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Final Environmental Impact Statement Proposed Tenaska Washington II Generation Project

Volume 1: Environmental Analysis and Technical Appendices

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**Final Environmental Impact Statement
(DOE/EIS-0194)**

Responsible Agency: U.S. Department of Energy, Bonneville Power Administration (BPA)
Title of Proposed Action: Tenaska Washington II Generation Project
State Involved: Washington

Abstract: BPA is considering whether to purchase electrical power from a proposed privately-owned combustion-turbine electrical generation plant in Washington. The plant would be fired by natural gas and would use combined-cycle technology to generate 240 average megawatts (aMW) of energy. The plant would be developed, owned, and operated by Tenaska Washington Partners II, L.P. The project would be located about 19 kilometers (12 miles) southeast of downtown Tacoma in the Frederickson Industrial Area, Pierce County. The proposed plant would occupy about half of a 6.4-hectare (16-acre) parcel and would be consistent with the industrial character of its surroundings. The proposed site is currently undeveloped and zoned for industrial use by the county.

Main environmental concerns identified in the scoping process and in comments on the Draft Environmental Impact Statement (EIS) include: (1) potential air quality impacts, such as emissions and their contribution to the "greenhouse" effect; (2) potential health and safety impacts, such as nuisance odors, plant safety, visibility and heat-emission systems which may affect low-flying planes and potential health effects of electric and magnetic fields; and (3) potential water quality and quantity impacts, such as the amount of wastewater to be discharged, the source and amount of water required for plant operation. These and other issues are discussed in detail in the EIS.

The proposed project already includes many features designed to reduce environmental impacts. Based on investigations performed for the EIS, no significant unavoidable adverse environmental impacts associated with the proposed project were identified, and no evidence emerged to suggest that the proposed action is controversial.

The EIS is being mailed to numerous agencies, groups, and individuals (see Section 8.0). There will be a 30-day no-action period before any decisions are made and the Record of Decision is signed.

**To request additional copies of the
Summary EIS or the complete EIS (2
Volumes) please contact:**
Bonneville Power Administration
Public Involvement Manager
P.O. Box 12999
Portland, Oregon 97212

**For additional information on the EIS
please contact:**
Bonneville Power Administration
Environmental Coordinator
Office of Energy Resources - RAE
P.O. Box 3621
Portland, Oregon 97208

**Copies may also be obtained by calling
BPA's toll free document request line:**
1-800-622-4520

For information on DOE NEPA activities contact: Carol M. Borgstrom, Director, Office of NEPA Oversight, EH-25, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, D.C. 20585, (800) 472-2756.

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**Proposed Tenaska Washington II
Generation Project
Final Environmental Impact Statement**

Volume 1: Environmental Analysis and Technical Appendices

**Bonneville Power Administration
January 1994
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S.0 SUMMARY

S.1 INTRODUCTION

The Bonneville Power Administration (BPA), a Federal power marketing agency in the U.S. Department of Energy, is considering whether to purchase electrical power from a proposed privately-owned gas-fired combustion turbine power generation plant in Pierce County, Washington. The proposed Tenaska Washington II Generation Project (Tenaska Washington II), which would generate 240 average megawatts (aMW) of energy, would be located about 19 kilometers (about 12 miles) southeast of downtown Tacoma, Washington, in the Frederickson Industrial Area. A regional map which includes the proposed project site is shown in Figure S-1. The site location is shown in more detail in Figure 3-2.

S.2 PURPOSE OF AND NEED FOR ACTION

S.2.1 Need

BPA has statutory responsibilities to supply electrical power to its utility, industrial, and other customers in the Pacific Northwest. As BPA embarked on the competitive acquisition process for additional conservation and generation resources, an underlying need for acquisition of new resources was to avoid electricity deficits caused by growing customer loads. In the time period since the Draft Environmental Impact Statement (DEIS) was issued for comment, BPA has become involved in a major effort to reassess its role and need for resources through the Competitiveness Project. That process is still very much in a developmental stage; however, it has provided preliminary indications that BPA's load growth may not be as great as was predicted in the 1990 and 1992 Resource Programs. BPA has examined the Tenaska Washington II project in light of these tentative conclusions and finds that even if their preliminary projections become reality, the Tenaska Washington II project is still needed and justified. It meets a number of system requirements. Most important among these is to firm non-firm hydroelectric power so that it can be sold at higher value firm power. It also helps with power system stability problems associated with voltage collapse in the Puget Sound area (Puget Sound Area Electric Reliability Plan Final EIS, 1992).

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0 4
Approximate Scale in Miles

0 6.5
Approximate Scale in Kilometers

== All roads

— City limits

- - - County boundary

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

REGIONAL MAP
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FIGURE

S - 1

S.2.2 Purpose

BPA's purpose for this action is to:

- Meet contractual obligations to supply requested, cost-effective electric power to BPA customers, having considered potential environmental impacts and mitigation measures in its decisions;
- Assure consistency with BPA's statutory responsibilities, including the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), which requires consideration of the Pacific Northwest Power Planning Council's (Council) Conservation and Electric Power Plan and Fish and Wildlife Program; and
- Develop a competitive, long-term resource acquisition program based on experience gained from the pilot acquisition program that led to the Tenaska Washington II proposal.

S.3 BACKGROUND

Guided by the recommendations in BPA's 1990 Resource Program, BPA commenced a pilot resource acquisition process to test various approaches for acquiring a diverse portfolio of cost-effective, reliable, and environmentally sound resources. The Competitive Resource Acquisition Pilot Program is one of several methods that BPA is testing to acquire energy resources. The primary objective of the pilot program is to provide BPA with the ability to systematically solicit, evaluate, and select cost-effective resource proposals that are offered for purchase. A secondary objective is for BPA to assess the benefits and costs of using a competitive process for developing cost-effective new energy supplies.

BPA issued a Request for Proposals in 1991 for 300 aMW of firm energy. In response to this solicitation, BPA received 102 resource proposals totalling 5,209 aMW of generation and 116 aMW of conservation. BPA evaluated the proposals based on system cost, project feasibility (including project location), and environmental criteria and selected three generation projects — the Tenaska Washington II is one — and all cost-effective conservation projects for further consideration and review towards satisfying the 300 aMW target. Each of these projects is being evaluated independently because these projects are not alternatives to one another and they are not connected, cumulative, or similar actions under the National Environmental Policy Act (NEPA).

S.4 ALTERNATIVES INCLUDING THE PROPOSED ACTION

S.4.1 Proposed Action: The purchase by BPA of 240 aMW firm power generated at the Tenaska Washington II project.

The proposed project would have three components: the power plant; an electrical transmission interconnection line connecting the power plant to BPA's existing South Tacoma switching station; and modifications to the South Tacoma switching station converting it to a substation.

The proposed power plant would occupy about half of an approximately 6.4-hectare (16-acre) parcel and would consist of an approximately 1840-square meter (20,000-square foot) structure housing the electricity generators, a cooling tower, electrical switchyards, an oil storage tank, and several other tanks, pumps and connecting piping. The tallest structure on the site would be the exhaust stack which would extend about 30 meters (100 feet) above the ground surface. An artist's sketch of the plant is shown in Figure 3-3.

Electricity would be produced using combined cycle technology. The heart of the Tenaska Washington II power plant would be a gas turbine. In a gas turbine, compressed air is mixed with natural gas and burned in combustion chambers. Rapidly expanding exhaust gases rotate a turbine as they exit the combustion chamber. The turbine drives the generator which produces electricity. Because the Tenaska Washington II power plant would use combined cycle technology, hot gases leaving the gas turbine would enter the heat recovery steam generator where much of the waste heat would be used to raise steam. This steam would then be used to rotate another turbine which would drive a second generator and produce more electricity. Cooled exhaust gases would be discharged to the atmosphere through an approximately 30-meter (100-foot) high stack.

The proposed power plant would be able to operate continuously but can be displaced (taken off-line) at BPA's request to help meet its varying operational requirements. A staff of 25 to 30 would work at the site. Fourteen of the staff, responsible for management, administration, engineering and maintenance, would work a regular 40-hour workweek. The remaining staff would be shift workers operating the proposed power plant around-the-clock. There would always be at least two operators at the proposed power plant at any given time.

Electricity generated at the power plant would be sold to BPA for marketing through the regional power grid. A new 230-kilovolt (kV) transmission interconnection line would be built to connect the proposed power plant to BPA's South Tacoma switching station which is located about 550 meters (about 1,800 feet) northwest of the power plant site. There are two alternative routes and configurations for the transmission line. One alternative, preferred

by Tenaska, would be installed underground; the other would be installed above ground. See Figure 3-7.

At the South Tacoma switching station, BPA would expand and modify existing facilities to accommodate electricity from the Tenaska Washington II power plant. New facilities would include circuit breakers, disconnect switches, control and protective relaying, communications equipment and a control house.

S.4.2 No Action

Under the No Action alternative, BPA would not acquire the energy output from the proposed Tenaska Washington II power plant, thereby foregoing the opportunity to assist in hydrofiring, regional voltage support and reduction of BPA's projected energy deficit with this particular project. In that event, it is unlikely that the proposed project would be implemented without a commitment from another party to acquire the energy output.

S.4.3 Other Actions

Since the proposed action would reduce, but not eliminate BPA's need for power, other resources will likely be considered independent of the proposed action and the pilot acquisition program. Other resource types potentially available to meet future loads include the following:

- Conservation (commercial, residential, and industrial)
- Renewables (hydropower, geothermal, wind, and solar)
- Cogeneration
- Combustion turbines
- Nuclear power
- Coal and clean coal

To comparatively evaluate these resource types, BPA has prepared a Resource Programs EIS. Every two years, BPA develops a resource program that explains how BPA proposes to meet its expected load obligations. The resource program examines alternatives composed of different combination of energy resource types. In developing a resource program, BPA prepares load forecasts jointly with the Council. A range of forecasts are prepared to reflect uncertainties about the future load growth. Next, a range of load resource balances is prepared by comparing the capability of the existing Federal system resources to the range of projected Federal system loads over the next 20 years. Concurrent with the process, BPA and the Council develop new resource supply forecasts to plan acquisitions of cost-effective resources as they are needed to meet growth. Under this approach, resources other than the

proposed action will be examined and evaluated in the future for their eligibility and ability to satisfy BPA's future needs.

S.5 AFFECTED ENVIRONMENT

The proposed Tenaska Washington II project would be located in the Frederickson Industrial Area of Pierce County. The proposed power plant would be built on a currently undeveloped site that has been used in the past for livestock grazing. The site is a dry, weedy upland area with a small stand of Douglas fir and a number of scattered oak trees. Wildlife habitat is generally degraded as a result of past agricultural use and current surrounding land uses.

The site is zoned for industrial use by Pierce County. Currently, land use in the Frederickson area is mixed, including some low-density residential housing and mobile homes, commercial use, light and heavy manufacturing and open space. A gas-fired power plant similar to the proposed Tenaska Washington II project is located about 600 meters (about 2,000 feet) south of the proposed power plant. To the northeast is a recently completed Boeing aircraft plant. It is expected that more industries will move into the area in the next two decades.

S.6 ENVIRONMENTAL CONSEQUENCES

Potential environmental effects of the proposed Tenaska Washington II project and the No Action alternative were analyzed by resource type (i.e., biology, geology, water quality, etc.). Analysis consisted primarily of comparing potential impacts with Federal, state and local regulations and identifying whether or not these impacts would comply with these regulations. In cases where no standards exist a more qualitative comparison of the with-project and without-project environments was made.

S.6.1 Environmental Impacts of Alternatives including the Proposed Action

The analysis in BPA's Resource Programs EIS indicated that natural gas-fired combustion turbines are a relatively benign energy generation technology from an environmental perspective. Gas-fired combustion turbines are relatively clean-burning in comparison with oil-fired and conventional coal plants. The Tenaska Washington II project includes features that would minimize the emission of air pollutants and the consumption of water.

The proposed project would be consistent with the industrial character of its surroundings. It would occupy an approximately 6.4-hectare (16-acre) parcel in an area with available utilities. Land use at the site would be converted from vacant and undeveloped to industrial. The land use change would be consistent with existing land use plans and policies. Land at the site has only modest wildlife habitat values and little utility for agriculture. No wetlands

exist at the site. No state or Federally-listed rare, threatened, or endangered species were observed during field surveys.

The project would lie in an area that is designated as a nonattainment area with respect to ambient air quality standards for carbon monoxide and ozone. Air pollutant emissions from the proposed project include 82.7 metric tons per year (91.2 tons per year) of carbon monoxide and 33.6 metric tons per year (37.0 tons per year) of volatile organic compounds (an ozone precursor). The Puget Sound Air Pollution Control Agency has established significant impact threshold criteria for new air pollutant sources in areas that are out-of-compliance with ambient air quality standards. These criteria are 90.7 metric tons per year (100 tons per year) of carbon monoxide and 36.3 metric tons per year (40.0 tons per year) of volatile organic compounds. The proposed project would also be in compliance with all other applicable air pollutant emission and ambient air quality standards.

Operation of the proposed project would produce noise. The predicted noise level at the nearest residence would be 46 decibels (dBA) compared to an applicable standard of 50 dBA. The maximum predicted noise level at the neighboring property line in an industrial area would be 66 dBA compared to an applicable standard of 70 dBA.

Process, sanitary and cooling system wastewaters averaging about 378,500 liters per day (100,000 gallons per day) would be routed to the Pierce County sewage system. The wastewater stream from the proposed project would be lightly polluted and would not affect Pierce County's ability to meet its wastewater discharge standards.

Water supply needs would be met with the existing available resources from the City of Tacoma Public Utilities (TPU). Water supply to the area would most likely be expanded as needed with the construction of an additional trunk line from a local reservoir and possibly from local wells.

The proposed Tenaska Washington II project already includes many features designed to reduce environmental impacts (see Section 5.14, Project Design Features for Reducing Environmental Impacts). By incorporating environmental protection features into the project design and operation plan some impacts would be prevented. Potential environmental impacts from both construction and operation of the Tenaska Washington II project are summarized in Table S-1. No significant or unavoidable adverse environmental impacts associated with the proposed project were identified.

The No Action alternative would have no environmental impacts. Other alternatives were analyzed separately in the Resource Programs EIS.

S.6.2 Areas of Controversy

No evidence has emerged during the preparation of this EIS to suggest that the proposed action is controversial. During scoping, concerns were raised about the potential impacts of the proposed project on groundwater availability in the Frederickson area. The proposed action would have no direct effect on groundwater levels. The water supply would be obtained from TPU. Depending on the results of a study currently in progress, TPU may choose to develop more wells in the Frederickson area to meet future water demand as the Frederickson Industrial Area develops. However, TPU does not plan to develop new groundwater wells specifically to meet demand imposed by the Tenaska Washington II project. Comments on the DEIS indicate that water supply continued to be an area of public concern. Other issues raised during the DEIS are disposition of wastewater, groundwater contamination, air quality and related issues to public health. All of these concerns and mitigation measures as appropriate have been addressed in the FEIS.

S.6.3 Issues to be Resolved

No unresolved environmental issues pertaining to the proposed action have been identified.

S.6.4 Other Considerations

The proposal would have some short-term impacts during construction. However it would be unlikely to damage the long-term productivity of the environment. Project construction would require the commitment of building materials, such as concrete, steel, and wood, for construction of the proposed generation facility and specific project equipment such as the turbines. Materials which could be re-used or recycled would be salvaged during decommissioning of the power plant. Project construction and operation would also require the use of fossil fuels, electrical energy, water, and other resources over the life of the proposed project. The amounts of these resources to be consumed cannot be accurately determined at this time and are considered irretrievable and irreversibly committed to the proposed project.

The Frederickson Industrial Area, as the name implies, is an area intended to be developed for industrial and manufacturing purposes. As additional industries choose to establish facilities in this area, cumulative regional impacts will become greater. The largest anticipated growth from industry in this area will be from the Boeing expansion which is expected to employ over 11,000 people by the year 2010. In the future, it is expected that traffic and associated congestion problems will increase, biological resources (vegetation, wildlife, wetland, and other possible resources) will diminish, and that air quality and the

noise environment will be degraded by increased vehicle traffic and industrial activity. In addition, impacts may occur to visual resources and groundwater quality and quantity.

With respect to cumulative impacts on air quality, the emissions from the proposed project would not significantly affect the area's ability to meet air quality standards in the future. The area is only marginally in nonattainment for carbon monoxide and ozone. The Washington Department of Ecology is developing programs to reduce the emissions of nonattainment pollutants and their precursors. These programs focus on vehicular emissions as the dominant source of nonattainment pollutants.

TABLE S-1
SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

RESOURCE	COMBUSTION TURBINE	TRANSMISSION LINES	SUBSTATION
Geology and Soils	Minor increase in soil erosion during construction.	Minor increase in soil erosion during construction.	Minor increase in soil erosion during construction.
Hydrology and Water Quality	Slight increase in runoff volume which would be contained on site.	None.	Slight increase in runoff volume.
Air Quality	Power plant would emit air pollutants, but at levels in compliance with applicable air quality and visibility standards and air toxic acceptable levels. Emission of greenhouse gases (primarily CO ₂). Emission of dust and engine exhaust during construction.	Emission of dust and engine exhaust during construction.	Emission of dust and engine exhaust during construction.
Biology	Removal of some vegetation and already disturbed wildlife habitat at 6.4-hectare (16-acre) site. The <i>Aster curtus</i> , a state sensitive and Federal Candidate 2 plant species, would be transplanted on site.	Wildlife expected to migrate from disturbed area during construction and return thereafter.	Removal of vegetation from less than 0.1 hectares (0.2 acres). Wildlife expected to migrate from disturbed area.
Land Use and Community Character	None. Plant would be sited in area zoned for industrial use.	None.	None. Improvements would take place with an existing switching station.
History and Archaeology	None expected.	None expected.	None expected.
Socioeconomics and Local Services	Project would create 25 to 30 permanent jobs and 225 to 250 construction jobs.	None.	Project would create 10 to 15 construction jobs.
Public Health and Safety	Hazardous substances used during construction and/or operation could be spilled and released to environment. Mitigations and spill contingency plans are proposed by applicant.	Lines, particularly overhead, could pose electric shock hazard and increased electric and magnetic fields.	None.

TABLE S-1
SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS (Continued)

RESOURCE	COMBUSTION TURBINE	TRANSMISSION LINES	SUBSTATION
Traffic and Transportation	Construction workers would generate an estimated 60 truck trips and 215 vehicular trips per day. Operation would generate roughly 30 vehicular trips per day.	Minor.	Minor.
Energy and Utilities	Plant would be serviced by existing utilities. Plant would produce 240 aMW of electrical energy.	None.	None.
Noise	Permanent increase in noise from project operation, but in compliance with applicable standards. Temporary noise increase during construction.	Temporary noise increase during construction.	Temporary noise increase during construction.
Visual Quality	Alteration of visual quality but appearance would be consistent with industrial surroundings.	Aboveground transmission line, if chosen, would have adverse effect on visual quality, but would be consistent with industrial surroundings.	Minor.

PURPOSE OF AND NEED FOR ACTION

1.1 NEED

BPA has statutory responsibilities to supply electrical power to its utility, industrial, and other customers in the Pacific Northwest. As BPA embarked on the competitive acquisition process for additional conservation and generation resources, an underlying need for acquisition of new resources was to avoid electricity deficits caused by growing customer loads. In the time period since the DEIS was issued for comment, BPA has become involved in a major effort to reassess its role and need for resources through the Competitiveness Project. That process is still very much in a developmental stage; however, it has provided preliminary indications that BPA's load growth may not be as great as was predicted in the 1990 and 1992 Resource Programs. BPA has examined the Tenaska Washington II project in light of these tentative conclusions and finds that even if their preliminary projections become reality, the Tenaska Washington II project is still needed and justified. It meets a number of system requirements. Most important among these is to firm non-firm hydroelectric power so that it can be sold at higher value firm power. It also helps with power system stability problems associated with voltage collapse in the Puget Sound area (Puget Sound Area Electric Reliability Plan Final EIS, 1992).

1.2 PURPOSE

BPA's purpose for this action is to:

- Meet contractual obligations to supply requested, cost-effective electric power to BPA customers, having considered potential environmental impacts and mitigation measures in its decisions;
- Assure consistency with BPA's statutory responsibilities, including the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), which requires consideration of the Pacific Northwest Power Planning Council's (Council) Conservation and Electric Power Plan and Fish and Wildlife Program; and
- Develop a competitive, long-term resource acquisition program based on experience gained from the pilot acquisition program that led to the Tenaska Washington II proposal.

1.3 THE PROPOSED ACTION

The proposed action is the purchase by BPA of electrical power which will be generated at a privately-owned gas-fired combustion turbine (CT) plant in Pierce County, Washington. The proposed Tenaska Washington II project would generate 240 aMW of electrical energy and would be built and operated by Tenaska Washington Partners II, L.P. (Tenaska), a developer of generation resources. Electricity generated at the proposed power plant would be supplied to BPA's South Tacoma facility for distribution through the regional power grid.

