than those to Nenana due to the proximity of larger communities within commuting distance, where some people might choose to reside. Additionally, in Nenana, where nearly one-half of the residents are Native Americans (U.S. Bureau of Census 1980), there would be considerable conflicts with cultural and subsistence activities.

During the operations phase, only 100 workers would be needed for each unit, causing the number of project-related residents to drop to approximately 1,500 persons in Nenana and 1,000 persons in Willow. Despite these reductions in numbers of residents, these figures still represent three and ten times the current population of Nenana and Willow, respectively.

5.7 TERRESTRIAL ECOLOGY

The Nenana coal-fired station would permanently remove 400 acres of vegetation for facility construction and about 45 acres due to waste disposal (Table 5-13). The Willow coal-fired plant would remove 300 acres for facilities and 45 acres for waste disposal (Table 5-13). The major impact of the coal plants on terrestrial resources would occur as a result of surface mining. The Nenana and Willow sites would necessitate disturbing 1,350 acres and 1,245 acres, respectively for coal production over the projected 30-year life of the facilities (Table 5-14). The natural gas generation facilities would result in the permanent loss or disturbance of approximately 410-420 acres (Table 5-14).

Along the Tenana and Nenana rivers near Nenana, the vegetation is primarily bottomland spruce-poplar forest. The Willow area is located in a river corridor dominated by bottomland spruce-poplar forest (ADNR and ADF&G 1982). The lower Beluga River area is mostly upland spruce-hardwood forest, except near the coast, where sedge-grass predominates. The Chuitna River originates in an area of high brush, and then extends through upland spruce-hardwood forest on its way to Cook Inlet. Southeast of Anchorage, the undisturbed natural vegetation is bottomland spruce-poplar forest.

Because of the amounts of land directly affected by the coal-fired and gas-fired facilities, impacts of the sites themselves on local wildlife populations would be moderate. The areas surrounding Willow offer high quality moose and bear hunting (ADNR and ADF&G 1982).

Furbearers utilize the riparian vegetation associated with the Beluga, Chuitna, Nenana, and Tenana River drainages (Selkregg 1974, AEIDC 1980, Bechtel 1983). Substantial trapping occurs along the streams near Willow. In addition, there is an increasing nonconsumptive use of wildlife resources in the area (e.g., wildlife photography, nature hikes) (ADNR and ADF&G 1982). Near the Nenana coal facility is a historic peregrine falcon nesting location. The Willow area supports bald eagles and waterfowl (i.e., harlequin ducks, mallards, canvasbacks, and ruddy ducks) (Commonwealth Associates, Inc. 1982). The 2,250 acres of vegetation that would be disturbed in the Healy area for coal production are primarily an upland spruce-hardwood community. The area is used as a summer range by approximately 12 caribou and supports about 0.3 moose/ km^2 (Gasaway et al. 1983, Elliott 1984). Depending on the units' location, the proposed gas-fired facilities near Anchorage could impact the lowland shrub communities used as winter range by the local moose population (Municipality of Anchorage 1980). Because of the tendency for moose north of the proposed Beluga site to assemble into dense aggregations or "moose yards" in the winter, and for the brown bear

Table 5-13

SUSITNA HYDROELECTRIC PROJECT
COAL-FIRED POWER GENERATION SCENARIO
SURFACE AREA LOST OR DISTURBED

	Lost or Disturbed Area (Acres)	
Type of Disturbance	Nenana Area	Willow Area
Plant and Associated Structures, Coal Unloading Facilities, and Coal Storage Piles	400	300
Waste Disposal Sites	45	45
Mine Expansion. One 200 MW Facility Would Require 450 Acre of Land be Mined Over the 30-Year Life of the Facility	1,350	900
Area Total	1,795	1,245
GRAND TOTAL	3,040	

Source: FERC 1984 (DEIS pg. 4-80).