2.1 THE ROLE OF BPA

BPA is a Federal power marketing agency within the Department of Energy. Its service area is the Pacific Northwest, including Oregon, Washington, Idaho, and Western Montana. BPA was established in 1937 to sell and transmit electrical power produced at Bonneville Dam on the Columbia River. As more Federal hydropower projects were built on the Columbia and elsewhere in the Pacific Northwest, BPA's responsibility for power marketing and transmission increased. Today BPA markets power from 31 hydropower projects, owned and operated by the Federal government, and from one nuclear power plant. Almost half the electrical power used in the Pacific Northwest comes from BPA.

In 1980, the Northwest Power Act (Pub.L. No. 96-501) was enacted, expanding BPA's authority and responsibilities. Under this Act, BPA is authorized to purchase power from new sources and integrate them into the existing system. At the same time the Northwest Power Act directs BPA to meet the future power needs of its utility customers. The Northwest Power Act also created the Council and directed it to prepare a regional power plan. The regional power plan provides the long-range context within which BPA's own planning takes place.

2.2 BPA'S RESOURCE PLANNING PROCESS

Every two years, BPA develops a resource program that explains how BPA proposes to meet its expected load obligations. The resource program examines alternatives composed of different combinations of energy resource types. In developing a resource program, BPA prepares load forecasts jointly with the Council. A range of forecasts are prepared to reflect uncertainties about the future load growth. Next, a range of load/resource balances is prepared by combining the capability of the existing Federal system resources to the range of projected Federal system loads over the next 20 years. Concurrent with the process, BPA and the Council plan the acquisition of cost-effective resources as they are needed to meet growth.

BPA prepared an EIS to support several resource programs. The Resource Programs EIS considered the environmental trade-offs among the resources available to meet load and the environmental impacts of adding these resources to the existing system. For each of the resource types available, BPA provided a technical description, an analysis of operating characteristics and capacity contribution, costs, potential environmental effects and mitigation,

and supply forecast. The potential environmental impacts of thermal resources were presented by average annual megawatt for the entire fuel cycle. Natural gas-fired combined-cycle combustion turbines were found to be relatively efficient and effective with a proven generation technology. They can be operated to meet both base loads and peak loads. They have high availability factors and offer the opportunity for displacement and dispatchability. This flexibility combined with their cost-effectiveness and relatively low environmental impacts (compared to other thermal generation) make combustion turbines an important part of BPA's energy future.

Figure 2-1 shows the mix of resources that BPA would acquire under twelve alternative strategies (the thirteenth strategy was no action). The alternative strategies combine energy conservation and generation resource development in differing proportions. Generation resources could include renewable energy resources, cogeneration and thermal resources. Renewable energy resources include hydro, wind, geothermal and solar power generation. Cogeneration is the generation of electrical power in combination with a heat-producing process. Thermal resources include generation of power by combustion of oil, natural gas, or coal or by nuclear fission. Other means of meeting loads such as efficiency improvements, fuel switching and energy imports were also considered.

In its April 1993 Record of Decision (ROD) on the Resource Programs EIS, BPA identified a management strategy for matching power supply with demand over the next two decades. The strategy is referred to as the "emphasize conservation alternative." This alternative is one of thirteen alternative strategies that BPA developed to meet a projected power deficit of 2,000 to 2,500 aMW in the year 2000. This projected deficit might be regarded as a worst-case condition, because high loads were assumed. In all likelihood, the deficit will be smaller. However, it is prudent to plan for the worst-case condition.

Under the "emphasize conservation" alternative, BPA would rely heavily on combustion turbines for its future power generation. Under this alternative, 1046 aMW of energy, or up to one-third of future acquisitions, would come from combustion turbines. Acquisition of Tenaska Washington II would be consistent with the emphasize conservation alternative.

Guided by the recommendations in BPA's 1990 Resource Program, BPA commenced a pilot resource acquisition process to test various approaches for acquiring a diverse portfolio of cost-effective, reliable, and environmentally sound resources. The Competitive Resource Acquisition Pilot Program is one of several methods that BPA tested to acquire energy resources. The primary objective of the pilot program is to provide BPA with the ability to systematically solicit, evaluate, and select cost-effective resource proposals that are offered for purchase. A secondary objective is for BPA to assess the benefits and costs of using a competitive process for developing cost-effective new energy supplies.

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

**ALTERNATIVE RESOURCE
ACQUISITION STRATEGIES**

**FIGURE
2-1**

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BPA issued a Request for Proposals in 1991 for 300 aMW of firm energy. In response to this solicitation, BPA received 102 resource proposals totalling 5,209 aMW of generation and 116 aMW of conservation. BPA evaluated the proposals based on system cost, project feasibility (including project location) and environmental criteria and selected three generation projects — the Tenaska Washington II project is one — and all cost-effective conservation projects for further consideration and review towards satisfying the 300 aMW target. Each of these projects is being evaluated independently because these projects are not alternatives to one another and they are not connected, cumulative, or similar actions, to the extent that the agency need examine them in a single NEPA document. NEPA compliance is discussed in more detail below.

2.3 ENVIRONMENTAL REVIEW

The Resource Programs EIS discussed earlier does not address the site-specific environmental impacts of individual power projects. Instead, it considers the trade-offs among various resources available to meet needs and the environmental effects of adding those resources to the existing power system.

BPA is now considering individual power development proposals that fit within the framework of its overall power acquisition strategy. As part of its evaluation of individual proposals, BPA is preparing a number of site-specific environmental documents, which focus on the direct impacts of individual proposals at particular sites. These site specific documents will not re-examine the larger issues pertaining to different power acquisition strategies that were addressed in detail in the Resource Programs EIS. Instead they will incorporate some of the analyses contained in the Resource Programs EIS by reference. This approach to preparing environmental documents is referred to as "tiering." It is consistent with the Council on Environmental Quality's guidelines for implementing NEPA. Its primary advantage is that it avoids duplication of effort.

This document is a site-specific EIS on the proposed Tenaska Washington II project. It fulfills the requirements of NEPA and Washington State's legislative equivalent, the State Environmental Policy Act (SEPA). Pierce County Planning Department has contributed to the EIS by providing review comments to ensure that SEPA and Pierce County's environmental requirements are met. Pierce County plans to satisfy SEPA requirements by adopting this EIS. Pierce County will review the final EIS and issue an "adoption form" if they are satisfied that it meets SEPA requirements. Pierce County can act on the proposed project seven days after issuance of the adoption form.

3.0

ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 THE PROPOSED ACTION

The proposed action is the purchase by BPA of 240 aMW firm power generated at the Tenaska Washington II project.

3.1.1 Location

The proposed Tenaska Washington II power plant site would be located about 19 kilometers (about 12 miles) southeast of Tacoma, Washington, in the Frederickson Industrial Area of Pierce County. It would lie near the center of a partially developed tract bounded on the north by 180th Street East, on the south by 192nd Street East, on the east by Canyon Road and on the west by 38th Avenue. It would occupy an approximately 6.4-hectare (16-acre) parcel. The regional map of the proposed project is shown in Figure 3-1. A map of the project site and its vicinity is shown in Figure 3-2.

The proposed Tenaska Washington II power plant is in the center of the area that uses most of the power. Power generation at this location will be a very significant contribution in limiting potential voltage sag and economic curtailments that would result from a transmission line failure.

3.1.2 Proposed Facilities and Operations

The proposed facilities have three components: the power plant; an electrical transmission interconnection line connecting the power plant to BPA's South Tacoma facility; and modifications to the South Tacoma facility. The South Tacoma facility, currently a switching station, would become a substation after modification to accept energy from Tenaska Washington II.

Power Plant

The Tenaska Washington II power plant would occupy about half of the parcel and would consist of an approximately 1840-square meter (20,000-square foot) structure housing the electricity generators, a cooling tower, electrical switch yards, an oil storage tank, and several other tanks, pumps and connecting piping. All proposed project features would be contained within the proposed power plant area and transmission corridor. The tallest structure on the site would be the exhaust stack which would extend about 30 meters (100 feet) above the

0 4
Approximate Scale in Miles

0 6.5
Approximate Scale in Kilometers

== All roads

— City limits

--- County boundary

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

REGIONAL MAP
 Proposed Project Site is located in Section 36,
 Township 19N and Range 3E

FIGURE

3 - 1

- Tacoma Public Utilities 110-kV Transmission Line
- Railroads
- 230-kV Transmission Corridor
- Natural Gas Pipeline

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

Site Location

FIGURE
3 - 2

ground surface. The structure housing the generators would be about 21 meters (70 feet) tall. An artist's impression of the proposed power plant is shown in Figure 3-3. This sketch is a general representation of the proposed power plant features and does not accurately portray the Frederickson Industrial Area, specifically other buildings and facilities (e.g., AMA Timber, Boeing) in areas surrounding the site. A plan of major equipment and buildings for the Tenaska Washington II power plant is shown in Figure 3-4. The heart of the Tenaska Washington II power plant would be a gas turbine. In a gas turbine, compressed air is mixed with natural gas and burned in combustion chambers. Rapidly expanding exhaust gases rotate a turbine as they exit the combustion chamber. The turbine drives the generator which produces electricity. Because the proposed power plant would be a combined cycle plant, hot gases leaving the gas turbine would enter the heat recovery steam generator where much of the waste heat would be used to produce steam. This steam would then be used to rotate another turbine which would drive a second generator and produce more electricity. The heat recovery steam generator would be equipped with duct burners that will allow it to burn natural gas when additional heat is needed. Cooled exhaust gases would be discharged to the atmosphere through an approximately 30-meter (100-foot) high stack.

Although Tenaska Washington II would burn natural gas, it is capable of switching to a back-up supply of fuel oil. Fuel oil would be used only in emergency situations; only 120 hours of fuel oil burning would be permitted each year. The Tenaska Washington II power plant would be designed to minimize air pollutant emissions using the best available control technology (BACT). BACT for proposed power plants of this type is determined by the U.S. Environmental Protection Agency (EPA). Tenaska proposes that BACT for the plant be the combustion of natural gas or low-sulphur No. 2 fuel oil in combination with various emission reduction equipment. In addition, the proposed NO_x control technology goes beyond current BACT requirements and would satisfy more stringent lowest achievable emission rate (LAER) requirements that do not apply to this project.

Under normal circumstances, the proposed power plant would be fueled with natural gas. Natural gas would be supplied to the power plant by the Northwest Pipeline Corporation from an existing pipeline which passes approximately 400 meters (approximately 0.25 miles) southeast of the proposed power plant site. A new pipeline stub would be built to connect the proposed power plant to the existing pipeline as indicated in Figure 3-5. Emergency back-up fuel oil would be stored on-site in an approximately 5,565-cubic-meter (35,000-barrel) tank surrounded by an earthen dike. The volume enclosed by the dike would be sufficient to contain the contents of the tank if it failed.

Water would be used at the proposed power plant for cooling and fire protection. It would be supplied by the TPU from an approximately 51-centimeter (20-inch) diameter main located in 192nd Street East. Cooling water would be recirculated through a cooling tower to

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

ARTIST'S SKETCH OF PLANT

**FIGURE
3-3**

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LEGEND

1. NATURAL GAS FILTERS
2. FUEL GAS SEPARATOR
3. WATER METER HOUSE
4. COOLING TOWER WATER TREATMENT
5. COOLING TOWER
6. CIRCULATING WATER PUMPS
7. STEAM TURBINE
8. TURBINE BUILDING
9. PARKING
10. GENERATOR
11. STEAM TURBINE AUXILIARIES
12. CONTROL & SWITCHGEAR BUILDING
13. TRANSFORMER
14. PACKAGED ELECTRONIC CONTROL CENTER
15. H.P. BFW PUMPS
16. L.P. / I.P. BFW PUMPS
17. TENASKA SWITCH YARD
- 18.
19. AIR INLET
20. ATOMIZING AIR SKID
21. BUS AUXILIARY COMPARTMENT
22. GAS TURBINE
23. FUEL GAS SKID
24. AMMONIA BLOWER
25. ACCESSORY MODULE
26. FUEL OIL SKID
27. AMMONIA TANK
28. BLOWDOWN TANK
29. HEAT RECOVERY STEAM GENERATOR
30. EVAP COOLER SUMP
31. WATER PUMP HOUSE
32. RAW WATER STORAGE TANK
33. NEUTRALIZATION TANK
34. DEMINERALIZED WATER STORAGE TANK
35. COLLECTION WATER SUMP
36. ACID TANK
37. WATER TREATMENT BUILDING
38. CAUSTIC TANK
39. LAB
40. MAINTENANCE/OFFICE BUILDING
41. CO. FIRE PROTECTION SKID
42. EARTH BERM
43. OIL STORAGE TANK (35,000 bbls.)
44. FUEL OIL UNLOADING AND TRANSFER PUMPS
45. H.R.S.G. STACK
46. GENERATOR AUXILIARY EQUIPMENT.
47. AUXILIARY TRANSFORMERS
48. PUMP BUILDING
49. DEAERATOR
50. TURBINE LAYDOWN
51. PIPE RACK
52. TRUCK ACCESS

NORTH

PRELIMINARY
NOT FOR
CONSTRUCTION

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OR CONSTRUCTION.

TENASKA WASHINGTON II
GENERATION PLANT

BONEVILLE POWER ADMINISTRATION
MAJOR EQUIPMENT AND
BUILDING DIMENSIONS

B	GWE	STP	153	HV	SEVEN				
A	PWE	LH			SEVEN				

APPLS POWER ASSOCIATES, INC.
Engineers - Architects - Constructors

NO. 09-34 AREA FIVE STG. 24-N

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

PLAN OF MAJOR EQUIPMENT AND BUILDINGS

FIGURE
3-4

minimize total water demand. A cooling tower fan would be situated at the top of the tower and would run continuously at a relatively low revolutions per minute rate. Water would be stored at the site in an approximately 2,270-cubic-meter (600,000-gallon) tank. Sanitary wastewater together with the spent water, or blowdown from the boilers and cooling tower would be discharged to the Pierce County sanitary sewer.

The proposed power plant would operate continuously but can be displaced (taken off-line) at BPA's request to help meet its varying operational requirements. A staff of 25 to 30 people would work at the site. Fourteen people, responsible for management, administration, engineering and maintenance, would work a regular 40-hour workweek. The remaining staff would be shift workers operating the power plant around-the-clock. There would always be at least two operators at the power plant at any given time.

Electrical Transmission Line

Electricity generated at the proposed power plant would be sold to BPA for marketing through the regional power grid. The power grid in the vicinity of the proposed project is shown in Figure 3-6. A new 230-kV transmission line would be built to connect the proposed power plant to BPA's South Tacoma facility which is located about 550 meters (about 1,800 feet) northwest of the power plant site. There are two options for the transmission line interconnection. Option A would be installed underground and is Tenaska's preferred option. It would leave the power plant site at its northeast corner and proceed north to the Chehalis railroad right-of-way. The transmission line alignment would follow the railroad tracks westward past the Olympic Oil Pipeline pumping station, proceed north and northwest to BPA's property, and then turn northeast to the South Tacoma facility. Option A would be approximately 1,300 meters (approximately 4,200 feet) long. Option B would be installed above ground on a series of tubular steel towers mounted on concrete bases. The transmission line would leave the power plant site at its southeast corner and proceed southward to 192nd Street East. At 192nd Street East, it would turn west to the approximate location of 42nd Street East and then turn north, crossing the railroad tracks to the South Tacoma facility. Option B would be approximately 2,500 meters (approximately 8,000 feet) long. Both alternative transmission line routes are shown in Figure 3-7.

Modifications to the South Tacoma Switching Station

As part of the reconfiguration of the South Tacoma switching station to a substation, BPA would expand and modify existing facilities to accommodate electricity generated by the Tenaska Washington II power plant (Figure 3-8). The existing switching station lies near the center of an approximately 7.7-hectare (19-acre) parcel of land owned by BPA. The switching station occupies about 1.11 hectares (2.75 acres). New facilities would include power circuit breakers, disconnect switches, control and protective relaying, metering equipment, communications equipment, potential and current transformers, and a control

Figure
3-5

170251 (d) 4 1/2 1 1/2

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NOTE: Numerical value represents kilovolts (kv).

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

Power Grid in the Vicinity
of the Proposed Project

FIGURE
3-6

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

Plot Plan Showing
Transmission Lines

Source: Applied Power Associates, Inc.

FIGURE

3-7

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PRELIMINARY

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

**South Tacoma
Substation Layout**

**FIGURE
3-8**

house. The fence line of the switching station would have to be altered to accommodate the new facilities. The new fence line would enclose about 1.14 hectares (2.82 acres). Several existing transmission lines connect to the South Tacoma switching station. Two 230-kV above-ground transmission lines, the Chehalis to Covington line and the Olympia to White River line cross the parcel of land owned by BPA. Transmission line disconnect switches located inside the existing South Tacoma switching station would be removed. These are mounted on wooden poles. The Olympia-White River 230-kV line and the Tacoma-Cowlitz 230-kV Tap to the Olympia-White River line will be terminated at the new substation with new dead end transmission structures. The new 230-kV transmission line (overhead or underground) to the Tenaska Washington II power plant would then be connected to the new substation switching facilities. Power from the Tenaska Washington II power plant would flow from the generation facility to the modified South Tacoma switching station and from there be integrated into the transmission grid.

BPA would install communications equipment on-site to provide an operational data and control line between the Tenaska Washington II project and BPA's operations center in Vancouver, Washington. Communications equipment would include a microwave radio antenna, radio receiver and transmitter connecting to the existing BPA microwave system and fibre optic cabling connecting the substation and generation project. The antenna dish, antenna support structure, and radio equipment would be located within the substation fence, with the radio equipment placed within a control house along with relays, meters and other electrical equipment.

The Covington to Chehalis transmission line currently goes through BPA property adjacent to the existing switching station. This line also has a tap to Tacoma's Cowlitz substation. The line disconnects would be removed from the existing switchyard to allow for the new substation construction, and the line disconnects would be relocated on BPA property outside the present fence, probably near a transmission line structure south of the present switchyard.

3.1.3 Probable Construction Scenario

The proposed power plant is expected to be built within an 18-month period. The maximum size of the construction crew would be from 225 to 250 workers. It is expected that most of the construction workers would be from the Tacoma area. Equipment used at the site would include light and heavy trucks, backhoes, bulldozers, graders, cranes, air compressors, welding machines, and power hand tools. Foundation piling equipment may also be used. Solid waste and excess excavated materials would be trucked to an approved disposal facility. Sanitary facilities would be provided for construction workers and would be installed, serviced and maintained by a commercial operator.

The reconfiguration of the South Tacoma switching station to a substation is expected to be accomplished within a 12- to 15-month period beginning in the fall 1994. Construction activities would require 15 to 20 workers (BPA employees and contractors). Ground disturbance in and around the existing switching station would take place, and would include grading, footings for structures, minor excavation, trenching for conduits, etc. Equipment used at the site would include light and heavy trucks and backhoes.

A 2-hectare (5-acre) construction staging area would be established in the northeast portion of the site. The staging area would be used for temporary material storage, offices and parking. On completion of the power plant, the staging area would be vacated and restored to its original condition.

Construction activities for the communications would include some ground disturbance within the substation for antenna structure footings and burial in conduit runs of the fibre optic cable. If Tenaska utilizes the overhead transmission interconnection line, the fibre optic communications cable would be configured with metallic wrapping and used as the overhead ground wire linking the power plant to the substation. If Tenaska utilizes the underground transmission interconnection cable, the fibre optic communications cable would be buried above the power cable, in a conduit. The conduit would be appropriately marked. No additional ground disturbance beyond that planned for power cable burial is anticipated.

3.1.4 Decommissioning

The Tenaska Washington II power plant would have a life expectancy of 20 to 40 years. If the proposed power plant were to reach the end of its useful life, it would be renovated or decommissioned. If the power plant were to be decommissioned, all structures and equipment at the power plant site would be dismantled and removed. Transmission interconnection lines and structures would also be dismantled and removed. BPA's South Tacoma substation would most likely not be decommissioned at the same time and would continue to serve the area.

3.2 ALTERNATIVES TO THE PROPOSED ACTION

3.2.1 No Action

Under the No Action alternative, BPA would not acquire the energy output from the proposed Tenaska Washington II power plant, thereby foregoing the opportunity to assist in hydrofarming, regional voltage support and reduction of BPA's projected energy deficit with this particular project. In that event, it is unlikely that the proposed project would be implemented without a commitment from another party to acquire the energy output.

3.2.2 Other Actions

Since the proposed action would reduce, but not eliminate BPA's need for power, other resources will likely be considered independent of the proposed action and the pilot acquisition program. Other resource types potentially available to meet future loads include the following:

- Conservation (commercial, residential, and industrial)
- Renewables (hydropower, geothermal, wind, and solar)
- Cogeneration
- Combustion turbines
- Nuclear power
- Coal and clean coal

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4.1 GENERAL CHARACTERISTICS OF THE AFFECTED ENVIRONMENT

This section describes the environment that could be affected by construction and operation of the proposed Tenaska Washington II project. The description provides the baseline for comparison of no action to the proposed action. It serves as the basis for discussion of potential environmental consequences presented in Section 5.0.

The proposed power plant site is located on an approximately 6.4-hectare (16-acre) parcel of undeveloped land. Topographic relief at the site is moderate and characterized by historical glacial activity. Soils of the area are very permeable, and most rainfall infiltrates rapidly into the groundwater system. Clover Creek and Chambers Creek provide the primary surface drainages for the project site watershed. The site is a dry, weedy, upland area recovering from recent grazing practices. A Douglas fir stand is located in the southeastern corner of the site and several Oregon white oak stands are scattered throughout the site. Most wildlife species found at the proposed site are common to disturbed areas. State and Federal special status species listings indicated that no rare, threatened, or endangered species are known to inhabit the project site. However, a recent survey determined the presence of a population of *Aster curtus* a Federal Candidate species (C2) and listed as sensitive by the Washington Natural Heritage Program (1990). Wetlands are not present at the proposed site.

The project vicinity is not known for any historic events, historic landmarks, or cultural uses. Current land uses in the vicinity of the Frederickson Industrial Area include low-density residential housing and mobile homes, commercial services, light and heavy manufacturing, agriculture (mostly livestock grazing), and open space.

4.2 GEOLOGY AND SOILS

4.2.1 Geology

The project site is geographically situated in the northern section of the Puget Trough Province (Puget Sound Basin) of western Washington. This lowland province is bounded on the east by the Cascade Mountains and on the west by the Olympic Mountains and Willapa Hills. Its physiographic and geologic boundary extends north to the Canadian border, and south into Oregon through the Willamette Valley (Franklin and Dyrness, 1988).

Several glaciations during the Pleistocene era (2.5 million to 10,000 years before the present) have influenced the geology of this region. The most recent deposits are from the Vashon glaciation. These deposits are unconsolidated in nature and consist of mixtures of boulders, cobbles, gravels, sands, silts and clays (Walters and Kimmel, 1968). Geologic maps of Washington, including the Southwest Washington Quadrant and the South Half of Tacoma Quadrangle, confirm the presence of Vashon outwash for the site (Walsh, 1987; Walsh, et al., 1987).

The surficial geology of the general area is composed of Vashon recessional outwash, a mixture of stratified sand and gravel deposited by melt-water streams during the Vashon glacial retreat. This material is fairly well-sorted and quite permeable, becoming finer in grain and less permeable with increasing distance from the glacier (Brown and Caldwell, 1985).

Steilacoom Gravel, a specific unit of Vashon recessional outwash deposited by high-velocity streams and rivers, occurs over the site. This deposit is typically from 12 to 18 meters (40 to 60 feet) thick, and is composed of coarse gravel (2.5-centimeter [1-inch] pebbles) with sand occurring between gravel particles (Walters and Kimmel, 1968; Earth Consultants, 1989; Dames & Moore, 1980). Steilacoom Gravel is relatively high in permeability.

The Vashon Till, a mixture of clay, silt, sand, gravel and boulders, typically underlies the Steilacoom Gravel separating this upper aquifer from a lower aquifer, the Vashon Advance Outwash. There is evidence in the project vicinity (well borings from the Boeing Plant and from Spanaway) indicating that the Vashon Till is not present beneath the project site.

The Vashon Advance Outwash is an 8- to 15-meter (25- to 50-foot) layer (Brown and Caldwell, et al., 1985) and consists mostly of coarse-grained materials (sands, gravels, cobbles and boulders). High permeability due to the coarse nature of the rock materials is a contributing factor in making Vashon Advance Outwash the primary supply source for domestic wells in the region (Walters and Kimmel, 1968).

4.2.2 Geologic Hazards

The primary geologic hazards are those related to earthquakes. The subduction of the small Juan de Fuca plate (off the Northwest coast) beneath the North American plate is believed to be the primary cause of earthquakes in western Washington and Oregon (Noson, et al., 1988). Increasing evidence in recent years indicates that western Washington and Oregon are subject to (1) a greater risk of shallow-crustal earthquakes and (2) large subduction zone earthquakes, a type which has not occurred in the region for about 300 years (Walsh, 1993).

4.2.3 Soils

Soils in the Puget Sound basin were formed in glacial materials and reflect the underlying geology; the soils also formed under the influence of coniferous forests and grassland (Franklin and Dyrness, 1988). The Soil Conservation Service (SCS) has identified the soils at the site as Spanaway gravelly sandy loam. On the general soil map for Pierce County, the SCS has included the site in the Spanaway Association, which characterizes the soil as nearly level and somewhat excessively drained.

Mixed on the surface with volcanic ash, Spanaway soil exhibits moderately rapid permeability and slow surface water runoff. Approximately 36 centimeters (about 14 inches) of the uppermost soil profile is typically black, gravelly sandy loam, increasing with depth to about 152 centimeters (about 60 inches) below the surface.

The SCS indicates that the engineering properties of Spanaway soil do not present limitations for construction and urban development. Slopes are generally between 0 and 6 percent, and there is little erosion hazard. Surface water readily percolates downward due to the gravelly structure of the soil, making protection of groundwater supplies from aboveground contaminants a concern (SCS, 1979).

Test pits dug at the site indicated that the topsoil is composed of glacial outwash sands and gravels and fine-grained alluvial deposits. Beneath this is a layer of coarse sands and gravels with a variable silt, gravel, and cobble content (Dames & Moore, 1980). In almost every test pit, a thin layer of topsoil consisting of dark brown sandy silt with organic material was encountered at the surface and is believed to mantle much of the area (Dames & Moore, 1980).

4.3 HYDROLOGY AND WATER QUALITY

4.3.1 Groundwater

The proposed project site is situated in the Clover-Chambers Creek Basin, a broad glacial basin covering approximately 135 square kilometers (52 square miles). Clover Creek and Chambers Creek are the primary surface drainages, with Chambers Creek being the principal drainage outlet for the entire drainage basin. With the exception of small areas covered by low permeability materials in the northern and southern parts of the Basin, gravels cover the Clover-Chambers Creek Basin.

Most groundwater flow originating in the Clover-Chambers Creek Basin flows northwest toward "The Narrows," a narrow water channel separating Tacoma from the Gig Harbor

Peninsula (Figure S-1). Groundwater flow drains into the entire area of "The Narrows" via three stratified units. The most shallow unit is approximately 45 meters (150 feet) below ground level; this is still above sea level, and water drains into the ocean as "surface water." The second unit lies approximately 100 meters (350 feet) below ground level, and the third lies approximately 160 meters (550 feet) below ground level. The majority of groundwater flow enters the ocean below sea level.

The aquifers of central Pierce County are recharged almost entirely by infiltration from direct rainfall. The impermeable nature of the consolidated rocks along the south and east margins precludes the possibility of movement of large quantities of water into central Pierce County from the mountains or foothills beyond. The slope of the water table in central Pierce County is extremely irregular, ranging from more than 23 meters per kilometer (120 feet per mile) in areas of great relief or relatively impermeable materials, to less than 1.8 meters per kilometer (10 feet per mile) in areas of little relief or coarse-grained, highly permeable materials. The average slope is about 9.4 meters per kilometer (50 feet per mile) (Walters and Kimmel, 1968).

Groundwater is the principal source of water supply for residences and small business in the Frederickson area. TPU also provides water to the area, including the Frederickson Industrial Area. The City's water supply is derived from the Green River, a surface water resource area located to the north in King County, and is augmented by groundwater. There are approximately 450 private and 45 public water supply wells within a 4.8-kilometer (3-mile) radius of the proposed site. These wells are under the authority of a number of water purveyors.

The proposed site is located above a regional shallow groundwater system that is generally found between 6 and 9 meters (20 and 30 feet) below the ground surface. The groundwater table typically fluctuates 1.3 to 1.5 meters (4.5 to 5 feet) during the year. Groundwater in the proposed project vicinity flows north towards Clover Creek (ENSR, 1993).

Groundwater Contamination

The depth to groundwater and the thickness of the unsaturated sediments are important factors to consider regarding land use activities that can contaminate the groundwater. Downward percolating surface waters pass through an unsaturated zone (called the vadose zone) and some contaminants are removed in this area from biological breakdown, filtration, and adsorption, thus reducing the amount of pollutants reaching the groundwater table. The thicker the vadose zone, the greater the chance for natural interception of pollutants. Because of the predominantly granular nature of the geologic material in the Clover-Chambers Creek

Basin, the vadose zone does not provide a very effective pollutant interception (Brown and Caldwell, 1985).

Numerous groundwater quality problems have arisen in the central Pierce County area, most of which are located in the Clover-Chambers Creek basin. These problems have resulted from a history of industrial use in the area and mismanagement of hazardous materials and waste disposal activities (see Section 4.9, Public Health and Safety). Significant increases in groundwater concentrations of nitrate-nitrogen and chloride have occurred in the last 20 years due to contamination from septic tanks and storm water recharge areas, although the levels were still well below drinking water standards in 1985 (Brown and Caldwell, 1985). The discovery of these problems combined with the fact that the area utilizes groundwater as a primary water source led to an effort to study the impacts of the contamination and protection of the resource. However, according to Pierce County Department of Health personnel, no drinking water problems are known to exist in the vicinity of the proposed site (ENSR, 1993).

Clover-Chambers Creek Groundwater Management Program

In 1986, the Washington Department of Ecology designated the Clover-Chambers Creek Basin as a Groundwater Management Area, which recognized that the area relied on groundwater as a water supply source and that the area was susceptible to groundwater contamination. This designation allowed the development of the Clover-Chambers Creek Basin Groundwater Management Program, which was initiated in 1988, and led to the completion of a Draft Program and an EIS (Brown and Caldwell, 1990). The Clover-Chambers Creek Basin Groundwater Management Program identifies 16 management elements that are based on mitigating the potential groundwater contamination risks associated with certain land use activities. These elements are addressed by existing state and county regulations and supplemented by the Tacoma-Pierce County Health Department programs and regulations that are being developed.

The Tacoma-Pierce County Health Department is the lead agency responsible for the Groundwater Management Program. The County has adopted a "Critical Areas" designation which includes the area in and around the proposed project site. The area is designated as an "Aquifer Recharge Area" (Pierce County Code Chapter 21.16). The purpose of this designation is to prevent further degradation of groundwater quality through the control of land use activities. The Tacoma-Pierce County Health Department requires the developer to submit a hydrogeological assessment, to determine the potential impact to groundwater resources, for every commercial facility proposed within the Aquifer Recharge Area boundary.

Sole-Source Aquifer Designation

In May 1987, a petition for sole-source aquifer designation of the Central Pierce County aquifer system was submitted by the Tacoma-Pierce County Health Department to the EPA. The Clover-Chamber Creek Basin aquifer system is within this larger aquifer system. Designation as a sole-source aquifer is a Federal recognition that an aquifer is needed to supply 50 percent or more of the drinking water for a given area and for which there are no reasonably available alternative sources should the aquifer become contaminated. A benefit of the sole-source aquifer designation is that projects receiving Federal financial assistance which have the potential to contaminate the sole-source aquifer would be subject to EPA review. This review could either prevent a commitment of Federal funding or cause a redesign of the project. Because BPA, a Federal agency, is considering purchasing power from the proposed project, an EPA review may be required. This review process should take approximately 30 days. EPA took public comments on the petition to designate the Clover-Chambers Creek Basin a sole-source aquifer at an informational meeting in July 1993. The Chambers Creek Basin aquifer system was formally designated as a sole source aquifer on December 9, 1993. EPA may review and comment on the project pursuant to Section 1424(e) of the Safe Drinking Water Act.

Groundwater Regulations

The Washington Department of Ecology has adopted groundwater quality standards (WAC 173-200) which implement the state's policy that natural and existing groundwater quality be preserved. These regulations set numerical limits for specific water quality constituents.

Other regulatory requirements are related to potential groundwater contamination by hazardous materials and are addressed in Section 4.9 Public Health and Safety. These include the Preparedness and Prevention Measures, Contingency Plan, and Spill Prevention Control Countermeasure Plan, which would be submitted by the project developer to Ecology for review and to the Tacoma-Pierce County Health Department for approval of compliance with regulatory requirements.

4.3.2 Surface Water

There are no surface water streams located on the proposed project site due to the highly permeable nature of the soils. Clover Creek originates northeast of the project site from a groundwater spring and flows westward down the basin, approximately 1,220 meters (4,000 feet) north of the project site.

4.4 AIR QUALITY

4.4.1 Meteorology

The project area experiences a mild climate with an average winter temperature of 4° C (40° F) and an average summer temperature of 16° C (62° F). The winters are wet and the summers fairly dry. The wettest month is November when precipitation averages 15 centimeters (5.7 inches) at the project site. Winds emanate predominantly from the southwest or northeast. Figure 4.4-1 shows a windrose for McChord Air Force Base which is located approximately 8 kilometers (5 miles) northwest of the project site.

4.4.2 Existing Air Quality

No air quality monitoring is currently being conducted at or near the project site. Background concentrations that are considered to be representative of the project site were provided by the Puget Sound Air Pollution Control Agency (PSAPCA) and the Washington Department of Ecology. They are shown in Table 4.4-1. The background concentration data in the table is limited to those pollutants that could potentially be affected by the proposed project.

Each of the air pollutants discussed in this section has potential health effects. Particulates can irritate the eyes, nose and air passages. Particulates with a diameter of 10 microns (PM_{10}) (0.000393 inches) or less can lodge in the lung, irritating or damaging sensitive lung tissue. In addition, particulates may contain harmful pollutants that are toxic or radioactive elements that may cause cancer. Sulfur dioxide (SO_2) can cause symptoms similar to allergic reactions or viral respiratory infections. SO_2 quickly restricts air flow in the lungs, causing shortness of breath, coughing, and increased secretions. Long-term exposure causes chronic bronchitis and may contribute to asthma. Oxides of nitrogen (NO_x) irritate mucous membranes and cause coughing, headache, and shortness of breath. Carbon monoxide (CO) interferes with the delivery of oxygen throughout the body. Mild oxygen deficiencies can affect vision and brain function. Exposure to high levels can cause headache, irregular heartbeat, nausea, weakness, confusion, and death. Ozone can irritate the nose, throat, and lungs, increase airway resistance, and decrease the efficiency of the respiratory system. People exercising and those with respiratory disease can experience sore throat, chest pain, coughing, and headaches. Volatile organic compounds (VOCs) and NO_x are currently regulated as precursors to ozone formation.

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

WINDROSE FOR
MCCHORD AFB 1980-1984

FIGURE
4.4-1

**TABLE 4.4-1
REPRESENTATIVE BACKGROUND AIR QUALITY DATA^a**

Pollutant		Background Concentration ($\mu\text{g}/\text{m}^3$)
NO ₂ ^b	Annual	30
SO ₂ ^c	Annual	27
	24-hour	106
	3-hour	319
	1-hour	426
PM ₁₀ ^d	Annual	29
	24-hour	85
TSP ^e	Annual	41
	24-hour	121
Ozone	1-hour	130
CO ^e	1-hour	19 mg/m ³
	8-hour	13 mg/m ³

^a Data limited to pollutant concentrations that could be affected by the proposed project

^b Value reported by Department of Ecology (1992)

^c As measured in Tacoma area (Ecology, 1991)

^d Data from PSAPCA (Knectel, 1992) from measurements taken in Puyallup, WA

^e Estimated from PM₁₀ data assuming PM₁₀ = 0.70 TSP (Knectel, 1992)

4.4.3 Regulatory Requirements

Air quality standards have been set by the United States, by the State of Washington, and by the PSAPCA. The standards fall into two general categories: emission standards that apply to air pollutant emissions as they emerge from a stack, and ambient standards that apply to atmospheric air.

Federal ambient air quality standards for certain pollutants were established in the Clean Air Act of 1970 and are referred to as National Ambient Air Quality Standards. The Clean Air Act has been amended several times, most recently in 1990. The State of Washington has adopted ambient air quality standards that are equal to, or more stringent than, Federal

standards. The ambient air quality standards apply to a group of pollutants known as criteria pollutants which include: ozone (O_3), CO, nitrogen dioxide (NO_2), SO_2 , total suspended particulates (TSP), and PM_{10} . In Washington, implementation of the Federal Clean Air Act has been delegated to the Washington Department of Ecology (DOE), and, in the project area, to the PSAPCA. The state's own air quality laws are also implemented by the Washington Department of Ecology and, in the project area, by the PSAPCA. Washington emission and ambient air quality standards are either the same as or more stringent than Federal standards.

Many urban areas are not in compliance with the ambient air quality standards. They are referred to as nonattainment areas. The project site lies within the Puget Sound Washington Intrastate Air Quality Control Region. The portion of the region that contains the project site is designated by the EPA as a nonattainment area for CO and ozone. It is in compliance for NO_2 , SO_2 , PM_{10} and the remainder of the criteria pollutants. The 1990 Clean Air Act Amendments require that nonattainment areas be brought into compliance with Federal ambient air standards within the next 6 to 20 years.

New Source Performance Standards (NSPS) for stationary gas turbines presented in 40 C.F.R. Section 60, Subpart GG, were promulgated by EPA on September 10, 1979 and subsequently amended. The most recent edition of 40 C.F.R. Section 60, Subpart GG, was issued in July 1992, and was the basis for the analysis in this EIS. NSPS turbine standards limit potential emissions of nitrogen oxides and SO_2 from certain classes of stationary gas turbines. NSPS rules affect sources constructed or modified after the proposed date of the applicable NSPS. In the case of the Tenaska Washington II project, the date is October 3, 1977.

Proposals for new facilities that may impact air quality are subject to a process called New Source Review. If the proposed facilities are in a nonattainment area for a particular contaminant, then it must be determined whether the new facilities will significantly affect the area's ability to attain the standards in the future. This is done by comparing the emissions from the new facility, and its predicted effects on ambient air quality, with significant impact threshold levels established by the PSAPCA. If the new facility emits less than the specified threshold amount of air contaminants, and will produce less than the specified threshold change in ambient air quality, it is judged to have a less than significant effect on the area's future ability to meet ambient standards and would, therefore, be permitted. If the new facility exceeds the threshold levels, the project proponent has three options: to withdraw the proposal; to modify the proposal so that it can meet the threshold levels by adding emission control equipment; or to provide offsets. Offsets are ways in which the increased emissions from a new facility are compensated for by reductions in emissions from an existing facility.

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The PSAPCA and the Washington Department of Ecology have listed certain substances as toxic air pollutants and established acceptable source impact levels (ASIL) for them. The PSAPCA's list of toxic air pollutants includes all substances listed in the National Emission Standards for Hazardous Air Pollutants (NESHAP). The ASILs are equally or more stringent than NESHAP.

4.4.4 Global Warming

Throughout the world, energy is obtained and goods and services produced primarily through the burning of fossil fuels. These combustion processes, while providing a fuel source, emit CO₂ and increase the amount present in the earth's atmosphere. Some experts within the scientific community believe that the increase in CO₂ is leading to a global temperature increase, or global warming, because CO₂ can trap heat in the earth's atmosphere. Because of CO₂'s ability to trap heat in the earth's atmosphere, it is believed that global warming could have adverse effects on life on earth (see discussion under Section 5.4.2, "Impact AQ3-1").

4.5 BIOLOGICAL RESOURCES

This section describes existing biological resources including vegetation, wildlife, sensitive species and wetlands at the proposed project site and nearby areas. For purposes of the biological resources section, the project site is defined as the area that would be disturbed by construction and over which the proposed power plant would be constructed. Additionally, the project vicinity refers to the Frederickson Industrial Area (shown in Figure 4.6-1 in Section 4.6, Land Use) and the surrounding area within an approximate 3-kilometer radius (2-mile radius).

Survey methods, limitations and tables summarizing flora observed at the site are located in Appendix E. Detailed descriptions of state- and Federal-designated Candidate species are also located in Appendix E.

4.5.1 Vegetation

The project site is basically a dry upland area recovering from past grazing practices. Left undisturbed it would eventually support a mixed forest of Douglas-fir and Oregon white oak. Two major vegetation assemblages occur within the project site: upland weedy fields and a wooded area. Upland weedy fields cover approximately 85 percent of the site, primarily consisting of invasive grasses, herbs, and shrubs. Grazing, logging, and pasture management have replaced native species with introduced pasture grasses tolerant of grazing. Within the upland weedy fields, approximately 10 to 15 percent of the site is collectively covered by St.

John's wort, red fescue, English plantain and hairgrass. Scotch broom, the most predominant shrub, covers roughly 15 percent of the site. A more detailed discussion and summary of vegetation is included in Appendix E.

The wooded area of the site can be subdivided into stands of Oregon white oak and Douglas fir stands. Two stands of Oregon white oak are located in the project site. The first oak stand, located roughly at the middle of the northern site perimeter, is composed of about 20 trees. These trees range in diameter-at-breast-height (DBH) from about 5 to 65 centimeters (2 to 25 inches) and in height from about 1.4 to 12 meters (4.5 to 40 feet), with an average DBH of about 30 centimeters (12 inches) and average height of about 7.5 meters (25 feet). A second stand of Oregon white oak is located at approximately the center of the site. There are roughly 35 trees with an average DBH of about 25 centimeters (10 inches) and height of about 7.5 meters (25 feet), respectively. Both of these stands consist of relatively young trees (20-70 years in age) and cover about 0.08 hectare (0.2 acre) collectively. Several other Oregon white oaks are scattered throughout the property. These oak stands may be subject to examination as potential critical habitat under Pierce County Code 21.18.030. If the stands qualify under the ordinance, Pierce County would consult with Washington Department of Wildlife (WDW) to help determine specific impacts or mitigation.