Table 5-14

SUSITNA HYDROELECTRIC PROJECT
NATURAL GAS-FIRED POWER GENERATION SCENARIO
SURFACE AREA LOST OR DISTURBED

Type of Disturbance	Lost or Disturbed Area (Acres) Tyonek-Beluga Area	Anchorage Area	Kenai Area
Plant Facilities	30-35	10	5-10
Transmission Lines	365	-	-
Project Totals	395-400	10	5-10
GRAND TOTAL		410-420	

Source: FERC 1984 (DEIS pg. J-84 and 2-39).

population to be a geographically "localized" group (Bechtel 1983), increased human pressure (and hunting) may result in a more detrimental impact than the physical structures of the gas-fired power plant itself. Northeast of the proposed Beluga facility are trumpeter swan nest sites. West of the Chuitna site are swan and bald eagle nest sites (Cook Inlet Region 1981, AEIDC 1980). Wetlands occur over much of the area considered for development in these power generation scenarios. Avoidance and/or minimization of these sensitive and protected ecosystems will be a major siting constraint.

5.8 AQUATIC ECOLOGY

5.8.1 Coal-Fired Power Generation

5.8.1.1 Coal Mine Expansion. The development of power plants would require expansion of the mined area in the Nenana field. The Nenana Field is located near the headwaters of streams that drain into the Kantishna and Tenana rivers. The Nenana River has runs of chinook, coho, and chum salmon (ADF&G 1983a). There is no information available on the size of these runs. Extensive commercial, sport, and subsistence fisheries exist downstream of the confluence of the Nenana and Tenana rivers, and into the lower Yukon (ADF&G 1983b). Potential impacts to regional aquatic environments are dependent on locations of mine expansion and erosion and water quality control measures. Therefore, these source terms must be resolved before conclusions can be made about potential impacts to aquatic environments.

Potential impacts from expanding the coal mine could be severe. Mine expansion could seriously affect stream morphology and sedimentation characteristics. Important habitats in nearby headwaters could be disturbed by dissolved and settleable solids. Acid mine drainage could lower the pH of these streams to levels that would exclude most desirable organisms. Additionally, toxic metals, nonmetals, and organics could leach from mine overburden or beneficiation plant tailings and impact these freshwater communities. All resident and migratory populations of the receiving waters could be severely affected by toxic and particulate effluents.

5.8.1.2 Unit Trains. Fuel requirements of the two proposed coal-fired alternatives would greatly exceed existing demands from the Usibelli mine, and therefore, the transport of coal through parts of the Railbelt Region could be increased substantially. Associated hazards to aquatic environments would relate to risks from coal transportation accidents. Aquatic environments exposed to these risks would be the Nenana, Tenana and Susitna Rivers, and some of their tributaries. Potentially significant impacts might occur from toxic or acidic chemicals leaching from coal accidentally spilled into these rivers. These chemicals could affect any of the aquatic populations or habitats in the Railbelt Region, depending on the location of the spill. Other materials that could enter these rivers from train accidents might include oil and diesel fuels.

5.8.1.3 Coal-Fired Power Plant. Construction of the five 200-MW coal units and the ten 70-MW combustion-turbine units would impact aquatic communities in the immediate vicinity of the facilities and along access routes. Aquatic habitats (e.g., wetlands) would pose a major siting constraint for these facilities and sensitive areas could be disturbed if in proximity to where the facilities are to be sited. Increased siltation and turbidity could adversely affect aquatic communities in the vicinity of construction sites and where access routes and power transmission corridors cross streams. During operation of the coal units, however, there would be additional impacts associated with coal piles and fly ash disposal areas. Sites for these areas would likely be near additional aquatic habitat (most likely wetland), and during operation there would likely be some change in the composition and distribution of aquatic plant, invertebrate, and fish communities in the immediate vicinity of runoff from these areas.

Sources of makeup water for these proposed plants are not yet determined. Either groundwater or river water could be used. If river water is used, then potentially significant impacts to fisheries might occur due to impingement and entrainment effects associated with intake structures. Wastewater will be discharged into local rivers or streams. The increased dissolved solids discharged into streams or other surface waters might cause some local changes in composition and distribution of plant, invertebrate, and fish communities.

5.8.2 Gas-Fired Power Plants

Construction and operation of the gas-fired power plants would require installation of gas wells, construction of gas pipelines from the wells to the power plant sites, and construction of the power plants themselves. All of those phases could affect the aquatic environment. For this Appendix, the specific environmental impacts of the various phases of the gas-fired power scenario cannot be evaluated, because the impact analyses would require knowledge of the specific plant site. The important issues that would have to be addressed during the impacts analyses for a specified power plant site would include the following:

- What are the frequencies and extent of fish and mammal populations in the affected region?
- Do any rate, threatened, or endangered species use habitats in the affected region?
- What kinds, extents, and durations of disturbances will be incurred by gas-fired plant construction on intertidal and/or benthic communities from dredging and siltation?
- What species, numbers, and sizes of fish will be impinged or entrained by water intake facilities, should they be necessary for cooling purposes?