A single Douglas-fir stand is located in the southeastern corner of the site. This stand measures approximately 0.4-hectare (1-acre) and consists of roughly 120 trees (including saplings). These trees have an average DBH of 65 centimeters (25 inches) and an average height of 14 meters (45 feet). This stand is young, about 50 to 80 years old, and contains 15 or more large, recently downed trees, most likely attributable to the unusually strong windstorm which occurred about 10 days prior to the field survey.

4.5.2 Floodplains/Wetlands

The WDW Priority Habitat and Species (PHS) and U.S. Fish and Wildlife National Wetland Inventory (NWI) maps indicated that no wetlands occur at the project site itself. A copy of the NWI map is provided in Appendix E. A series of wetlands are located roughly 365 meters (1,200 feet) due south of the site. The aerial photo did not show possible wetland signatures at the site.

Field surveys also did not indicate the presence of wetlands. The majority of plants observed throughout the site consisted of upland, weedy grasses, herbs and shrubs, as described above. The SCS has mapped the site as Spanaway gravelly sandy loam (41A), which is a well drained soil. Soil sampling at the site verified the non-hydric nature of the soil. Samples did not exhibit organic characteristics (peaty/mucky soils) and lacked low chroma matrix, gleization, signs of leaching, and mottling typical of hydric soils. Several locations were

sampled throughout the site, including the lowest point, which appeared to be located in the bottom of a swale. However, because of the lack of proximal water features, the overall flat nature of the site, and the lack of wetland vegetation, it is believed that this swale is artificial and created from temporary earth-moving practices.

The proposed project site is located in an upland area and is not contained within a 100- or 500-year floodplain and is not susceptible to prolonged inundation. The Federal Emergency Management Act (FEMA) indicates that the closest 100-year floodplain is located approximately one mile north of the site near Clover Creek (Woodward-Clyde Consultants, 1992).

4.5.3 Wildlife and Wildlife Habitat

The project site is located in an area with disturbed wildlife habitat. Industrial facilities, scattered residential units and undeveloped areas surround the site. Vegetation at the industrial and residential locations has been altered, in many cases by grading and removal of natural habitat. In addition, undeveloped areas have been subject to intensive grazing practices or removal of native vegetation.

Stands of oak and Douglas-fir trees provide canopy cover and potential nesting, breeding and food sources for wildlife. In addition, upland weedy fields, primarily located in the western and northeastern portions of the site, provide potential forage and ground nesting/den habitat for small mammals and birds. However, these tree stands are small and isolated from higher quality habitat (i.e., areas with greater diversity, less disturbance, and larger size).

Those factors listed above limit potential wildlife habitat within the project vicinity and at the site. Most species occurring at the site are quite common and may be considered habitat generalists.

Wildlife (or recognizable signs) observed during field surveys include small mammals (such as moles and voles) and birds. A complete listing of species has been included in Appendix E.

Upland weedy fields are rated as moderate habitat value for wildlife because they provide some cover and source of food for a variety of species. They are rated as low habitat value for vegetation because plant species present are typically non-native/invasive and widely distributed outside of the project study area.

The wooded area located at the site is rated as moderate habitat for wildlife and vegetation because it is: composed of a moderate assemblage of species; degraded but not transformed from its original state; and common in surrounding areas.

4.5.4 Sensitive Species

A review of state and Federal special status species listings indicated that no rare, threatened or endangered species are known to inhabit the project site. However, a recent survey determined the presence of a population of *Aster curtus*, a Federal candidate species (C2) and listed as sensitive by the Washington Natural Heritage Program (1990). (Salix Associates, 1993). Ten other candidate species may be present in the project vicinity. A summary of these species, including their Federal and state status, is provided in Table 4.5-1. Detailed descriptions of these species are located in Appendix E.

The WDW's PHS database indicates that several sensitive species have been recorded in the project vicinity, although none within less than 3.3 kilometers (2 miles) of the project site. They include the western bluebird (*Sialia mexicana*), western gray squirrel (*Sciurus griseus*), great blue heron (*Ardea herodias*), purple martin (*Progne subis*), bald eagle (*Haliaeetus leucocephalus*), and the fisher (*Martes pennanti*).

In their response letters, both the Washington DNR and the U.S. Fish and Wildlife Service (USFWS) indicated that although no Federal- or state-listed rare, threatened or endangered species were known to inhabit the project site, several proposed and candidate species may be present in the vicinity. Copies of agency response letters are located in Appendix C. These species include one plant, the white-top aster (*Aster curtus*) which was found on the project site, one bird, mountain quail (*Oreotyx pictus*), two amphibians, northern red-legged frog (*Rana aurora aurora*), and spotted frog (*Rana pretiosa*) and one mammal, Tacoma western pocket gopher (*Thomomys mazama tacomensis*).

In addition to those sources listed above, a review of the WDW publication entitled "Management Recommendations for Washington's Priority Habitat and Species" was reviewed for potential sensitive habitat (i.e., habitat which is either sensitive and/or habitat which supports sensitive species) within the project site. No sensitive habitat was determined present for the project site. A review of sensitive species indicated that several species could be associated with habitat found within the project area. These species include the Columbia white-tailed deer (*Odocoileus hemionus columbianus*), pileated woodpecker (*Dryocopus pileatus*), western bluebird (*Sialia mexicana*) and western gray squirrel (*Sciurus griseus*). Although the project site supports habitat for these species, it is unlikely that any of these species would rely on this area as prime habitat because of the disturbed nature of the surrounding area and because the amount of forested area is small and relatively isolated.

TABLE 4.5-1
ENDANGERED, THREATENED, CANDIDATE, AND PROPOSED
SENSITIVE PLANT AND WILDLIFE SPECIES
POTENTIALLY OCCURRING IN THE PROJECT STUDY AREA

Species	Common Name	Federal Status	State Status	Observed at Site	Habitat in Study Area
FLORA					
<i>Aster curtus</i>	white-top aster	C2	SS	Yes	Marginal
FAUNA					
<i>Siala mexicana</i>	western bluebird	S	SC	No	Marginal
<i>Sciurus griseus</i>	western grey squirrel	--	SC	No	Marginal
<i>Ardea herodias</i>	great blue heron	--	M	No	No
<i>Pronge subis</i>	purple martin	S	SC	No	No
<i>Heliaeetus leucocephalus</i>	bald eagle	T	T	No	No
<i>Martes pennanti</i>	fisher	C2	SC	No	No
<i>Oreotyx pictus</i>	mountain quail	C	--	No	Marginal
<i>Rana aurora aurora</i>	northern red-legged frog	C	M	No	No
<i>Rana pretiosa</i>	spotted frog	C	SC	No	No
<i>Thomomys mazama tacomensis</i>	Tacoma western pocket gopher	C	SC	No	Moderate

Federal Status Codes (Category)

- T - Threatened
- E - Endangered
- C - Federal Candidate. Information sufficient to support the appropriateness of being listed as endangered.
- C2 - Under Review. Information insufficient to support the appropriateness of being listed as endangered
- S - Sensitive. A species which is vulnerable or declining and may become a candidate; informal designation.

State Status Codes (Washington Department of Wildlife or Washington Department of Natural Resources)

- T - Threatened
- SC - State Candidate. Information sufficient to support the appropriateness of being listed as threatened, rare or sensitive.
- M - State Monitor Species.
- SS - State Sensitive. A vascular plant tax on which is vulnerable or declining, and could become endangered or threatened in the state without active management or removal of threats. DNR has no regulatory authority to protect sensitive species; they only operate under an advisory/review role to other agencies.

The closest siting of any of the species listed above is that for the Western bluebird which has been sited roughly 3.2-kilometers (2-miles) west of the project site; however, these species are nesting in artificial nest boxes and not in natural cavities. The project site does not support natural cavities. It is highly unlikely that any sensitive species use this area either for migration, nesting or as a prime feeding area and no sensitive habitats are located here.

4.6 LAND USE AND COMMUNITY CHARACTER

For purposes of the land use discussion, the project site is defined as the area that would be disturbed by construction and over which the facility would be constructed. The project vicinity refers to the Frederickson Industrial Area.

4.6.1 Existing Land Uses

The proposed project site is located in the Frederickson Industrial Area of Pierce County. The area where the proposed project would be situated is zoned Heavy Manufacturing. Boundaries and zoning designations for the Frederickson Industrial Area are shown in Figure 4.6-1. The proposed power plant would lie within a tract of land bounded on the north by 180th Street East, on the south by 192nd Street East, on the east by Canyon Road, and on the west by 38th Avenue East.

Land uses within the vicinity of the Frederickson Industrial Area include low-density residential and mobile homes, commercial services, light and heavy manufacturing, and agricultural settlements (domestic livestock and garden production). Existing land uses surrounding the project site are shown in Figure 4.6-2. Primary land uses surrounding the site are heavy and light industrial and scattered low-density residential and agricultural.

The proposed power plant site is bordered on the north, south, east and west by open and undeveloped areas. However, the open area to the south was cleared of vegetation, and an industrial facility was constructed in 1993. AMA Timber Products occupies a parcel of land to the southwest of the site. Improvements include two large buildings and paved and graveled areas.

East of the proposed power plant site is an area, approximately 150 meters (500 feet) wide and 300 meters (1,000 feet) long, which has been graded at some time in the past. Sparse weeds and shrubs are present there. East of the project site is a light industrial complex (a floral warehouse and wholesale business) and several mobile homes. To the north of the site and beyond the open area and the Chehalis Western Railroad is a single-family residence surrounded by a Christmas tree farm. Two other single family residences are located near the Christmas tree farm about 60 meters (200 feet) east of 184th Street.

SOURCE Pierce County Department of Planning and Natural Resource Management Dec. 3, 1990

BONNEVILLE POWER ADMINISTRATION
 Proposed Tenaska Washington II
 Generation Project

**FREDRICKSON INDUSTRIAL
 AREA BOUNDARY**

**FIGURE
 4.6-1**

OFFICIAL USE ONLY

A gas-fired, peaking unit power plant used during periods of peak demand is located about 600 meters (2,000 feet) due south of Tenaska's site, on the far side of 192nd Street East.

A new Boeing facility has just been completed about 1,126 meters (0.7 miles) northeast of the site. This facility will provide aircraft parts in support of Boeing assembly divisions at Everett and Renton, Washington. The site area is about 213 hectares (527 acres) (Boeing, 1991).

The facilities needed to connect the proposed power plant to BPA's electrical power distribution system are a part of the proposed project. BPA's South Tacoma switching station is located approximately 600 meters (2,000 feet) northwest of the power plant site. The switching station lies near the center of an approximate 7.7-hectare (19-acre) parcel of land owned by BPA. The switching station itself occupies about 15 percent of this parcel. Transmission lines associated with this facility are discussed in Section 4.11 and shown in Figure 3-7. North of the switching station, on the far side of 180th Street East, is a small residential area. In addition to the switching station, a pumping station, Olympia Pipeline Pump Station, is located approximately 400 meters (1,300 feet) northwest of the site, between the proposed power plant and the switching station.

Planning Background and Zoning Designations

Growth management policies for the State of Washington are regulated by the State Legislature under the Washington Administrative Code (WAC) 365-195 and contained within the 1990 Growth Management Act. Responsibility for implementation of these policies is delegated to each county. The codes require counties to meet the goals, mandates and standards outlined in the Growth Management Act, as well as any local requirements.

Pierce County zoning designations, including the Frederickson Industrial Area, are outlined in the 1962 Plan. Pierce County is currently revising the plan to conform to the 1990 Growth Management Act. The revised plan (1994 Plan) is expected to be adopted by July 1994. The Tenaska Washington II project was specifically included in the Draft Comprehensive Plan for Pierce County in June 1993.

In March 1991 the Frederickson Industrial Area was subject to its own area-wide rezone (Frederickson Rezone). Under the 1962 Plan, the Frederickson Industrial Area was designated Rural Residential, Suburban Residential, Extensive/Extractive Industrial and General Use (G). New zoning designations for the area include Heavy Manufacturing (M-2), Commercial (C-3), Suburban Residential (SR-12) and Suburban Agricultural (SA-12), both with a minimum lot size of about 1,115 square meters (12,000 square feet) per dwelling unit. In addition, several

locations are zoned Residential Estate (RE-30), with an approximately 2,790-square meter (30,000-square foot) dwelling unit designation.

The site and a portion of the surrounding area is owned by the Port of Tacoma and is designated in the 1962 Plan as Heavy Industrial. Although it is located within the Frederickson Industrial Area, it was not included in the Frederickson Rezone and thus, is not directly affected by changes therein.

4.7 HISTORY AND ARCHAEOLOGY

This section describes cultural resources at, and surrounding, the proposed project site, and the methods used to identify these resources. The study area for cultural resources encompasses the proposed new facilities, including new structures, construction staging areas, fencing, utility lines, new and improved access roads, and power transmission and pipeline routes. Field methods used for the archaeological survey are included in Appendix F.

4.7.1 Prehistoric and Historic Occupation of the Southern Puget Sound Region

Human occupation and use of the southern Puget Sound region can be separated into two distinct time periods, prehistoric and historic. Prehistoric times include the period prior to exploration of the region by Euroamericans (individuals of European descent living in America) from approximately 8,000 years before present to roughly 200 years before present. Historic times include the period beginning with initial exploration by Euroamericans, or roughly the past 200 years.

4.7.2 Ethnohistory

Before 1855, the Nisqually and Puyallup Indians, both Coast Salish-speaking groups, occupied lands that encompass the project study area. After 1855, they were moved to reservations in central Oregon and Washington. Nisqually and Puyallup tribes extended their settlement-subsistence systems from Puget Sound inland along riverine areas and in other drier, inland environments (Smith, 1940). Movement patterns of these tribes were based primarily on seasonal availability of food sources, with focus of the yearly cycle on the permanent winter village (Smith, 1940).

4.7.3 Prehistoric Period

Archaeological sites for this time period are primarily located in coastal and lowland zones and include shell middens (deposits of shells and refuse found in areas frequently occupied), lithic scatter (sites which consist of variably-sized scatters of stone tools and waste material

produced during tool manufacture) and rock shelters (containing lithic artifacts and limited amounts of bone). Of these three categories, lithic scatters and shell middens constitute the most widespread and best archaeological sites.

4.7.4 Historic Period

The historic period is defined primarily through the discovery and settlement of the area by Euroamericans. During the late eighteenth century, Americans began to establish their presence in the area. In 1818, the United States and Great Britain agreed to joint occupation of the Pacific Northwest, with Great Britain remaining the dominant force, particularly north of the Columbia River.

The earliest American settlers in the southern Puget Sound region came in 1845 to establish the town of New Market at Tumwater Falls, Washington (Heritage League, 1990). In 1853, Congress created the Washington Territory, and in 1889, Washington achieved statehood. The Donation Land Claim Act (DLCA), which granted each white male 130 hectares (320 acres) of land in the Puget Sound basin, provided additional incentive for Americans to settle the Pacific Northwest.

4.7.5 Historic Use of the Study Area

The project vicinity is not known for any historic events or landmarks. The study area (site) is not developed and historically has been used for livestock grazing.

4.7.6 Survey Results

No cultural resources were identified or observed at the project site or in the vicinity of the site during either the pre-survey investigation or field reconnaissance. No resources are indicated in the project area on the National or State Registers of Historic Places, or on the Washington State Archaeological and Historic Sites Inventories. However, construction of the proposed power plant would require grading and excavation of the site which could disturb buried or obscured cultural resources not detected during the field survey.

4.8 SOCIOECONOMICS AND PUBLIC SERVICES

This section describes the socioeconomic environment in the vicinity of the proposed project, and includes the City of Tacoma and nearby communities of Pierce County that are within commuting distance.

4.8.1 Population

The population of Pierce County has grown over the past 6 years from 530,800 in 1986, to 624,000 in 1992. About 40 percent of the Pierce County 1992 population lived in incorporated cities and towns. Tacoma is by far the largest city in this county, with about 179,000 people in 1992. Puyallup, the second largest city, has 25,400 people, while the remaining jurisdictions each have less than 7,500 people (Populations of Cities, Towns, and Counties Used for the Allocation of State Revenues, State of Washington, June 30, 1992). The Pierce County census tract for the Frederickson Area where the proposed project would be located (tract 714.01), indicates a 1980 population of 4,069, and a 1990 population of 5,655 (Puget Sound Council of Governments, February 1991). The County Public Works Department has an even smaller population tract increment developed for transportation zones. The population within the transportation area zone, which includes the area of the proposed project bounded by Canyon Road to the east, 192nd Street to the south, 38th Avenue to the west, and 176th Street to the north (TAZ 711) was 1,622 people in 1990 (Puget Sound Regional Council, Working Forecasts, February 14, 1993).

The new Boeing facility, one of the first large developments in the Frederickson area, located to the north and east of the proposed facility, is expected to have a considerable impact on population growth in Pierce, King, Kitsap, Snohomish, and Thurston Counties. The plant is expected to have a working population of 11,419 employees per day by 2010 (Boeing-Pierce County EIS, 1991). The greatest Boeing-induced population growth is estimated for Pierce County where it is expected to be 23.5 percent greater than growth without development of the Boeing plant (Growth Impacts of Boeing-Frederickson, South County Council of the Tacoma-Pierce County Chamber of Commerce, 1992).

4.8.2 Housing

In 1991, there were 196,671 housing units in the Tacoma-Pierce County area, with 3.6 percent, or 7,007 units vacant. Vacancy rates fell from 4.2 percent in 1986, and 4.1 percent in 1988. The total number of units in 1991 can be broken down into single family detached homes, mobile homes, and multi-family homes. Of the 134,184 single family homes, 2.5 percent were vacant; of the 45,075 multi-family homes, 6.5 percent were vacant. There were 9,613 mobile homes, with 2.4 percent vacant (Housing Survey Summary, Tacoma-Pierce County Chamber of Commerce, July 1992).

The nearest residential units are located to the north of the proposed project in a small tract of 10 to 12 homes, with the closest homes located about 550 meters (1,800 feet) away. A residential community about 1,200 meters (4,050 feet) to the south of the proposed project is located along 224th Avenue, and is separated from the Frederickson Industrial Area by an

approximately 410 meter-wide (1,350 feet) wooded buffer (May 3, 1992, color aerial photograph, scale: 1 centimeter equals 55 meters [1 inch equals 450 feet]).

4.8.3 Employment

Employment data is available from the Puget Sound Council of Governments for forecast and analysis zones defined partially by the 1980 census tracts. The total number of people employed in the Spanaway forecast and analysis zone of Pierce County, which includes the Frederickson Industrial Area, rose from 824 in 1970, and 1,593 in 1980, to 2,395 in 1990. The number of people employed is projected to be 3,549 in the year 2000 and 5,640 in the year 2020. In 1970, the majority of jobs were held in the government and education sector (504 people). By 1990, retail trade employment had tripled, 164 to 493, and service industries employment had increased by a factor of 6, 104 to 652. Projections for the years 2000 and 2020 indicate that employment in services will nearly match employment in government and education, whereas employment in retail trade will be about double, 338 to 662, the 1990 value.

4.8.4 Tax Revenues

The 1991 General Fund budget for Pierce County was \$322,449,930. Of this budget, \$54,222,460 came from property and other local taxes (Annual Budget for Fiscal Year 1991, Pierce County Council Ordinance No. 90-140S).

4.8.5 Fire Protection

The project site is located in Fire District No. 7. Fire District No. 7 is staffed by 30 full-time employees and operates one station at 176th and 22nd Avenues East (Headquarters station 71), one at 3421 East 224th Street (Station 72), and another at 162nd Street and Park Avenue (Station No 73). Areas that are served by District No. 7 include the Chehalis Western Railroad, Pacific Avenue, Canyon Road, 192nd Street East, and 176th Street from Pacific Avenue (Lisa Trett, Fire District No. 7, pers. comm., April 21, 1993). Fire District No. 7 is bordered by Fire District No. 21 to the east of Canyon Road. Because of its proximity, the proposed project may have an effect on Fire District No. 21 as well.

Inspections for compliance with fire codes are provided by the Pierce County Fire Prevention Bureau (a division of the Pierce County Department of Emergency Management) rather than the fire districts, which are formed as special taxing districts in the State of Washington (Boeing-Pierce County EIS October 1990).

4.8.6 Law Enforcement

Law enforcement services in the project area are provided by the Pierce County Sheriff's Department, which serves the unincorporated portions of the county and is staffed by 227 commissioned officers and 54 noncommissioned staff. Responsibilities of the Sheriff's Department include traffic control, crime prevention services, and support investigation services, except for the area east of Interstate Highway 5 (I-5), which is handled by the Washington State Patrol under a special agreement (Boeing-Pierce County EIS, October 1990).

4.8.7 Education/Schools

The Bethel School District No. 403, with headquarters in Spanaway, serves an area of approximately 570 square kilometers (220 square miles), including the project site, and about 10 percent of the County population. The district operates 14 elementary schools, three middle schools, and two high schools, as well as an alternative school, a transportation center, an educational service center, two preschool centers, and a warehouse/maintenance facility. A new elementary school opened in the fall of 1992. The 1990-91 school year student enrollment is estimated at 11,500 (Boeing-Pierce County EIS, October 1990).

4.8.8 Libraries

The Pierce County Library District serves the area with branches and bookmobile services. The South Hill library, opened in 1990, is located at 154th and Meridian and serves eastern Pierce County. Two additional buildings were completed in 1992, the Graham branch, located at 224th and 90th Street, and the Summit Branch, behind the shopping center on 112th Street and Canyon Road (Boeing-Pierce County EIS, October 1990).