- What are the risks of rupturing submarine cables and releasing cable oil into aquatic habitats?

- What important invertebrate and plant species that serve as food for fishes, mammals, or humans inhabit gas-fired alternative sites?

5.9 NOISE IMPACTS

The coal-fired power plant alternatives will cause noise due to three separate activities. These are: 1) coal mining; 2) coal transportation by train, and 3) power plant operation. Noise calculations have been made for each activity. Standard atmospheric conditions of 59°F and 70 percent relative humidity with no wind have been assumed for all the calculations. Extreme meteorological conditions could affect the levels presented by as much as 20 decibels in either direction. An existing background level of 30 decibels has been assumed for the mine and power plant region.

5.9.1 Coal Mine Blasting Noise

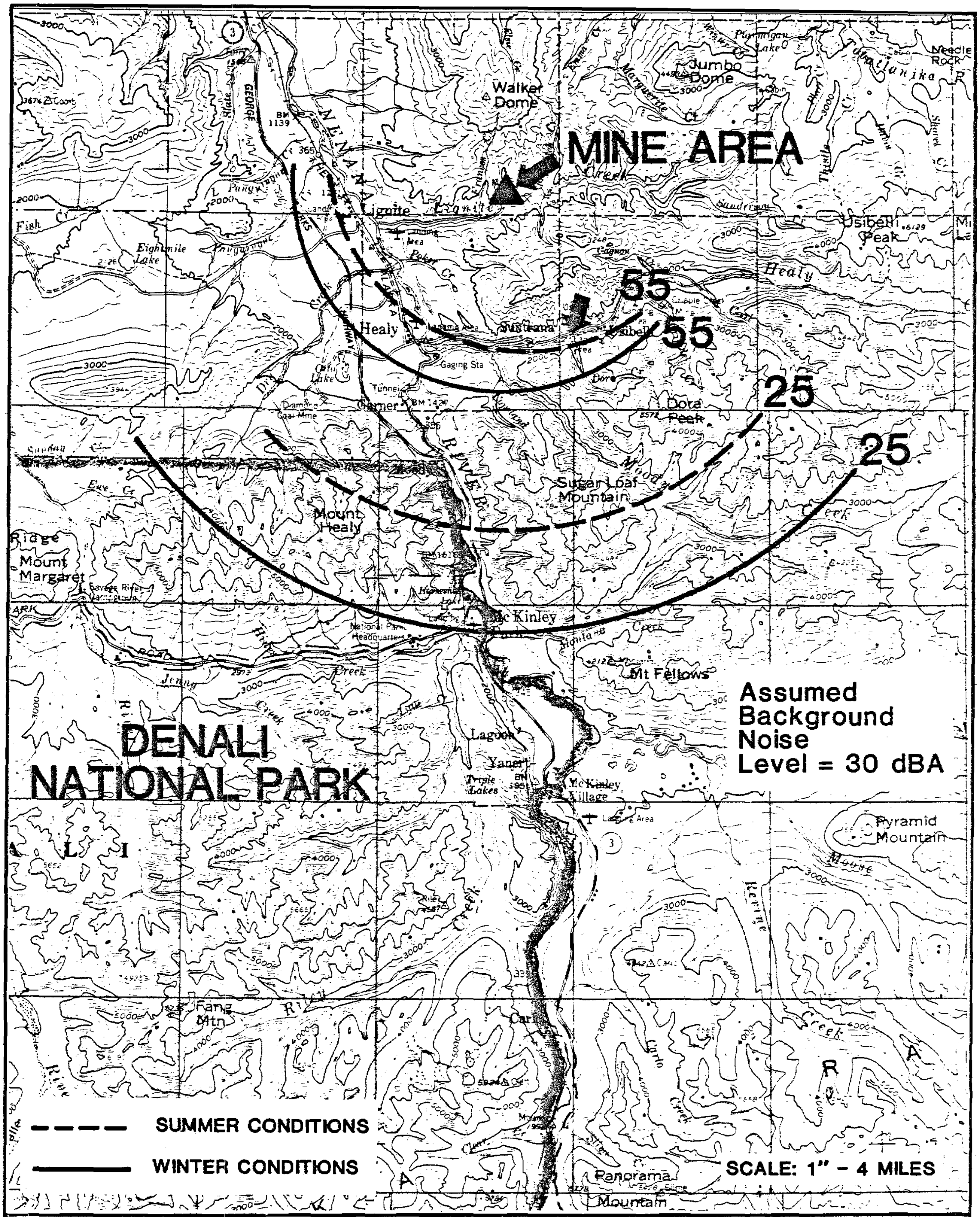
The impacts on Denali National Park caused by blasting at the mine were estimated using worst case assumptions. The source noise levels for the Lignite Creek mine blasting operations were estimated to be 83 dBA at 5,000 feet distance, based on published data for mines in the southwestern United States (Foch 1980). As a worst case assumption, the blasting noise contours at various distances away from he Lignite Creek mine were calculated based on flat terrain, with no noise attenuation by topography or foliage. Considering the complex terrain around the mine site, this assumption should result in conservatively high calculated noise levels. The only noise attenuation mechanisms used for this study were hemispherical wave spreading and atmospheric absorption. Published absorption rates (U.S. Forest Service 1980) were used for two different conditions: the winter season (10°F, 70 percent humidity) and the summer season (70°F, 70 percent humidity).

The calculated worst case blasting noise levels around the Lignite Creek mine are shown in Figure 5-6 would occur daily. There are some conditions that could cause higher noise levels than those shown in the figure. For example, the occurrence of low elevation inversions could cause channeling of sound waves, which would result in higher noise levels in the national park. A detailed field study and sophisticated computer modeling would be needed to provide a more precise estimate of noise impacts inside the national park.

5.9.2 Continuous Mining Noises

The noise impacts around the Lignite Creek mine caused by continuous operation of the mining equipment were calculated using worst case assumptions. There is little information available regarding the specific equipment that would be used at the mine. Based on the 13,600 tons per day coal mining rate, it was estimated that all of the coal handling and waste handling could be handled by four 170-ton haul trucks. To approximate the worst case noise levels created by all the heavy equipment that would be used at the site, the assumed source noise levels at the mine were based on the use of ten 170-ton haul trucks. Based on published equipment noise levels (Foch 1980), the calculated source noise level for the mine was 104 dBA at 50 feet distance.

The same assumptions that were used to predict the blast noise contours were also used for the continuous mining contours: flat terrain, and winter condition atmosphere noise absorption. The calculated noise levels caused by the mining operations are shown in Figure 5-7.



HARZA-EBASCO
SUSITNA JOINT VENTURE

ESTIMATED BLASTING NOISE LEVELS (dBA)

FIGURE
5-6

A detailed field study (to measure onsite sound absorption) and a sophisticated computer study would be needed to provide a more precise estimate of the continuous mining noise impacts.