4.9 PUBLIC HEALTH AND SAFETY

The Tenaska Washington II project would involve the use of some products and processes during construction and operation that could affect public health and safety if improperly handled. For example, ammonia would be used and stored on site for cleaning purposes. If the ammonia is not properly handled, it could pose a risk to public health. Lubricating oils, hydraulic fluids, cleaning solvents, paints, paint thinners, wastewaters from the cooling tower collection sump, and other materials and process wastes would be found on site, and could pose a risk to public health and safety if not used and disposed of properly.

YIMO 200

Other potential concerns and proposed mitigation measures which have been addressed include:

- Hazardous material may be present at the site and could be disturbed during construction.
- Improper handling of hazardous materials used, stored, or generated during construction and/or power plant operations could result in an accidental release to the environment.
- Natural gas and fuel oil used or stored on-site are flammable and could be explosive under certain circumstances.
- Toxic materials could be emitted to the air in the power plant exhaust.
- Electrical transmission lines could pose an electric shock hazard.
- Electrical transmission lines could increase the exposure of individuals to electric and magnetic fields.

Background information on each of these potential health risks is discussed in this section, except toxic air pollutant emissions, which is discussed in Section 4.4.

4.9.1 Phase I Environmental Site Assessment

Before a site can be developed, a study is conducted to assess whether hazardous materials could exist in the soil or underlying groundwater as a result of prior use or migration of pollutants from an adjacent site. This study is referred to as a Phase I Environmental Site Assessment. Such a study was completed for the proposed project by ENSR Consulting and Engineering in 1992. The study was limited to a review of historical land use information and a preliminary site survey. No soil or groundwater samples were taken at the proposed site; however, there was information available from groundwater monitoring wells of an adjacent property and this information was discussed in the ENSR report.

The preliminary site survey indicates that the site and adjacent properties were used for livestock grazing until 1985. There has been no prior industrial use of the site. This information, together with the results of the field survey, led to the conclusion that there is no evidence to suggest that hazardous materials or petroleum hydrocarbons are present at the site.

If the presence of hazardous materials is suspected at a site, a Phase II Environmental Site Assessment must be conducted. Such a study was conducted for a site located adjacent to and south of Tenaska's site. As part of the study, four groundwater monitoring wells were constructed at the adjacent site. It was the conclusion of the investigators that no

contamination resulting from hazardous materials or petroleum hydrocarbons is evident adjacent to the site.

A similar Phase II study was conducted for the Boeing site located about 1.2 kilometers (0.75 mile) to the east (Pierce County, 1991). The Boeing site has been used for industrial purposes since 1935. Low levels of carbon tetrachloride, nickel, beryllium, arsenic, and chromium were found in samples taken from groundwater wells. Because of the northward flow of groundwater, these contaminants would not be likely to migrate to the proposed Tenaska Washington II project site.

Other potentially significant land uses, located primarily within about 76 meters (250 feet) of the proposed site, include the Puget Sound Power and Light (Puget Power) Frederickson-Spanaway substation, and the Washington Natural Gas compressor station, which are located to the south of the proposed site across 192nd Street East. Documents reviewed at the Washington Department of Ecology did not indicate that there had been a release of hazardous material or waste from Puget Power (ENSR, 1993). The only known potentially hazardous material that is near the site is natural gas contained in a buried 66-centimeter (26-inch) pipeline maintained by Northwest Pipeline Corporation (NPC), and the Olympic pumping station, which is a refined petroleum metering facility that provides gasoline and aviation jet fuel in the Pacific Northwest. NPC pipeline would provide natural gas for the proposed Tenaska Washington II project.

4.9.2 Electric Shock Hazard

There is no existing electrical service to the proposed site. The closest electrical transmission lines are an overhead 110-kV Tacoma Public Utility power transmission line, located about 230 meters (750 feet) from the proposed site, a 12.5-kV overhead power line located along 38th Avenue East, approximately 915 meters (3,000 feet) from the proposed site, and a 115-kV overhead Puget Sound Power and Light Company power transmission line located along 192nd Street East, approximately 365 meters (1,200 feet) from the proposed project. The proposed project has two options for constructing new power lines: overhead power lines or underground cables. Either type of new power line would be designed and constructed in accordance with the National Electrical Safety Code (NESC). NESC specifies the minimum allowable distances between the lines and the ground or other objects. These requirements basically determine the edge of the right-of-way and the height and placement of the line (i.e., the closest point that houses, other buildings, and vehicles are allowed to the line).

Because they are buried and out of reach, underground cables are not normally associated with shock hazards as much as overhead lines. However, excavation and trenching activities,

which could take place at a later date (i.e., after completion of Tenaska's line), could present shock hazards to construction workers.

4.9.3 Electric and Magnetic Fields

Overhead power lines, like all electrical devices and equipment, produce electric fields and magnetic fields. Current (the movement of electrons in a wire) produces the magnetic field. Voltage (the force that drives the current) is the source of the electric field. The strength of these fields also depends on the design of the line and on the distance from the line. Field strength decreases rapidly with the distance.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances. Average electric field strength in the home from electrical appliances is typically less than 0.10 kilovolts per meter, and average magnetic field strength in the home is typically between 1 and 100 milligauss (mG). Magnetic fields of tens of hundreds of mGs can be present when standing very close to appliances carrying high currents. In the middle of rooms away from wiring and appliances, the average magnetic field is typically less than 1 mG. Typical electric and magnetic field strengths for some common electrical appliances are given in Table 4.9-1.

Both electric and magnetic alternating current (AC) fields induce currents in conducting objects, such as people and animals. These currents, even from the largest power lines, are too weak to be felt. However, some scientists believe that these currents might be potentially harmful and that long-term exposure should be minimized. Hundreds of studies on electric and magnetic fields have been conducted in the United States and other countries. A summary of electric and magnetic field studies can be found in Appendix D.

Unlike electric fields, magnetic fields are not reduced in strength by trees and building material. Thus, magnetic fields are of a greater concern to public health and safety. Power lines can be the major source of magnetic field exposure within a home located close to a power line. Typical electric and magnetic field strengths for some BPA overhead transmission lines are given in Table 4.9-2.

Underground cables, because of their insulated design format and buried state, do not generate an external electric field. In addition, with the design being proposed for this project, magnetic field profiles decrease considerably faster than with overhead power lines.

TABLE 4.9-1
TYPICAL ELECTRIC AND MAGNETIC FIELD STRENGTHS FROM
COMMON APPLIANCES AT A DISTANCE OF 0.3 METER (1 FOOT)

Appliance ¹	Electric Field (kV/m)	Magnetic Field (mG)
Coffee Maker	.030	1 - 1.5
Electric Range	.004	4 - 40
Hair Dryer	.040	0.1 - 70
Television	.030	0.4 - 20
Vacuum Cleaner	.016	20 - 200
Electric Blanket ²	.01 - 1.0	15 - 100

kV/m - kilovolts per meter

mG - milligauss

¹ By 0.9 to 1.5 meter(s) (3-5 feet), the magnetic field from appliances is usually decreased to less than 1 mG.

² Values are for distances from a blanket in normal use, not 0.3m (1 foot) away.

Sources for appliance data: Miller, 1974; Gauger, 1985.

TABLE 4.9-2
TYPICAL ELECTRIC AND MAGNETIC FIELD STRENGTHS FROM
BPA OVERHEAD TRANSMISSION LINES

Transmission Lines	Electric Field (kV/m)	Magnetic Field (mG)	
		Maximum ¹	Average ²
115-kV			
Maximum on Right-of-Way	1.0	63	30
Edge of Right-of-Way	0.5	14	7
200 Feet from Center	0.01	1	0.4
230-kV			
Maximum on Right-of-Way	2.0	118	58
Edge of Right-of-Way	1.5	40	20
200 Feet from Center	0.05	4	2

kV/m - kilovolts per meter

mG - milligauss

¹ Under winter peak load conditions (occurs less than 1 percent of the time).

² Under annual average loading conditions.

Because public concern is increasing over potential health effects of electric and magnetic fields and because a clear course of action has not been determined from present scientific evidence, BPA has developed interim guidelines. These guidelines state that BPA should not increase public exposure to electric and magnetic fields where practical alternatives exist. Thus, it is BPA's practice to consider potential electric and magnetic field exposure increases in the design and location of new transmission facilities. Increases in long-term, involuntary exposures to these fields are avoided if practical alternatives exist.

4.10 TRAFFIC AND TRANSPORTATION

4.10.1 Regional Setting

The project site is approximately 19 kilometers (12 miles) south/southeast of the City of Tacoma and roughly 13 kilometers (8 miles) south/southwest of Puyallup. The study area contains a number of major arterials, including I-5 and State Routes 512 and 7. The western terminus of State Route 512 is at a junction with I-5, just south of Tacoma (Figure 4.10-1). This state route serves as a main arterial extending east from I-5, eventually becoming 107th Street East. The Chehalis Western Railroad passes approximately 0.4 kilometer (0.25 mile) north of the site.

Major streets in the vicinity of the site and on which the transportation analysis concentrated include State Route 512, 176th Street East, 192nd Street East, and Canyon Road, which traverses approximately 0.4 kilometer (0.25 mile) east of the site.

4.10.2 Local Transportation System

Immediate access to the site is from 192nd Street East, about 0.4 kilometer (0.25 mile) south of the site boundary. 192nd Street East is reached from Canyon Road and 38th Avenue. Canyon Road is primarily reached from State Route 512. 38th Avenue is reached from 176th Street East, which defines its most northern point. 192nd Street East is an urban, two-lane road with a minimal shoulder area. 38th Avenue is a shoulderless, narrow, two-lane urban road. 176th Street East is a two-lane urban road with a wide shoulder and designated right-turn lane onto Canyon Road. Canyon Road is a four-lane road with off-ramps and on-ramps connecting it with State Route 512. Canyon Road has a wide shoulder and four signalized intersections along its route from Route 512 to its southern terminus at 192nd Street East (112th Street East, 128th Street East, 160th Street East and 176th Street East). State Route 512 is a four-lane expressway. I-5 is an eight-lane freeway (four lanes in either direction) and the major arterial through Tacoma.

BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

Transportation Study Area

FIGURE
4.10 - 1

OFFICIAL USE ONLY

No paved or graveled roads cross or lead to the power plant site, although an unimproved dirt road skirts its western boundary. This road begins at 192nd Street East and follows the eastern boundary fence of the AMA Timber Products facility. The road continues north along the site perimeter to the Chehalis Western Railroad tracks. Paved roads surround the site and include Canyon Road, 184th Street East, 38th Avenue East and 192nd Street East. These roads serve as access to industrial facilities and as commuter corridors for vehicles traveling to or from Tacoma, Puyallup and the I-5 corridor.

4.10.3 Existing Traffic Volumes

Traffic flow for the project vicinity reflects commuter traffic into and out of the Frederickson area, which serves as a bedroom community for centers north of its location (e.g., Tacoma/Seattle). Existing peak-hour traffic volumes occur along established "commute corridors", such as Canyon Road and State Route 7 in a northbound direction during the morning (a.m.) and in a southbound direction during the evening (p.m.) (Boeing, 1991).

Roadway capacity is a function of traffic volumes and the physical characteristics of a road. In order to establish the setting for existing traffic conditions, average daily traffic (ADT) and peak-hour counts have been analyzed for roads in the study area that could be affected by traffic to and from the power plant. On Canyon Road north of Military Road, the ADT is 19,546 vehicles; south of Military Road, the ADT drops to 6,370 vehicles.

Roadway capacity is expressed in terms of Level-of-Service A through F. Table 4.10-1 shows ADT volumes for roads in the study area. When available, it also shows the Levels-of-Service for some roads, as well as traffic volumes during peak morning and evening hours.

The worst traffic congestion currently occurring within the study area is south bound on Canyon Road at its intersection with 112th Street East, just south of its junction with State Route 512, during afternoon peak-hour traffic. Studies performed in October 1992 indicate that this intersection operates at Level of Service "E" during the peak p.m. hour (Mike Shopshire, Pierce County, pers comm., March 26, 1993). The cause of congestion is people returning to the Frederickson Industrial Area at the end of the workday. There are plans by the County to upgrade Canyon Road and State Route 512 by widening portions of their routes and creating additional designated turn lanes (Chris Beckman, Pierce County, pers. comm., March 19, 1993). Further improvements may be accomplished from an analysis of intersection signalization during the peak hours.

TABLE 4.10-1
TRAFFIC VOLUMES AND LEVELS-OF-SERVICE ON AREA ROADWAYS

Roadway Segment	Description	ADT (vpd)	Peak Hour Counts (vph)		Level of Service	
			AM	PM	Current	Construction
Canyon	North of Military	19,546	1,673	2,024	E	E
Canyon	South of Military	6,370	676	731	C	C
192nd	West of 38th	1,188	102	132	A	B
512	East of Canyon	46,900				
512	East of State Route 7	51,500				
180th	East of 40th	184	17	27		
176th	East of Canyon	12,091	992	1,151		
176th	West of Canyon	9,734	683	847		

Key

- A Free flow (relatively). If signalized, conditions are such that no approach phase is fully utilized by traffic and no vehicle waits through more than one red indication. Very slight or no delay.
- B Stable flow. If signalized, an occasional approach phase is fully utilized; vehicle platoons are formed. This level is suitable operation for rural design purpose. Slight delay.
- C Stable flow or operation. If signalized, drivers occasionally may have to wait through more than one red indication. This level is suitable operation for urban design purposes. Acceptable delay.
- D Approaching unstable flow or operation; queues develop but quickly clear. Tolerable delay.
- E Unstable flow or operation; the intersection has reached ultimate capacity; this condition is not uncommon in peak hours. Congestion and intolerable delay.
- F Forced flow or operation. Intersection operates below capacity. Jammed.

¹ Source: Transportation Research Circular 212 - Interim Materials on Highway Capacity Analysis - Highway Research Board, January 1980.

Localized congested areas also occur along Canyon Road, especially during peak-hours at signalized intersections along its route. These areas are congested for roughly 10 to 15 minutes during peak traffic hours. The cause of this congestion is most likely the introduction of new industrial facilities in the Frederickson Industrial Area, such as the new Boeing plant (Mike Shopshire, Pierce County, pers. comm., March 26, 1993).

4.10.4 Growth Trends

In order to predict the effects of growth on traffic flow to the year 2010 Pierce County has been broken down into a series of traffic zones. In the 1990 census, the zone in which the proposed site is located had an estimated population of 1,622, or 0.26 percent of the total County. Predictions for the years 2000 and 2010 indicate that the population for this zone will increase to 2,615 and 3,529, respectively; or by roughly 1,000 people per decade. However, the total population would still be relatively low compared to other zones of similar size. Major traffic trends for this area are expected to be influenced primarily by large industries such as Boeing, which anticipates a total working population of 11,419 by the year 2010. The resident population, not all of which currently drives or would drive to work in the future, contributes a relatively small portion of the total number of vehicles.

4.11 ENERGY AND UTILITIES

4.11.1 Water Supply

Water would be supplied by TPU Water Distribution. An existing 51-centimeter (20-inch) diameter municipal water main is located about 427 meters (1,400 feet) from the proposed power plant site along 192nd Street East, and is available to provide water for the proposed project. TPU is investigating the future needs for water supply in the Frederickson area.

4.11.2 Sanitary Sewer

An existing 61-centimeter (24-inch) diameter sanitary sewer is located parallel to 192nd Street East, about 427 meters (1,400 feet) south of the proposed site. Currently there is a 162 meter (530 feet) extension of 25-centimeter (10-inch) sewer extending north from the existing 61-centimeter (24-inch) sewer line in 192nd Street East towards the subject property in the future proposed roadway identified as 50th Avenue East. Most likely, a new hookup would be installed to this 25 centimeter (10 inch) sewer, along 50th Avenue. The new hookup would be built according to Pierce County codes.

4.11.3 Storm Drainage

No storm water drainage facilities are known to exist around the proposed project site; natural drainage currently provides for the flow of runoff. The Pierce County Surface Water Management Department regulates storm water facilities for the county.

4.11.4 Solid Waste Disposal

The municipal solid waste landfill for Pierce County is operating under a 5-year extension from 1991. The landfill is operated privately by Land Recovery, Inc., and is in a siting process to acquire and develop the adjacent area.

4.11.5 Electricity

Electricity would be generated by the proposed project through the gas turbine-generator and the steam turbine-generator. Some of this energy would be used at the proposed project to operate plant power and lighting needs. The majority of the energy would be tied into BPA's South Tacoma substation.

During periods when the proposed generation facility would be off-line (not producing energy for BPA), power would be provided to the facility by a local utility power system. In the event that the power plant is shut down and utility power is also out of service, an emergency generator would connect a portable 100-kW/1250 megavoltamperes (mva), 480 volt, three-phase generator to the power plant's 480 volt system.

Power is available from the Puget Power 115-kV power line located along Canyon Road and 192nd Street East, and from Tacoma Public Utilities' 12.5-kV power line located along 38th Avenue. Power needs for meeting the proposed facility's auxiliary needs and for construction would likely be provided by TPU's transmission line. Initial start-up power to energize the proposed project would be provided through BPA's 230-kV transmission system (Mike Lebens, Tenaska, pers. comm., March 26, 1993).

A 110-kV transmission line is located in an easement corridor which skirts the western boundary of AMA Timber Products in a north/south orientation roughly 230 meters (750 feet) west of the proposed site. It is operated by TPU.

4.11.6 Natural Gas

Northwest Pipeline Corporation has a pipeline located about 305 meters (1,000 feet) from the property boundary. This pipeline would supply the natural gas to the proposed power plant.

4.11.7 Back-Up Fuel Oil

An emergency back-up supply of fuel oil would be stored on site. The fuel would be trucked to the site from commercial delivery points. Delivery points would vary based on price and availability of the fuel oil.

4.12 NOISE

4.12.1 Noise and Its Measurement

Noise is commonly defined as unwanted sound that disrupts normal human activities or diminishes the quality of the human environment. Transient noise sources, such as aircraft directly overhead or passing motor vehicles, are usually short duration noises and are often excluded from regulation. Stationary noise sources are emitted from fixed locations and are associated with a specific land use. Examples of stationary noise sources are ventilation fans, fabrication machinery, and water pumps. Ambient noise consists of all noise generated in the vicinity of a chosen location by typical noise sources, such as local traffic, wind blowing in trees, neighboring industries, and general aircraft traffic. The total noise level as measured with a sound level meter is composed of a typical mix of all sources, both distant and nearby, which form the *ambient* noise environment at the measurement location.

Noise is measured as a sound pressure level exerted on the microphone of a sound meter. The magnitude of audible sound levels, decibels (dB), has a very wide range. Decibel measurement scales are based upon the logarithm, which is not linear, and consequently sound pressure levels from different noise sources cannot be added arithmetically. For example, a 70 dB sound added to another of equal magnitude will equal a sound of 73 dB, *not* 140 dB. Sound levels are adjusted (or weighted) by the sound meter for the variation in ear sensitivity and are reported as A-weighted decibels (dBA).

Noise levels also change with time. The following methods of averaging noise are commonly used to describe the noise environment and time-varying noise levels:

- *Maximum sound pressure level* ($L_{\max}$) — the highest sound pressure level observed during a measurement, either of the ambient noise or from a particular noise source.
- *Statistical noise level* (L_{10} , L_{50} , etc.) — for time-varying noise sources, the statistical sound levels describe how often a given sound level is exceeded during the period of the measurement. For example, L_{10} is the noise level exceeded 10 percent of the time, that is, not very often. The L_{90} noise level

would be exceeded most of the time (90 percent of the time), and would represent the *background noise level* or lowest ambient noise levels of the noise environment. Particular, identifiable noise sources are additive to the background noise, forming the total noise environment.

- *Equivalent sound pressure level* (L_{eq}) — the sound level of a steady, non-time-varying noise which is equivalent, in total acoustic energy, to the noise level of a time-varying noise. The L_{eq} is measured over a specified period of time, usually one hour, and represents an average acoustic energy for that time period.
- *Day-night noise level* (L_{dn}) — the 24 hour equivalent level with a 10 dB penalty added during night hours (10:00 p.m. to 7:00 a.m.) to allow for greater community sensitivity to noise occurring at night. The L_{dn} is calculated from hourly L_{eq} measurements.

4.12.2 Ambient Noise Levels

Noise measurements were made at the proposed Tenaska Washington II project site and on property surrounding the site where noise impacts would be likely to occur. Contributors to the ambient outdoor noise levels observed and measured at the site, and in the vicinity of the site, include distant aggregate mining activities, aggregate haul trucks along Canyon Road, Boeing plant noise, passenger and light-duty vehicles, aircraft, wind blowing through trees, bird songs, and adjacent to 184th Street East, saw cutting and impulsive stapling noise at a pallet manufacturing plant.

The ambient measurements were made on February 20, 23, and 24, 1993, using a Bruel & Kjaer sound Level Meter Type 2231 and with a Larson/Davis Integrating Sound Level Meter Model 700. Short-term L_{eq} measurements were typically made for approximately 10 to 15 minutes and averaged over that period of time by the meter. Measurement locations are shown in Figure 4.12-1.