5.9.3 Train Noise

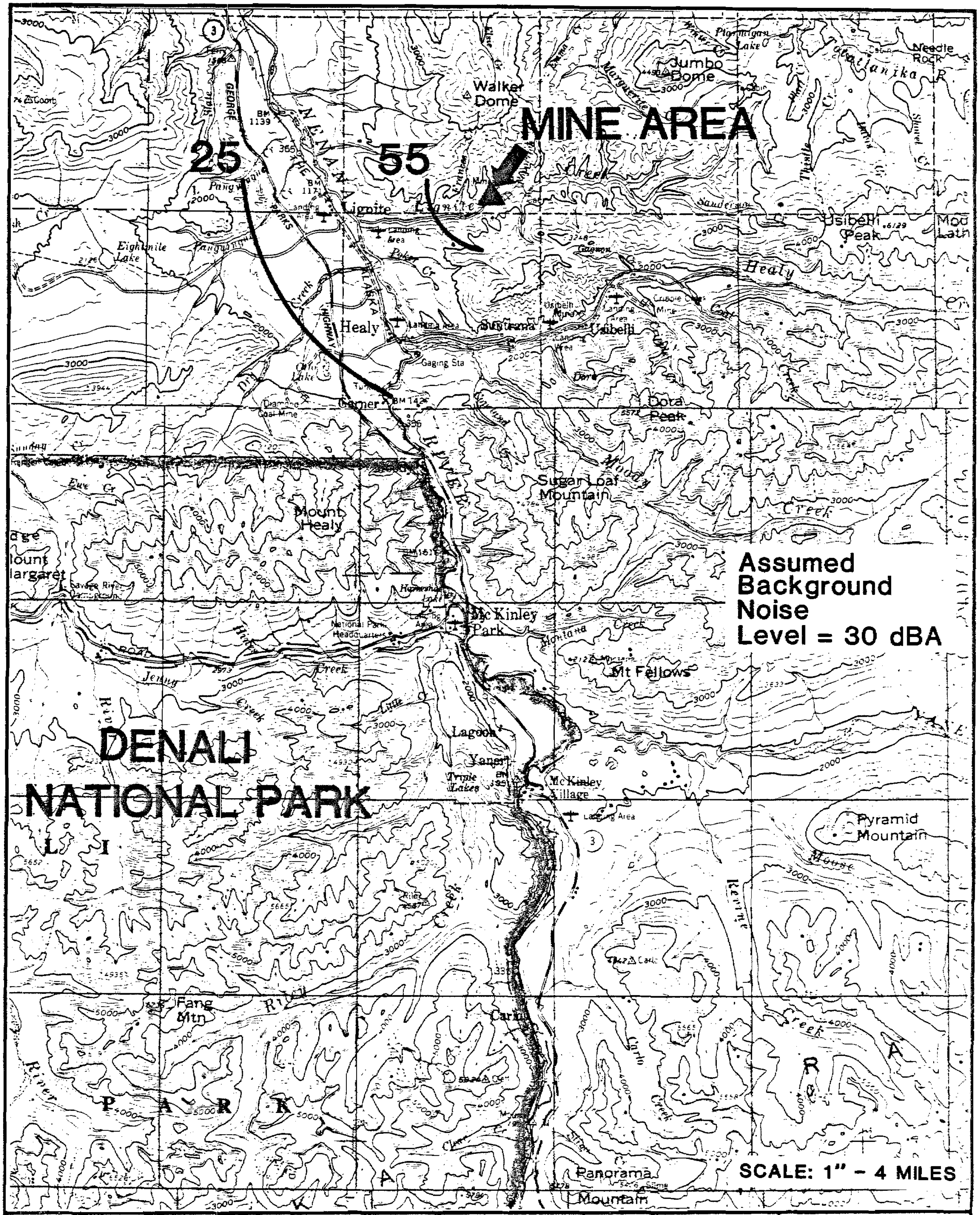
Noise level contours along the existing Alaska Railroad between Anchorage and Fairbanks have been calculated for the existing traffic, winter and summer, and with the addition of the coal trains required to supply the five proposed plants. The calculated noise levels are shown in Figure 5-8. The line was divided into two segments because two plants would be located south of the mine and three plants north of the mine such that four coal trains (two empty and two full) would travel on the southern segment adjacent to the east boundary of Mt. McKinley Park and six coal trains (three empty and three full) would travel on the segment north of the park.

Current train traffic data were obtained from the Chief Dispatcher on the Alaska Railroad (Jubb, 1984) and coal train data from Battelle Study describing the proposed power plants (Battelle, 1982). The procedure used to develop the contours was developed by the State of California and was published in the Journal Sound and Vibration, February, 1975.

5.9.4 Power Plant Noise

The calculated noise levels for the plant are shown in Table 5-15. The noise levels should be below the EPA limit of 55 dBA (L_{DN}) at all locations beyond 900 meters away from the center of the plant.

The 70 MW gas fired power plants could cause moderate noise impacts. The calculated noise levels are shown in Table 5-16. The noise levels would exceed the allowable EPA limit (L_{DN}) for all locations within roughly

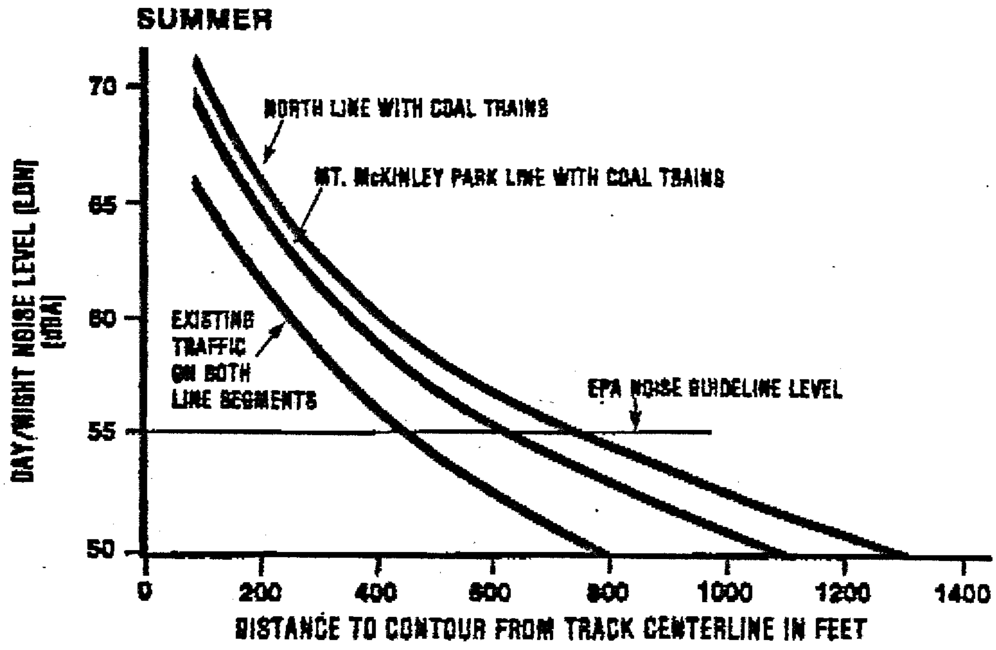


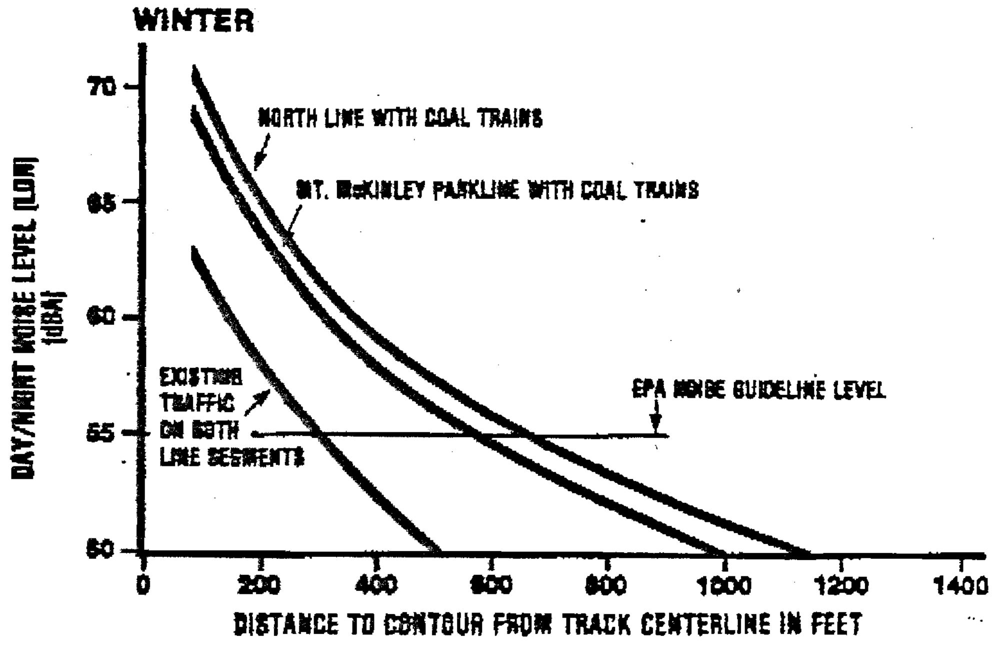
HARZA-EBASCO
SUSITNA JOINT VENTURE

ESTIMATED CONTINUOUS MINING NOISE LEVELS (dBA) DURING WINTER CONDITIONS

FIGURE
5-7

RAILROAD DAY/NIGHT NOISE LEVEL CONTOURS (LDN)





HARZA-EBASCO SUSITNA JOINT VENTURE	Railroad Day/Night Noise Level Contours	FIGURE 5-8

900 feet of the plant. One of the peaking plants will be in the Anchorage area, presumably in an industrial part of the city. The power plant could contribute to possible noise violations in limited residential areas near the plant site.