Hourly L_{eq} noise levels ranged from about 50 to 55 dBA during the day and 45 to 50 dBA at night. Nighttime levels were influenced by 16 kilometers per hour (10 miles per hour) winds and would probably be about 5 dB lower without the wind. The lowest ambient noise level observed was 44 dBA, which occurred at 7:30 pm. Noise levels are slightly higher than those that might be expected at a typical rural location because of the influence of military air traffic.

BONNEVILLE POWER ADMINISTRATION
 Proposed Tenaska Washington II
 Generation Project

**NOISE MEASUREMENT
 LOCATIONS**

**FIGURE
 4.12-1**

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A sampling of the noise was made along Canyon Road, located at Site 6 in Figure 4.12-1, to determine the influence of truck and vehicle traffic on the noise environment of the project vicinity. Traffic volume for the segment of Canyon Road at the measurement site (M6) was estimated at 300 vehicles passing per hour. Approximately 40 percent of the vehicles were heavy trucks, based upon direct observation. At about 12 meters (40 feet) from the centerline of the nearest lane of traffic, the noise level was 63 dBA L_{eq} . Daytime noise levels within approximately 300 meters (1,000 feet) of the road are dominated by traffic noise. The project site is about 365 meters (1,200 feet) from Canyon Road.

4.12.3 Noise Regulations and Guidelines

Local, state, and Federal noise regulations and guidelines protect residents and workers from excessive noise from neighboring activities. By Pierce County ordinance and state law (WAC 173-63), this project would be subject to maximum allowed levels of noise as measured at the property line of adjacent occupied land. The allowable noise level depends upon the land use designation of the property. For an industrial noise source, the allowed *daytime* noise level at neighboring industrial property, at the property line, is 70 dBA, and at residential property lines, 60 dBA. At night, the limits for residences are 10 dBA lower.

The noise descriptor most often used in estimating noise impacts is the equivalent noise level (L_{eq}). The county and state noise regulations do not use the L_{eq} to take into account the time-varying nature of typical noise sources. Instead, the regulations allow the noise level to exceed the stated maximum allowable for short periods of time. For most noise sources, the allowed increases to short-term noise levels can be approximated by allowing the predicted or measured L_{eq} of the noise source to be 2 dBA higher. The noise limits for evaluating the Tenaska Washington II project, however, have been left unmodified, and therefore provide a slightly conservative basis for assessing noise impacts. Table 4.12-1 lists the allowable noise limits for the project:

TABLE 4.12-1
MAXIMUM PERMISSIBLE NOISE LEVELS
ADJUSTED FOR L_{eq} AVERAGING
(dBA)

Noise Receiver	Daytime	Night
Residential	60	50
Industrial	70	70

Some noise sources are exempt from regulated limits. They include aircraft, railroads, vehicles operating on public roads, and temporary construction sites between the hours of 7:00 a.m. and 10:00 p.m.

The Federal Noise Control Act of 1972 gave each state the responsibility for noise control. Executive Order 12088 requires that Federal agencies such as BPA comply with state and local noise control regulations.

4.13 VISUAL QUALITY

The objectives of the visual resource baseline inventory were to identify, describe, and map all significant visual resources which may be affected by the construction and operation of the proposed power plant and ancillary facilities. The baseline data were recorded in sufficient detail for assessment of direct and indirect impacts of the project. Although no public lands were directly affected, the visual resource study was conducted in compliance using Federal guidelines established by the Forest Service Visual Management System (FSM 2380) and SCS Priority Landscape System (Technical Release No. 65). These guidelines were used specifically to identify scenic or visually sensitive landscapes. Data sources included color aerial photography and U.S. Geologic Survey (USGS) topographic maps, supplemented by field reconnaissance and physiographic information described by Fenneman (1931).

4.13.1 Results

The characteristic landscape is relatively flat land, sloping slightly to the south, and edged to the northeast by a small ridge. Most of the original cedar, hemlock, and Douglas fir forest has been cleared. Small clusters of coniferous trees and individual stands of oak trees are scattered around the project area. Numerous physical modifications (Figure 4.13-1) have occurred to the landscape. Large tracts of land surrounding the project area have been and are being converted into industrial use. Major industrial modifications include an existing power generation plant and a cleared and graded area to the south; BPA's South Tacoma switching station to the northwest; a timber mill and manufacturing plant to the southwest; and a sand and gravel operation and wood storage yard to the east. A network of roads surrounds the project area. Several sets of transmission lines cross to the north, west and south of the project area. Two small residential areas, located to the northeast and northwest, are separated by a tree farm.

The scenic quality is enhanced by the background distance zone influence of Mt. Rainier located to the east/southeast of the project area. Mt. Rainier is one of the most visually dominant landforms of the Pacific Border physiographic province. The scenic quality at the

- TRANSMISSION LINE
RAILROAD
1 MINIMAL DISTURBANCE
2 DISTURBED
3 MAJOR DISTURBANCE
4 DRASTIC DISTURBANCE

1 IN = 2420 FT

1 CM = 290 M

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BONNEVILLE POWER ADMINISTRATION
 Proposed Tenaska Washington II
 Generation Project

Physical Modifications
 to the Landscape

FIGURE
 4.13 - 1

project site ranges from minimal to common with significant cultural modifications as described earlier. The visual sensitivity ranges from low to moderate for industrial locations and low to high for residential areas. This is based on general landscape appearance and maintenance of surrounding properties. The general view distance to the project site is foreground to middleground and ranging from 0.2 to 2 kilometers (0.1 to 1.5 miles). The view distance from Mt. Rainier National Park is about 37 kilometers (23 miles). The Visual Quality Objective (VQO) is mostly Modification with some Partial Retention. This objective allows project facilities and activities to visually dominate that landscape as viewed from certain locations (e.g., industrial locations). However, project facilities and activities should remain visually subordinate to the characteristic landscape from other viewing locations (e.g., residential areas).

Key observation points (KOPs) identified for the study area include residential areas located to the north of the proposed project, Canyon Road and 38th Avenue located respectively to the east and west of the proposed project. Other KOPs identified include vistas and overlooks oriented toward the proposed project area from Mt. Rainier National Park.

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5.1 INTRODUCTION

This chapter describes potential impacts of the proposed project on the environment and the impacts of alternatives to the proposed project. A summary of these impacts by resource is provided in Table 5.1-1. Sections 5.2 through 5.13 describe the impacts of construction and operation of the proposed Tenaska Washington II project on various environmental elements. Each section begins with a statement of the method of analysis indicating how impacts were determined.

In most cases, mitigation measures designed to eliminate or lessen impact are suggested. A summary of significant and unavoidable impacts is contained in Section 5.15. Section 5.14 describes mitigation measures already planned for the project such as project design features intended to reduce environmental impacts. Other environmental summaries are contained in Sections 5.15 through 5.16. The cumulative impacts of the proposed action and other similar actions are described in Section 5.18. Environmental impacts of alternatives to the proposed action are described in Section 5.19.

The majority of impacts discussed below are associated with the proposed power plant. Unless otherwise stated in the text, impacts resulting from the transmission line and modifications to the BPA South Tacoma substation are minor.

Technical studies in support of the environmental analyses, other than the archaeology and noise studies, were performed by Woodward-Clyde Consultants. The archaeology study was performed by J. Scott King of Historical Research Associates, Inc., in Seattle, Washington. The noise study was performed by Michael R. Yantis Associates, Inc., of Bellevue, Washington.

5.2 GEOLOGY AND SOILS

5.2.1 Methods of Analysis

Geology and soil characteristics for the proposed site were determined by review of a number of sources including the SCS, Pierce County Soil Map; Geologic Maps from the Washington Department of Geology and Earth Resources; and several technical reports prepared by Brown and Caldwell, Earth Consultants, Inc., and Dames & Moore, all of which are referenced in Section 8.0 References.

TABLE 5.1-1
SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

RESOURCE	COMBUSTION TURBINE	TRANSMISSION LINES	SUBSTATION
Geology and Soils	Minor increase in soil erosion during construction.	Minor increase in soil erosion during construction.	Minor increase in soil erosion during construction.
Hydrology and Water Quality	Slight increase in runoff volume which would be contained on site.	None.	Slight increase in runoff volume.
Air Quality	Power plant would emit air pollutants, but at levels in compliance with applicable air quality and visibility standards and air toxic acceptable levels. Emission of greenhouse gases (primarily CO ₂). Emission of dust and engine exhaust during construction.	Emission of dust and engine exhaust during construction.	Emission of dust and engine exhaust during construction.
Biology	Removal of some vegetation and already disturbed wildlife habitat at 6.4-hectare (16-acre) site. The <i>Aster curtus</i> , a state sensitive and Federal Candidate 2 plant species, would be transplanted on site and seeds would be gathered.	Wildlife expected to migrate from disturbed area during construction and return thereafter.	Removal of vegetation from less than 0.1 hectares (0.2 acres). Wildlife expected to migrate from disturbed area.
Land Use and Community Character	None. Plant would lie in area zoned for industrial use.	None.	None. Improvements would take place with an existing switching station.
History and Archaeology	None expected.	None expected.	None expected.
Socioeconomics and Local Services	Project would create 25 to 30 permanent jobs and 225 to 250 construction jobs.	None.	Project would create 10 to 15 construction jobs.
Public Health and Safety	Hazardous substances used during construction and/or operation could be spilled and released to environment. Mitigations and spill contingency plans are proposed by applicant.	Lines, particularly overhead, could pose electric shock hazard and increased electric and magnetic fields.	None.

TABLE 5.1-1
SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS (Continued)

RESOURCE	COMBUSTION TURBINE	TRANSMISSION LINES	SUBSTATION
Traffic and Transportation	Construction workers would generate an estimated 60 truck trips and 215 vehicular trips per day. Operation would generate roughly 30 vehicular trips per day.	Minor.	Minor.
Energy and Utilities	Plant would be serviced by existing utilities. Plant would produce 240 aMW of electrical energy.	None.	None.
Noise	Permanent increase in noise from project operation, but in compliance with applicable standards. Temporary noise increase during construction.	Temporary noise increase during construction.	Temporary noise increase during construction.
Visual Quality	Alteration of visual quality in Frederickson. Appearance would be consistent with industrial surroundings.	Aboveground transmission line, if chosen, would have adverse effect on visual quality, but would be consistent with industrial surroundings.	Minor.

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5.2.2 Impacts and Mitigation Measures

Impact G1 Construction and operation of the Tenaska Washington II project could preclude the use of geologic resources at the site.

Impacts

There are no known unique geologic features or mineral resources that could be affected by this project. Due to their suitability for urban development, much of the area underlain by Spanaway soil is being converted to urban uses. Remaining areas are used primarily for hay production and pasture. This soil is moderately productive under good management conditions, but is not prime farmland (SCS, 1979).

Mitigation Measures

No mitigation measures are suggested.

Impact G2 Geologic conditions at the Tenaska Washington II project site could threaten the stability of structures at the site.

Impacts

Based on past records and current research regarding seismic events in the region, ground-shaking is possible in the project area. Site-specific engineering and geotechnical studies would be necessary prior to project construction to assess structural stability. Structures, including both the power plant and associated transmission lines, should be designed to conform with the building standards for seismic risk in the project region and the recommendations of the geotechnical engineer.

Mitigation Measures

No mitigation measures are suggested beyond those built into the project.

Impact G3 Construction of the Tenaska Washington II project could cause soil erosion.

Impacts

Short-term construction impacts would consist of ground-disturbing activities including topsoil exposure. Erosion would probably be minor for this project due to the relatively gentle slopes, permeable soils and lack of proximity to surface water drainages.

Mitigation Measures

The following mitigation measure is suggested:

- G3-1 To minimize erosion, control measures could be applied to all exposed areas during and following construction. During construction, incorporation of standard erosion control measures such as silt fencing, straw bales, and temporary seeding serves to minimize erosion. Once construction is completed, landscaping of exposed areas stabilizes soil and serves an aesthetic purpose as well. The *Storm Water Management Manual for the Puget Sound Basin* (Ecology, 1992) contains several recommendations concerning erosion control.

5.3 HYDROLOGY AND WATER QUALITY

5.3.1 Methods of Analysis

Methods used for the analysis of this section were based upon the results of previous studies, the project description, and discussions with Pierce County and the State. Previous studies were used to determine runoff characteristics, the infiltration capacity of the soils, and other features of the area that would have an effect on hydrology and water quality. Tenaska was consulted to determine how the construction and operation of the proposed project would impact hydrology and water quality. Pierce County and the Washington DOE were consulted to address the regulatory guidelines and policies affecting hydrology and water quality. References used for this section are shown in Section 9.0.

5.3.2 Impacts and Mitigation Measures

Impact HY1 The proposed project could alter rates of storm water runoff and infiltration into the groundwater system.

Impacts

Soils at the proposed Tenaska Washington II project site are very permeable. At present, much of the rainfall falling on the site is intercepted by vegetation and evapotranspires or percolates into the soil. Runoff occurs only during the heaviest precipitation. Development of the Tenaska Washington II project site would have a negligible effect on the rates of storm water runoff and infiltration. Vegetation would be cleared from a portion of the site and replaced with approximately 1.2 hectares (3 acres) of impervious surfaces, such as building roofs and concrete and asphalt paving. Neither the substation modifications nor any transmission towers would substantially add to the area of impermeable surface.

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Tenaska filed a Notice of Intent for coverage under Storm Water Baseline General Permit with Washington DOE on August 2, 1993. Washington DOE determined that operation of the facility will not require National Pollution Discharge Elimination System (NPDES) storm water permitting. An NPDES permit will be obtained for construction. A preliminary storm water pollution prevention plan has been developed by Tenaska.

However, management plans to reduce runoff from pollutant sources will be addressed in the storm water management plan for the proposed facility, which would be submitted to Pierce County for approval. The plan would be reviewed under Pierce County's Aquifer Recharge Area Ordinance and the Site Development Ordinance. The Aquifer Recharge Area Ordinance pertains to protection of the Clover-Chambers Creek Aquifer. The storm water management plan would be consistent with the Washington DOE's Puget Sound Water Quality Management Program (PSWQMP) guidelines for best management practices (1991).

Precipitation falling on impervious and semi-impervious surfaces would be collected and routed to a retention-infiltration system. The drainage system would consist of two parts: a building roof drain infiltration system, and a bioswale and retention-infiltration pond for the remainder of the site. The fuel storage area will be lined with impervious material. Precipitation from the fuel storage area will be checked for oil content and either routed to the oil-water separator, if necessary, or to the bioswale and infiltration pond for disposal. The two components of the system would be designed to avoid runoff from the site except during an event larger than the 100-year return frequency storm. The net effect of development of the site would be negligible alterations in infiltration and runoff rates. As is the case at present, virtually all precipitation falling on the site would evaporate or percolate into the subsurface.

Mitigation Measures

No mitigation measures are suggested beyond those already built into the project.

Impact HY2 Operation of the proposed project could increase the discharge of water pollutants.

Impacts

Plant operations would generate a variety of wastewaters including process wastewater, cooling water blowdown, sanitary wastewater and potentially-polluted storm water runoff. The wastewater management system at the plant would be designed to route all polluted waste streams to the sanitary sewer. Unpolluted storm water runoff would be routed to an infiltration system.

Polluted and potentially-polluted waste streams from plant operations would be routed to a wastewater sump. Water from the wastewater sump would be combined with cooling tower blowdown and discharged to the Pierce County sanitary sewer. Sanitary wastes would be discharged directly to the Pierce County sanitary sewer. Approximately 380,000 liters/day (100,000 gallons/day) would be discharged from the proposed project to the Pierce County sewer system. The wastewater stream would be lightly polluted because most of it would be cooling tower blowdown. Cooling tower blowdown would contain salts and possibly traces of chemicals used to control algal growth in the towers. The discharged wastewater would meet all of the volume and effluent quality requirements of the Pierce County Utilities Sanitary Sewer System and would not affect Pierce County's ability to meet its own discharge limits. Additional wastewater treatment or volume reduction is not needed.

Process equipment and floor drains within buildings would be routed directly to the wastewater sump. Exterior process equipment areas, and other exterior areas that could be potentially subject to oil spills, would be paved and surrounded by a curb to contain spills or storm water runoff. Drainage from the curbed area would be routed to an oily water sump and then to an oil-water separator. After oil is removed, the remaining wastewater would be routed to the wastewater sump. Interior and exterior areas, potentially subject to chemical contamination would also be paved and curbed. Any drainage or spillage from these areas would be routed to a chemical waste sump. The contents of the chemical waste sump would be pumped to a neutralization tank where it would be blended with wastewater from the demineralizer. Neutralized chemical wastewater would be routed to the wastewater sump.

Storm water runoff from portions of the site with very little or no potential for oil or chemical spills would be collected and routed to groundwater infiltration systems. Less than 10 percent of the storm water runoff at the site would be routed to the sanitary sewer system as described above. Roof drains would be connected to several separate infiltration systems. Unpolluted storm water runoff from the rest of the site would first be directed to a bioswale, and then to a retention and infiltration pond. Retained storm water would either percolate into the ground through the bottom of the pond or evaporate. The infiltration capacity of the pond would be increased by the installation of a perforated pipe in the subsoils under the pond.

The Tacoma-Pierce County Health Department requires submittal of a hydrogeological assessment to determine the potential impact to groundwater resources (see Section 4.3.1). A copy of the hydrogeological assessment has been submitted by the project developer to Tacoma-Pierce County Health Department for review and approval. Any additional mitigation measures above those identified in the assessment will be incorporated into the project to comply with the requirements as determined by Tacoma-Pierce County Health Department. See Section 5.11.2, "Impact EU1", for further discussion of water supply.

Drainage from the diked area surrounding the fuel oil tank would be handled separately. The diked area would be equipped with an impervious liner. Drainage from within the diked area would be conveyed to a sump equipped with a valve. The valve would normally be kept in the closed position and any drainage would accumulate in the sump. Periodically the contents of the sump would be sampled. If oil is present the accumulated liquid would be directed to the oil-water separator. After oil is removed the remaining water would be conveyed to the wastewater sump and hence to the sanitary sewer. If the drainage in the sump is free of oil it would be drained to the bioswale and infiltration system.

As previously stated, the storm water management plan for the proposed facility would be submitted to Pierce County for approval, and would be consistent with the Washington DOE's PSWQMP guidelines for best management practices (1991).

Mitigation Measures

No mitigation measures are suggested beyond those built into the project.

Impact HY3 Construction of the proposed project could increase the discharge of water pollutants.

Impacts

Water quality impacts would be the greatest during the initial construction phase due to excavation, grading, and movement of construction vehicles on unpaved surfaces. During construction, an additional 2 hectares (5 acres) that the project will ultimately occupy would be required for construction activities. Increased erosion from unprotected soil has the potential to increase the amount of sediment carried by storm water runoff. This sediment can carry contaminants from construction equipment into the groundwater system, which would be rapidly transported through the permeable soils without proper preventative measures described below.

Mitigation Measures

HY3-1	Storm water runoff could be controlled in a manner which would limit erosion, such as by use of hay bales, sandbags, or other temporary sediment fences. Equipment and machinery used during construction could be kept covered with a waterproof tarp to prevent contamination from rainfall runoff.
HY3-2	Construction practices could be timed so that the initial phases occur during periods of little rainfall (i.e., summer).

- HY3-3 Tarps or other protection could be placed over equipment when not in use, and construction supplies could be kept in a covered area.
- HY3-4 Fuel and oil used during construction could be stored in tanks that are mounted above ground over impermeable surfaces.

The TPU Water Division will request that the Tacoma-Pierce County Health Department impose, under authority of Pierce County Code Chapter 21.16 (Aquifer Recharge Areas), monitoring requirements and other appropriate mitigation measures necessary to protect groundwater quality. A copy of the hydrogeological assessment has been submitted to Pierce County Health Department for review and approval. Any additional mitigation measures above those identified in the assessment will be incorporated into the project to comply with their requirements.

5.4 AIR QUALITY

5.4.1 Methods of Analysis

Project-related air emissions were examined with reference to State and Federal emission limits. In Washington State, implementation of the Federal Clean Air Act has been delegated to the Washington DOE. In the project area, responsibility for implementation has been delegated to the PSAPCA.

The Tenaska Washington II project would have to operate in accordance with permit conditions established by the PSAPCA. A permit application was filed by Tenaska in December 1992 ("Notice to Construct, Application Tenaska Washington II Generation Project, Frederickson, Washington," Tenaska Washington Partners II, L.P., 1992). The application was reviewed by PSAPCA and submitted for agency and public comment on August 11, 1993. No comments were received by PSAPCA (Jay Willenburg, PSAPCA, pers. comm., September 15, 1993). The supporting technical analyses performed for the permit application are the basis for much of the discussion in this section of the EIS. Excerpts from the Notice to Construct Application can be found in Appendix G.

The PSAPCA, as part of its New Source Review procedures, has established threshold criteria that define numerically what the agency considers to be a significant impact. The threshold criteria and other pertinent regulatory requirements are discussed in Section 4.4.3. The following paragraphs discuss whether or not the proposed project would meet these numerical threshold criteria and other applicable air quality standards. The EPA-approved ISCST2 dispersion model was used to compare ambient air pollutant concentrations which would result from the proposed project with applicable standards and threshold criteria.