6.0 COMPARISON WITH SUSITNA PROJECT

6.1 INTRODUCTION

In this section, the key environmental impacts of the Susitna Hydroelectric Project are directly compared with the estimated impacts of the thermal power alternatives. For this comparison, the significance of each environmental impact is qualitatively characterized by three indicators: the magnitude or severity of the impact; the areal extent of the impact; and the duration of the impact.

The magnitude of the impact defines the severity of the impact, regardless of the spatial extent or the frequency of the event. the magnitudes are qualitatively ranked as "insignificant," "minor," "moderate," or "major." For example, any impact that caused exceedances of allowable regulatory limits would be considered to be "major" in magnitude.

The areal extent of the impact defines the geographical area that would be affected by the impact. The extent is qualitatively ranked as "insignificant," "minor," "moderate," or "major." For example, any regional haze over the entire Cook Inlet region caused or that might be caused by air pollutant emissions from the power plants would be considered to be "major" in extent.

The duration of the impact refers to the time frame associated with the events. The duration is qualitatively ranked as "short term," "moderate," or "long term." For example, the fugitive dust impacts during the power plant construction would last roughly two years, and would be of "moderate" duration.

To directly compare the environmental effects of the Susitna project, each of the key issues involved in the two alternatives are qualitatively ranked in Table 6-1. The reader is referred to Chapters 4.0 and 5.0 for detailed discussions of each key issue.

Table 6-1

SUSITNA HYDROELECTRIC PROJECT
COMPARISON OF ENVIRONMENTAL IMPACTS OF THE SUSITNA PROJECT AND THE THERMAL POWER ALTERNATIVES

	Susitna Project			Coal-Fired Power Scenario			Gas-Fired Power Scenario		
Issue	Magnitude	Extent or Frequency	Duration	Magnitude	Extent or Frequency	Duration	Magnitude	Extent or Frequency	Duration
Air Quality									
Fugitive Dust	Moderate	Minor	Moderate	Moderate	Moderate	Long Term	Minor	Minor	Long Term
Point Source Pollutants	Insignificant	Minor	Moderate	Moderate	Major	Long Term	Minor	Major	Long Term
Coal Mining Dust	--	--	--	Major	Major	Long Term	--	--	--
Plume Visibility	Insignificant	Insignificant	Insignificant	Moderate	Major	Long Term	Minor	Major	Long Term
Aesthetics									
Landscape Alteration	Moderate	Moderate	Long Term	Major	Moderate	Long Term	Moderate	Moderate	Long Term
Visibility to:									
o Recreationists	Moderate	Moderate	Long Term	Major	Moderate	Long Term	Moderate	Moderate	Long Term
o Air Travelers	Moderate	Major	Long Term	Major	Moderate	Long Term	Major	Major	Long Term
o Land Travelers	Minor	Minor	Long Term	Major	Moderate	Long Term	Moderate	Minor	Long Term
Noise									
Construction Noise	Moderate	Minor	Moderate	Moderate	Minor	Short Term	Moderate	Minor	Short Term
Operational Noise	Minor	Minor	Long Term	Minor	Minor	Long Term	Moderate	Moderate	Long Term
Coal Mine Blasting	--	--	--	Major	Major	Long Term	--	--	--
Coal Mine Operation	--	--	--	Moderate	Major	Long Term	--	--	--
Terrestrial Ecology									
Big Game	Moderate	Moderate	Long Term	Impacts are site specific, so no precise evaluations are possible without knowledge of the specific plant sites			Impacts are site specific, so no precise evaluations are possible without knowledge of the specific plant sites		
Furbearer	Moderate	Moderate	Long Term						
Raptor	Moderate	Moderate	Long Term						
Waterfowl	Insignificant	Minor	Long Term						
Aquatic Ecology									
Upstream Fish Passage	Insignificant	Insignificant	Long Term	Impacts are site specific, so no precise evaluations are possible without knowledge of the specific plant sites			Impacts are site specific, so no precise evaluations are possible without knowledge of the specific plant sites		
Down Stream Spawning	Moderate	Moderate	Long Term						
Downstream Rearing	Moderate	Moderate	Long Term						

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