To assess the potential for cumulative impacts, proposed new sources (i.e., not part of the baseline) in the region were reviewed with PSAPCA and Washington DOE; none have been permitted within the project's significant impact area. Unless permitted, proposed sources cannot be included as "real" in cumulative impacts. Because there are no other projects competing for this airshed, significant cumulative impacts are not anticipated with this project. Existing sources, such as the "peaker" power plant nearby, are already included in the baseline that was used to assess project impacts. Thus, including the peaker in cumulative impacts would be to double-count its impacts.

5.4.2 Impacts and Mitigation Measures

Impact AQ1 Operation of the Tenaska Washington II power plant could adversely affect air quality.

Impacts

Emissions from the proposed project. There would be two sources of air contaminant emissions at the power plant: the exhaust from the combined cycle gas turbine, and the oil storage tank. Emissions from the turbine exhaust stack would be minimized by the use of control systems: a selective catalytic reduction system to reduce NO_x in the exhaust gases, and an oxidation catalyst to lower CO and VOC emissions. The temperature of gases emitted from the air emission stack range from about 93°C (200°F) to 132°C (270°F). The gaseous emissions would not be visible. The oil storage tank would be painted white to minimize heating by the sun and consequent evaporative emissions. Evaporative emissions of VOC from the oil tank, at approximately 23 kilograms per year (50 pounds per year), would be very small relative to the turbine stack. (See Appendix G, Supporting Data for Emission Calculations, page 1. Also see revised emissions data for particulate matter in Tenaska's December 3, 1993, letter to PSAPCA in Appendix G.)

The character of the emissions from the turbine stack would depend on the type of fuel being burned. Specific contaminant emissions would include NO_x, CO, SO₂, VOC and particulates. Emissions of all contaminants would be greater when oil is the fuel. The estimated maximum hourly emissions are shown in Table 5.4-1. They are based on the manufacturer's guaranteed emission levels which are, in turn, based on source tests at similar facilities. (See Appendix G, Emission Calculations, Attachments 3 and 4.) Estimated annual average emission rates are shown in Table 5.4-2. It is assumed that the plant would operate for 97.3 percent of the time. Tables 5.4-1 and 5.4-2 reflect the emission limits currently stated in the air permit for the project issued by PSAPCA.

TABLE 5.4-1
ESTIMATED MAXIMUM POTENTIAL HOURLY EMISSIONS FROM
TENASKA WASHINGTON II PROJECT

Pollutant	Maximum Hourly Emission Rate Kg/hr (lbs/hr)	
	No. 2 Oil Firing	Natural Gas Firing
NO _x	29.7 (65.5)	10.8 (23.8)
SO ₂	42.0 (92.5)	5.4 (12.0)
CO	10.4 (23.0)	10.3 (22.8)
VOC	7.0 (15.4)	5.3 (11.7)
Particulates	37.5 (82.6)	8.34 (18.4)
PM ₁₀	37.5 (82.6)	8.07 (17.8)

Note: Maximum hourly emission rates for NO_x and SO₂ will occur at low ambient temperature. NO_x and SO₂ emission rates are based on -6 C° (20°F) ambient temperature and 300 MMBtu/hr duct firing. Maximum hourly emission rates for CO, VOC, particulates, and PM₁₀ will occur during warm summer days 26 C° (80°F) ambient temperature and 430 MMBtu/hr duct firing. Peak emission rates occur when firing No. 2 fuel oil, which will be limited to 120 hours per year.

TABLE 5.4-2
ESTIMATED ANNUAL AVERAGE EMISSION FROM
TENASKA WASHINGTON II PROJECT

Pollutant	Annual Avg. Emission Rates metric tons/year (tons/year)
NO _x	89.7 (98.9)
SO ₂	49.3 (54.3)
CO	82.7 (91.2)
VOC	33.5 (36.9)
Particulates	90.9 (82.4)
PM ₁₀	88.1 (79.9)

Note: The estimated annual average emissions are based on 120 hours operation on No. 2 fuel oil at -6 C° (20°F) ambient temperature and 8,400 hours operation on natural gas at 10 C° (50°F) ambient temperature. Both cases include 300 MMBtu/hr duct firing on natural gas, which is the maximum annual average duct firing rate. The 120 hours operation on No. 2 fuel at -6 C° (20°F) ambient temperature represents the worst-case emission condition; the 8,400 hours operation on natural gas at 10 C° (50°F) ambient temperature represents average case emission conditions near average annual ambient temperature. Total gas turbine use is limited to 8,520 hours per year, or a 97.3 percent annual utilization factor. The estimated annual average emission rate is equivalent to the maximum potential emissions, because the power plant will be limited by permit to 8,520 hours per year.

Tenaska indicates that the plant would function on a full-time basis but would be shut down for servicing for slightly less than 240 hours per year or just less than 3 percent of the total hours in a year.

It is also assumed, in the emission calculations, that the Tenaska Washington II power plant would burn natural gas for all but 120 hours each year when fuel oil could be used (the annual limit for fuel oil use). In fact, the plant would always burn natural gas unless gas supplies become unavailable. If the gas supply pipeline becomes inoperable, then the plant would switch to its back-up supply, fuel oil. Tenaska's permit from PSAPCA will designate the amount of time fuel oil can be burned. Tenaska operates several plants in Texas similar to the Tenaska Washington II project. To date, these plants have never needed to operate on their back-up fuel.

Vehicular/equipment engine exhaust emissions will be minor and temporary during construction. Air quality impacts will be temporary during construction. The project will not generate significant vehicle trips compared to the existing traffic levels in the area. Vehicular and equipment exhaust emissions during project operations will, thus, have a minor incremental/cumulative impact locally and regionally.

Compliance with emission standards for stationary gas turbines. Stationary gas turbines are subject to certain Federal emission standards for NO_x and SO_2 . The standards are referred to as NSPS and would apply to the Tenaska Washington II project. The type of turbine planned for the Tenaska Washington II project would emit less than 10 percent of the NO_x allowable under NSPS. (See Appendix G, Emission Calculations.) The SO_2 standard is expressed as a maximum sulphur content in the fuel to the turbine of 0.8 percent by weight. The sulphur content of No. 2 fuel oil is expected to be 0.05 percent by weight. The sulphur content of natural gas would be even less. It is unlikely that such low emission levels of NO_x and SO_2 would impact human health. Thus, the Tenaska Washington II project would comply fully with the NSPS. The emission controls proposed for the power generation facility meet or exceed current BACT. The high-efficiency selective catalytic reduction unit proposed to control nitrogen oxide emissions to 3 ppm is more efficient than devices recently determined to be BACT for similar sources in Washington and it achieves control levels specified in very stringent LAER (lowest achievable emission rate) determinations in other states. Furthermore, the oxidation catalyst proposed to control CO emissions will also reduce VOC emissions. It satisfies BACT requirements, as determined by PSAPCA.

Compliance with ambient standards. As noted earlier, the project area is not in compliance with ambient standards for CO and ozone. The Tenaska Washington II power plant's air pollution control consultant has compared the proposed plant's expected emission levels of CO and VOC and their expected impacts with the PSAPCA's significant impact threshold

criteria for nonattainment areas for these contaminants. The results of the comparison are shown in Table 5.4-3.

TABLE 5.4-3
ESTIMATED MAXIMUM POTENTIAL EMISSIONS AND IMPACTS
ON NONATTAINMENT POLLUTANTS
TENASKA WASHINGTON II PROJECT

Pollutant	Averaging Time	Emissions metric tons/yr (tons/yr)	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)	PSAPCA Significant Emissions Thresholds metric tons/yr (tons/yr)	PSAPCA Significant Impact Thresholds ($\mu\text{g}/\text{m}^3$)
CO	Annual	82.7 (91.2)		90.7 (100)	
	8-hr		3.0		500
	1-hr		15.0		2000
VOC	--	33.6 (37.0)	--	36.3 (40)	--

Notes: CO and ozone are non-attainment pollutants. VOC is considered for ozone non-attainment. Significant impact thresholds were established by the Puget Sound Air Pollution Control Agency as part of their New Source Review process pursuant to the Clean Air Act. PSAPCA has formally recognized NO_x as an ozone precursor in its recently revised air regulations and attainment plans for this marginal non-attainment area for ozone. NO_x is not included in this table because PSAPCA has confirmed the project as a "minor" source of NO_x in its proposed permit for the project.

For CO emissions, the threshold emission criterion for new sources in nonattainment areas is 90.7 metric tons per year (100 tons per year). The Tenaska Washington II project would emit 82.7 metric tons per year (91.2 tons per year) of CO. The threshold emission criterion for ozone is expressed in terms of VOC rather than as ozone itself. VOCs, unburned hydrocarbons (excluding methane and ethane) in automobile exhaust for example, contribute to a complex chain reaction in the atmosphere that increases ozone concentrations. The threshold emission criterion for VOC is 36.3 metric tons per year (40 tons per year). Estimated emissions from the Tenaska Washington II project would be 33.6 metric tons per year (37 tons per year). In addition, CO and VOC emissions from the Tenaska Washington II project would not be expected to adversely affect human health.

The region is not in attainment of the 8-hour ambient standard (10 micrograms per cubic meter [$\mu\text{g}/\text{m}^3$]) for CO. The project's maximum CO impact under worst-case meteorological conditions has been found to be well below EPA/Washington DOE significant impact thresholds for CO, as reported in Section 5.4.2 (see Table 5.4-3 and Appendix G). PSAPCA's threshold criterion for a significant impact to ambient air quality in a nonattainment area for CO is approximately $500 \mu\text{g}/\text{m}^3$ (0.0002 pounds per cubic foot) during

an 8-hour period and about $2,000 \mu\text{g}/\text{m}^3$ (0.0007 pounds per cubic foot) during a 1-hour period. This threshold criterion applies to ambient air at any point outside the proposed facility where a member of the public could come into contact with air containing contaminants from the power plant. To compare expected impacts with these threshold criteria, Tenaska's consultant used the ISCST2 computerized mathematical model that simulates dispersion of air pollutants. The model was developed and approved by the EPA and is discussed in Appendix G, Part 6. The maximum estimated concentration of CO in an 8-hour period is about $3 \mu\text{g}/\text{m}^3$ (1.1×10^{-6} pounds per cubic foot). The maximum estimated concentration in a 1-hour period is about $15 \mu\text{g}/\text{m}^3$ (5.3×10^{-6} pounds per cubic foot). These estimated concentrations are far below the threshold criterion for significant impacts to ambient air quality as shown in Table 5.4-3.

Sulfuric acid mist emissions of 4 kilograms/hour (9 lbs/hr) have been estimated by the turbine manufacturer while burning fuel oil. For emergency operation purposes, we have included up to 120 hours of back up fuel oil use per year; this equates to approximately .45 metric ton/year (0.5 ton/year) of emissions. This level is well below the EPA/Washington DOE prevention of serious deterioration regulations (PSD) significant emission threshold of 6.35 metric tons/year (7 tons/year). Modeled maximum 24-hour impacts (worst-case dispersion assumed to occur the same time as fuel oil use) equal $0.43 \mu\text{g}/\text{m}^3$, which is well below the Washington ASIL of $3.3 \mu\text{g}/\text{m}^3$ for this compound. Thus emissions and impacts will be insignificant. Furthermore, this predicted amount of sulfuric acid mist emissions is not anticipated to contribute significantly to acid rain in the project region. No existing or proposed nearby sources are known to significantly contribute to local impacts for this pollutant; thus, cumulative impacts are also expected to be insignificant.

The Tenaska Washington II project would be below the PSAPCA's significant impact threshold criteria for both emissions and ambient air quality. Thus, the proposed project would not cause or significantly contribute to existing nonattainment problems in the area and would not impair the area's ability to come into compliance with ambient air quality standards at some time in the future. No additional emission reduction equipment or offsets would be necessary.

The Tenaska Washington II power plant was also modeled for the effects of the project on ambient levels of NO_2 , particulates, PM_{10} and SO_2 . The project area is currently in compliance with air quality standards for these contaminants. Particulate concentrations are measured as TSP and PM_{10} . PM_{10} are particulates with a diameter of less than 10 microns. The results are shown in Table 5.4-4. In all cases predicted concentrations are below the Washington State and Federal Ambient Air Quality threshold standards and would not be expected to have adverse effects on human health.

TABLE 5.4-4
ESTIMATED MAXIMUM IMPACT FOR ATTAINMENT POLLUTANTS
TENASKA WASHINGTON II PROJECT

Pollutant	Averaging Time	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)	PSAPCA Significant Impact Thresholds ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	0.0	1
TSP	24-hr, highest	2.1	5
	24-hr, highest, second high	1.0	--
	Annual	0.0	1
PM ₁₀	24-hr, highest	2.1	5
	24-hr, highest, second high	1.0	--
	Annual	0.0	1
SO ₂	1-hr	58.5	--
	3-hr, highest	20.3	25
	3-hr, highest, second high	13.0	--
	24-hr, highest	4.4	5
	24-hr, highest, second high	2.0	--
	Annual	0.0	1

Notes: Maximum emissions used in the impact estimates are based on: continuous fuel oil firing for 1-, 3-, 8-, and 24-hour periods; weighted annual average fuel oil and gas use for annual emissions (oil = 120 hours; gas = 8,400 hours).

Significant impact thresholds were established by the Puget Sound Air Pollution Control Agency as part of their New Source Review process pursuant to the Federal Clean Air Act as amended.

Another set of state and Federal regulations apply to areas that already meet the Federal ambient air quality standards. These regulations are designed to prevent unacceptable degradation in areas that have good or excellent air quality. The regulations are referred to as the prevention of significant deterioration (PSD) regulations, and apply to projects that will emit or have the potential to emit more than 90.7 metric tons per year (100 tons per year) of any air pollutant. As a result of emission controls and fuel use limitations in the PSAPCA permit, the project's emissions will not exceed the 90.7 metric tons per year (100 tons per year) for any PSD pollutant. Thus, the project will be a "synthetic minor" source and PSD permitting will not be required for the Tenaska Washington II project. However, because the project would be located near an area that is sensitive to air quality changes, Mount Rainier National Park, Tenaska has conducted the analyses similar to those required under the PSD regulations. The results are shown in Table 7-4, Appendix G. The proposed project would not cause changes in ambient air quality any greater than that allowed under the PSD

regulations. Also see Tenaska's December 3, 1993, letter to PSAPCA (Table 4) in Appendix G.

Compliance with standards for air toxics. Based on the chemical characteristics of the natural gas that would be burned at the proposed power plant, the emissions of substances listed as toxic air pollutants can be estimated. Estimated toxic air pollutant emissions are shown in Table 5.4-5. The ISCST2 air pollutant dispersion model was used to estimate ambient air quality concentrations of toxic air pollutants. Table 5.4-6 compares estimated concentrations resulting from operation of the proposed power plant with the applicable standards. In all cases the concentrations resulting from power plant operation are far below the standards. Similar estimates were made for the condition when the power plant would use oil as fuel. Again, the concentrations resulting from power plant operations would be below the applicable standards (Appendix G, Part 7). With either fuel, the air toxic emissions would not have an adverse impact on human health.

The proposed plant would also emit some ammonia from the stripping equipment used to control air pollutant emissions. Ambient ammonia concentrations resulting from power plant operations were modeled using the ISCST2 dispersion model and would be below applicable standards as shown in Table 5.4-6. The modeled maximum one-hour impact is 0.03 ppm ($19 \mu\text{g}/\text{m}^3$), which is well below the odor threshold. Because the ammonia concentrations would not be detectable as an odor, would fall below Washington DOE's ASIL for individual projects, and because there are no known significant sources of ammonia emissions nearby, cumulative impacts are expected to be insignificant.

Mitigation Measures

No mitigation measures are suggested beyond those already built into the project.

Impact AQ2 Construction of the Tenaska Washington II power plant could adversely affect air quality.

Impacts

Air pollutants would be emitted from the exhaust systems of construction vehicles and equipment and from vehicles used by construction workers to commute to the site. The amount of pollutants emitted in this way would be small compared to total vehicular emissions in the Tacoma area. It is not expected that construction-related emissions would result in any violation of air quality standards.

TABLE 5.4-5
ESTIMATED EMISSIONS OF TOXIC AIR POLLUTANTS
NATURAL GAS FIRING OF TENASKA WASHINGTON II PROJECT

TAP	Estimated Emissions Kg/hr (lb/hr)
Isomers of Hexane	0.011 (0.025)
N-Butane	0.570 (1.257)
N-Pentane	0.074 (0.163)
Hexane	0.011 (0.025)
Heptane	0.011 (0.025)
Octane	0.011 (0.025)
Nonane	0.006 (0.013)
Cyclopentane	0.011 (0.025)
Cyclohexane	0.006 (0.013)
Methycyclohexane	0.011 (0.025)
Formaldehyde	0.462 (1.018)
Acetaldehyde	0.017 (0.038)
Isomers of Xylene	0.011 (0.025)
Benzene	0.063 (0.138)
Toluene	0.023 (0.050)
Ethylbenzene	0.006 (0.013)
O-Xylene	0.006 (0.013)
M-Xylene	0.006 (0.013)
1,3,5-Trimethylbenzene	0.011 (0.025)
1,2,4-Trimethylbenzene	0.006 (0.013)
1,2,3-Trimethylbenzene	0.006 (0.013)
Ammonia	13.6 (30.0)

Note: Non-methane/non-ethane compounds contained in total project VOC emission estimate.

TABLE 5.4-6
PREDICTED MAXIMUM AIR TOXIC IMPACTS FROM NATURAL GAS FIRING
OF TENASKA WASHINGTON II PROJECT

Toxic Air Pollutant	Type ^a	Toxic Impacts ($\mu\text{g}/\text{m}^3$)	WA DOE	Exceedance (Yes/No)
			ASIL ($\mu\text{g}/\text{m}^3$)	
Isomers of Hexane	B	0.00120	5994	N
N-Butane	B	0.05978	6327	N
N-Pentane	B	0.00777	5994	N
Hexane	B	0.00120	599.4	N
Heptane	B	0.00120	5328	N
Octane	B	0.00120	4825.5	N
Nonane	B	0.00060	3496.5	N
Cyclopentane	B	0.00120	5727.6	N
Cyclohexane	B	0.00060	3496.5	N
Methycyclohexane	B	0.00120	5328	N
Formaldehyde	A	0.00101	0.077	N
Acetaldehyde	A	0.00004	0.45	N
Isomers of Xylene	B	0.00120	1448.5	N
Benzene	A	0.00014	0.12	N
Toluene	B	0.00239	1248.8	N
Ethylbenzene	B	0.00060	1448.6	N
O-Xylene	B	0.00060	1448.6	N
M-Xylene	B	0.00060	1448.6	N
1,3,5-	B	0.00120	416.3	N
Trimethylbenzene	B	0.00060	416.3	N
1,2,4-	B	0.00060	416.3	N
Trimethylbenzene	B	1.41	59.9	N
1,2,3-				
Trimethylbenzene				
Ammonia ^b			59.9	N

- ^a Type A carcinogen, annual average
Type B non-carcinogen, 24-hour average
Type D Federal CAA listing, but not in WAC 173-460

^b Ammonia slippage results from the use of emission control equipment rather than combustion.

Particulate matter (dust) would be generated by grading, excavation and the movement of construction vehicles. It is not possible to accurately estimate the particulate concentration that might occur at the Tenaska Washington II power plant site because it is dependent on meteorological conditions and soil moisture. Measurements made during construction of apartments and shopping centers in the southwestern United States indicate that approximately 1 metric ton (1.2 tons) of dust are emitted per 0.4 hectare (per acre) per month of

construction activity (U.S. Environmental Protection Agency, 1985). The higher humidity experienced in the Tacoma area would likely reduce dust emissions at the project site below the levels measured in the Southwest. Nevertheless, Federal and state ambient standards for particulates could be exceeded under some circumstances.

Mitigation Measures

The following mitigation measures would reduce the impacts of construction on air quality:

- AQ2-1 The construction contractor could water all exposed soil surfaces twice each day during dry weather. Frequency of watering could be increased on days when wind speed exceeds 24 kilometers per hour (15 miles per hour).
- AQ2-2 Stored construction materials that could be a source of dust could be covered.
- AQ2-3 Vehicle and equipment engines could be turned off when not in direct use to reduce exhaust emissions.
- AQ2-4 Vehicle speeds in the construction area could be limited to minimize dust in the area.
- AQ2-5 Truck beds could be covered when they are transporting dirt/soil.

Impact AQ3 Project construction and operation could contribute to carbon dioxide (CO₂) emissions.

Impacts

As a combustion process, the proposed project would emit CO₂ during both the construction and production phases. As noted in Section 4.4.4, some scientists believe that increased atmospheric CO₂ is leading to a global warming effect. If, in fact, this hypothesis is correct, then the project would contribute to CO₂ emissions and to global warming.

Mitigation Measures

- AQ3-1 Sequestration of carbon is a mitigation measure.

Currently, there are no regulations restricting CO₂ emissions from any type of source. Tenaska, however, has implemented a voluntary program and has committed funds towards effective carbon sequestration projects in an effort to help offset CO₂. Actions being considered by Tenaska take the form of "control offsets" where one action offsets the

contribution of another action. Among the many strategies being researched for possible use for carbon offsets are biotic measures, which encompass such approaches as slowing or suspending the loss of existing forests (forest preservation), creation of new biomass storage (afforestation, reforestation, plantations), and increasing carbon stored in nonliving reservoirs (enhanced soil fertility).

Tenaska has retained the services of a leading authority on carbon mitigation and offset strategies to assist them in developing and analyzing viable options. Tenaska believes that some type of carbon forestry program makes the most sense, and is currently evaluating some promising proposed projects. Depending upon the projects selected, Tenaska estimates it could sequester 15 percent to 30 percent of the carbon emitted by the proposed Tenaska Washington II project through various sequestration projects.

5.5 BIOLOGICAL RESOURCES

The following section describes potential impacts to vegetation, wetland, wildlife and rare, threatened, endangered, and sensitive species from proposed project construction. Potential mitigation measures have been examined to minimize or eliminate these impacts.

5.5.1 Methods of Analysis

The impact assessment focuses on loss, degradation, or modification of vegetation, wetlands, wildlife, and rare, threatened, endangered, or sensitive species. Impacts are characterized as either direct or indirect. Direct impacts include habitat removal or destruction of individual plants and animals from construction or operation of the proposed project. Indirect impacts are induced by the proposed project. Effects can be removed in time or distance from the impact source. An example of a direct impact is loss of tree stands to construction; an indirect impact would be increased development of affiliated industry surrounding the project, causing additional habitat loss to wildlife. Impacts can also be considered either temporary (short-term) or permanent (long-term). Direct, short-term impacts could occur as a result of temporary disturbance of sensitive wildlife species during construction, such as from noise, dust or traffic. Direct, permanent impacts would include permanent loss of plant or wildlife habitats in previously undeveloped areas.

Direct impacts from grading for the proposed project would include the elimination of existing vegetation, and loss of wildlife unable to displace successfully to another location. Indirect impacts from project construction typically extend beyond the project study area, as most wildlife at the site use an area of habitat larger than the project site vicinity. Hence, indirect impacts for wildlife are considered in a somewhat larger area depending on the species of concern.

5.5.2 Impacts and Mitigation Measures

The following discussion addresses impacts on vegetation, wildlife, and sensitive species. Because wetlands do not exist at the site, the proposed project would not impact this sensitive habitat.

Impact BR1 The proposed project could alter vegetation at the approximately 6.4-hectare (16-acre) site.

Impacts

The footprint of the proposed power plant is positioned so that impacts are confined primarily to the western half of the site. However, portions of the eastern half, particularly the northeastern corner, would be utilized for staging areas, construction worker parking and heavy machinery storage and maneuvering and would be affected. Direct, permanent impacts to upland fields, a low value-rated habitat, would occur from project construction in the western half of the site. Direct, temporary impacts would occur to this habitat in the eastern half of the site where the staging area will take place and be discontinued after project construction. Removal of much of this vegetation constitutes a minor impact and no mitigation measures are suggested. This habitat is disturbed and is common in many areas surrounding the project site, within and outside of the project vicinity. Impacts to a population of white-top aster (*Aster curtus*), which exists in the western portion of the site, are addressed under Impact BR3.

Both Douglas-fir and Oregon white oak stands have been classified as having moderate habitat value. A portion of these stands would be removed. Roughly one-half of the trees from each of the oak stands, up to 0.04 hectare (0.1 acre) collectively, and up to 20 percent, 0.2 hectare (0.4 acre), of the Douglas-fir stand would be removed for project construction. In addition, approximately 15 oaks and 20 Douglas-firs scattered throughout the rest of the project site would be removed. Trees removed would include both mature trees and young saplings/seedlings.

Potential direct, temporary and/or permanent impacts could occur to the oak and Douglas-fir stands beyond the boundary designated for power plant construction. These types of impacts may be caused by (1) movement/storage of heavy machinery, and (2) use of these areas for staging areas. Temporary impacts would include damage to trees (e.g., limb/bark removal, hitting/strong blow to the tree, minor soil compaction around roots) which does not necessarily permanently damage the tree and from which some trees can heal. Douglas-fir are, however, very sensitive to soil compaction around their roots and in most cases are likely to die. This would constitute a direct permanent impact. Some of the impacts, although not obvious, may cause permanent damage such as susceptibility to wind throw or disease.

Mitigation Measures

The following mitigation measures are suggested for this project in order to minimize impacts to vegetation:

- BR1-1 Landscaping at the site could mitigate for loss of habitat from construction using exclusively native plants. Seeds/acorns for trees to be planted as compensation and/or landscaping, especially oaks, could be collected from sources at the site to ensure a greater success rate.
- BR1-2 The number of trees removed during power plant construction could be minimized. Special attention should be given to trees in staging and other construction areas to avoid damaging them including compacting soil around their bases.
- BR1-3 Landscaping practices could mitigate losses by replacing those trees lost by species type along the periphery and interior portions of the site. Smaller specimens could be salvaged from construction areas, stored and replanted as landscaping. A replacement ratio of 3:1 could compensate for the smaller size of the replacement stock and the uncertainty of survival.

These mitigation measures should be coordinated with Visual Resource mitigation measures which also call for landscaping.

In addition to mitigation measures listed above, Tenaska has embarked on a project with the Clover Creek Council, a local citizens group, whose mission is to restore and maintain the Clover Creek watershed. This watershed is currently in a severely degraded condition. Although the Tenaska Washington II project would be located in the Clover Creek watershed, the distance of the proposed site from Clover Creek is approximately 1.6 kilometers (1 mile). Tenaska has participated in a review of the Clover Creek Council's plans for an environmental education program targeted at youth in the Clover Creek watershed area. Tenaska has contributed funds to the Clover Creek Council to help with organizational development and project support.

Impact BR2 Construction of the proposed project could impact wildlife habitat at and surrounding the project site.

Impacts

Construction activities would eliminate some habitat, forcing birds, herpetofauna and mammals currently using the project study area into other areas. There could be some direct,

permanent impacts to less mobile wildlife species. If this should occur, only species which are common in the region would be affected. Losses of these individuals are not expected to substantially alter local populations.

Construction activities would also occur at the substation. However, these activities would not cause impacts to vegetation or wildlife, because this area is already fully developed and disturbed.

Mitigation Measures

The following mitigation measure is suggested to minimize impacts to wildlife anticipated from this project:

BR2-1 Project construction should disturb as little area as possible in order to minimize potential impacts to wildlife.

Impact BR3 The proposed project could possibly impact sensitive species.

Impacts

No state or Federally-listed rare, threatened, or endangered species were observed during surveys. Ten wildlife species judged to be sensitive, but not protected, could occur at the site. None were observed during the field surveys. Of the ten sensitive species identified, five could be potentially impacted by the proposed project: western bluebird, western gray squirrel, mountain quail, Tacoma western pocket gopher and white-top aster. Except for the white-top aster, the probability of occurrence at the site is low.

Removal of vegetation could force western bluebirds, western gray squirrels, mountain quail and the Tacoma western pocket gopher if any are present on the site, into outlying habitats which may already be at capacity. Because of the small areal extent of the site and its only moderate habitat value, this impact, if it should occur, would affect very few individual birds or animals. The likelihood of impacting these sensitive species is expected to be low and minor because loss of any individuals that may inhabit or use the project site is not expected to substantially alter local populations. White-top aster (*Aster curtus*), a state-sensitive species and a Federal Candidate (C2) for listing under the Endangered Species Act, occurs in the western portion of the site as one main population and four subpopulations (Figure 5.5-1). The project as proposed would replace portions of this existing population as shown on Figure 5.5-1.

OFFICIAL USE ONLY

Legend

- ① Oil Storage Area
- ② Tenaska Switch Yard
- ③ Construction Laydown and Parking Area
- ④ Biofiltration Swale and Infiltration Pond
- ⑤ Turbine/Maintenance/Office Building

Approximate extent of an individual white-top aster population

- An individual clump (i.e., clone) of white-top aster

Scale

0 18 36 48 meters

0 75 150 feet

1 cm = 18 meters

1 inch = 150 feet

OFFICIAL USE ONLY

Project # 91C0006K	BONNEVILLE POWER ADMINISTRATION	Location of White-top Aster (<i>Aster curtus</i>) at the Proposed Project Site	Figure 6.5 - 1
WOODWARD-CLYDE CONSULTANTS	Proposed Tenaska Washington II Generation Project		

Mitigation Measures

The following mitigation measures are suggested for this project:

- BR3-1 The Federal- or state-designated status of any species listed in this report or other could change to a protected class between the time of the environmental review and project construction. Potential changes should be monitored.
- BR3-2 The hardiest populations of *Aster curtus* within the construction areas of the generation plant would be transplanted to an undisturbed portion of the site and maintained to exclude invasion species. A botanist would be consulted for the transplanting of the *Aster curtus*.
- BR3-3 Depending on the construction schedule, seeds of the *Aster curtus* would be collected from the existing populations and given to the Washington State Department of Natural Resources or other agency for re-establishing *Aster curtus* populations at a more suitable location.

Impact BR4 Construction of the proposed project transmission interconnection lines, natural gas pipeline stub, water line, and sewer line could impact wildlife habitat and vegetation along a narrow corridor.

Impacts

If overhead transmission interconnection lines are used and transmission structures are installed, vegetation at a number of isolated plots along the transmission line corridor would be removed. If underground transmission interconnection lines are used and a natural gas pipeline is installed, a narrow trench the length of the transmission corridor would be dug. Again, vegetation would be removed, but in this case, it would become reestablished after construction is complete. Both overhead and underground lines would impact a very small area of land, considerably less than about 0.4 hectares (1 acre). No impacts from alteration of the substation are anticipated.

The installation of underground water and sewer lines would be in narrow trenches similar to the installation of the natural gas line. Removed vegetation would become reestablished after construction is complete.

Wildlife habitat which would be impacted by both these options, primarily upland fields, is already disturbed at the site and is common in the project vicinity. If wildlife is present, some individual animals may be forced to relocate. Wildlife species potentially impacted from these activities are common in the region. Any loss of individual animals in the project

study area would be very small and would not be expected to alter local populations substantially.

Mitigation Measures

The following mitigation measures are suggested to minimize disturbance to wildlife and vegetation from project construction:

BR4-1 Avoid removal of all large trees to the extent practicable by routing transmission lines around them.

BR4-2 Minimize trench width and transmission structure base size.

5.6 LAND USE AND COMMUNITY CHARACTER

5.6.1 Methods of Analysis

Land use for the proposed project was examined with reference to existing or planned land uses, or planning regulations or controls adopted by local, state and Federal governing bodies. Consistency of the proposed project with these regulations/controls was reviewed and is described below.

5.6.2 Impacts and Mitigation Measures

Impact LU1 Construction and operation of the Tenaska Washington II power plant could alter land use at the project site.

Impacts

Construction of the power plant and transmission lines (overhead and/or underground) would alter land use at the site from vacant to industrial use. These project components are located in areas zoned for heavy industrial use and consequently they would be consistent with land use designations. The proposed project would also be consistent with all other existing county land use plans and policies. The Frederickson Rezone provides for and encourages intensive industry in areas zoned Heavy Manufacturing, such as the proposed project site.

The facility would directly border two other parcels devoted to heavy industrial uses to the south and southwest. Several other heavy and light industrial facilities are located in the vicinity of the site. No land use conflict or incompatibility with adjacent land uses is expected. Alteration of the substation would include expansion by roughly 0.07 hectare (0.17

acre) and inclusion of substation electrical equipment. No land use conflict or incompatibility with existing land use is expected.

Mitigation Measures

No mitigation measures are suggested.

5.7 HISTORY AND ARCHAEOLOGY

5.7.1 Methods of Analysis

Under the National Historic Preservation Act (NHPA) significant cultural resources are generally those which are 50 years or older, have substantial integrity of form, feeling or association, and meet one or more of the criteria for eligibility to the National Register of Historic Places (NRHP), as set forth in 36 C.F.R. Section 60.4. Impacts to National Register-eligible resources may be significant under NEPA. Criteria for assessment of effects are set forth in 36 C.F.R. Section 800. In addition to these criteria, resources may be significant under SEPA if they are listed or eligible for listing on state or local registers of local places. A detailed discussion of Archaeological survey methods is provided in Appendix F.

5.7.2 Impacts and Mitigation Measures

No archaeologic or historic resources are known to exist in the project study area or in its immediate vicinity.

Impact CR1 Construction of the Tenaska Washington II power plant associated transmission interconnection lines and natural gas pipeline stub, and alteration of the existing substation could disturb previously undetected cultural resources.

Impacts

Project construction would alter the site surface and a portion of the underlying soil. The project would have the potential to uncover, disturb or destroy archaeological resources and/or Native American burials which were not discovered during the field investigation and survey. However, the area is regarded as having only moderate to low archaeological sensitivity on the basis of research and reconnaissance. The potential for undiscovered resources is low.

Mitigation Measures

The following mitigation measure would reduce the impacts to undetected cultural resources.

- CR1-1 If archaeological materials or human burials are uncovered during construction, work in the vicinity would halt until the significance of the find can be evaluated by a qualified archaeologist or, in the case of human burials, until the County Coroner and the appropriate Native American tribe have had an opportunity to make their findings and recommendations for the burials disposition.

5.8 SOCIOECONOMICS AND PUBLIC SERVICES

5.8.1 Methods of Analysis

Methods of analysis for this section were used to determine existing conditions and compare these with anticipated changes from the proposed project. Background conditions were obtained from material provided by the City of Tacoma, Pierce County and the Tacoma-Pierce County Chamber of Commerce. Information on anticipated changes from the proposed project was obtained from Tenaska.

Socioeconomic effects of an action would be judged to be an impact if they resulted in a substantial imbalance between housing demand and supply; if they increased the demand for local services sufficiently to cause a deterioration in existing services; and if they included more than a 1 percent reduction in tax revenue.

Construction of the proposed project would include an 18-month construction period beginning in January 1995, and would involve the employment of about 225 to 250 persons. Commercial operations are scheduled to begin in June 1996, and the facility is expected to employ about 30 persons.

5.8.2 Impacts and Mitigation Measures

Impact SE1 Construction and operation of the proposed power plant could affect population, employment, and demand for housing in the Frederickson/Tacoma area.

Impacts

Population. Construction workforce for the proposed project would number about 225 to 250 workers. It is expected that the majority of construction workers would be from the

Seattle/Tacoma metropolitan area, located between 8 and 48 kilometers (5 and 30 miles) from the proposed site. Workers outside of the nearby area would likely commute from their existing residences rather than relocate to Pierce County during construction. Because relatively few of the construction workers or operation employees are expected to move into the area for employment, impacts on population growth would be negligible.

Operating staff would include a total of about 30 persons working in shifts. The proposed power plant would operate 24-hours per day, 7 days per week. About 14 personnel would be present on site during the day on weekdays. Except for six or seven managerial staff who would likely be transferred from outside the area, the majority of the permanent staff would be expected to be hired from the existing local workforce.

If it is assumed that one-half of the operating staff (15 new permanent employees) moves into the Pierce County area, that one person per household would be employed at the proposed facility, and that an average household size for Pierce County is 2.5 persons per household, then the total increase in population would be 37 or 38 persons. Thus, relative to the population of the county, this would represent a small increase in population.

Housing. Because of the short duration of construction and the expected ability of the local construction workforce to accommodate the needed construction skills, local housing supply would be only minimally affected during power plant construction. Construction workers outside of the Pierce County area would likely commute from their existing residences rather than relocate to Pierce County during construction.

The majority of the employees at the proposed power plant would already reside in the local area. Under a worst-case scenario, even if half the new employees move into the local area, there would be little to no impact on the local housing market. (In 1991 there were 3,373 vacant, single-family housing units and 2,921 vacant, multi-family housing units in the Tacoma/Pierce County area.)

Employment. A temporary increase of approximately 225 to 250 jobs would occur during the time of project construction. Project construction is expected to last for about 1 year. The increased number of construction workers would likely have a small beneficial indirect impact on other service-oriented businesses, but is not expected to have an appreciable indirect effect on employment for the area. About 30 permanent jobs would be associated with the proposed project. The net effect on employment is expected to be positive.

Mitigation Measures

No mitigation measures are suggested.

Impact SE2 Construction and operation of the proposed power plant could increase tax revenues.

Impacts

Tenaska has estimated annual taxes for the proposed project at approximately \$1 million for property taxes, \$7 million for state (6.5 percent) and county (1.0 percent) sales tax, and \$1 million for a state gas use tax, based on normal availability of natural gas consumed. These taxes are based upon an expected 20-year life of the facility, beginning in 1997. The facility may continue operating after 20 years depending on energy production needs and the need for capital improvements at that time.

Mitigation Measures

No mitigation measures are suggested.

Impact SE3 Construction and operation of the proposed power plant could increase the demand for local services.

Impacts

Fire Protection. A 2,270-cubic meter (600,000 gallon) fresh water storage tank would be used to supply water for fire protection, which would be sized to deliver about 126 liters per second (2,000 gallons per minute). The staff at the Tenaska Washington II power plant would be trained to handle small fire emergencies.

Services available from the local fire districts do not include response to hazardous material emergencies; hazardous material response capability would likely be handled by trained personnel at the power plant or from the City of Tacoma Hazardous Material Response Team. Spill Prevention Control and Countermeasure Plan, required for the proposed project, would indicate to the local Fire Districts how to manage an industrial fire (see Public Health and Safety Section 5.9).

Of concern to the Fire District is the storage and transportation of hazardous materials to and from the site. Any changes impacting transportation of materials or increased vehicle traffic would affect Fire District #7 and District #21.

Operations at the facility would be typical of a small, light industry. Emergency planning and trained staff at the proposed facility could deal with a small fire if it was to occur. Major emergencies would be unlikely. Impacts to the fire districts are expected to be minor.

Law Enforcement. It is not expected that there would be a demand for law enforcement at the power plant. Response times to call in the vicinity of the project site vary depending on the location of the squad car, the nature of the call, as well as other factors.

Education/Schools. Because the proposed project is not expected to cause substantial increases to the area population, no adverse effects on schools would be expected.

Libraries. Because the proposed project is not expected to have an impact on population in the area, no adverse effects would be expected.

Mitigation Measures

No mitigation measures are suggested beyond those built into the project.

5.9 PUBLIC HEALTH AND SAFETY

5.9.1 Methods of Analysis

Methods used for analysis include the review of relevant State and Federal guidelines and regulations for public health and safety, internal BPA guidance on impacts from electric and magnetic fields, and discussions with Tenaska describing expected project processes and operations. Much of the information used was developed using the professional experience and best judgment based upon projects of this type.

The term hazardous materials refers to substances which, if released in an uncontrolled manner, can be harmful to people, animals, property, and/or the environment (Planning Guide and Checklist for Hazardous Materials Contingency Plans, Federal Emergency Management Agency, July 1981). Potential impacts from hazardous waste were reviewed to determine if the proposed project involves use or storage of a hazardous substances in a manner that poses a threat to public health or safety. Potential toxic air pollutant emissions for the proposed power plant are discussed in Section 5.4.

5.9.2 Impacts and Mitigation Measures

Impact HS1 Undetected hazardous materials already at the site could be disturbed during construction and released to the environment.

Impacts

There are no known hazardous substances already at the site that could be disturbed during construction, based upon the results of a Phase I Site Assessment performed by ENSR (1993).

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There are no potential impacts to the site from adjacent properties based upon Phase II Site Assessment studies reviewed by ENSR (1993).

Mitigation Measures

No mitigation measures are suggested.

Impact HS2 Hazardous materials used during construction could be spilled and released to the environment.

Impacts

Hazardous materials likely to be used during construction are gasoline, diesel fuel, motor oil, and possibly solvents and paints. Potential water quality impacts include the introduction of oils, grease, and petroleum products resulting from the use and/or improper handling of heavy equipment and construction products on the site. Because of the pervious nature of the soils, these contaminants could be transported into the shallow groundwater system during rainfall.

Another source of potential groundwater contamination and risk to public health could be from underground transmission lines. Lines are dug and placed at least 1 meter (3 feet) below ground surface. These lines are filled with a synthetic insulating liquid commercially marketed as DCL 500, which could potentially leak during operation or be spilled during construction. DCL 500 is not listed as a hazardous substance on either EPA's Hazardous Waste List or Hazardous Substance List or on the Occupational Safety and Health Administration's (OSHA) Occupational Safety and Health Standards List of Cancer Suspect Agents. In addition, the Material Safety Data Sheet (MSDS) does not list any adverse health risks expected under normal conditions/use. DCL 500 is a stable, inert material under normal storage and handling conditions and does not present a high health risk. In addition, DCL 500 has an ignition point of 165° to 185°C (330° to 365°F), which is well above temperatures that will exist during normal operating conditions. Also, DCL 500 is relatively water insoluble (0.1 percent). DCL 500 poses the risk of only minor human irritation, would not constitute a serious threat under normal working conditions and would not require the use of respiratory protective equipment. Because of its non-compressible, relatively viscous state, the threat of DCL 500 entering the groundwater is low. If a leak were to occur, only a limited quantity of fluid would escape before pressure was relieved. The line would be pressure tested when first installed and then continually pressure monitored for potential leakage. The steel pipe containing the fluid is welded completely end-to-end and coated and cathodically protected from corrosion. Thus, potential for leakage and risk to human health is low. (Phil Black, Tenaska, pers. comm., April 22, 1992).

Mitigation Measures

The following mitigation measures are suggested:

- HS2-1 Storm water runoff could be controlled in a manner which would limit erosion, such as the use of hay bales, sandbags, or other temporary sediment fences. Equipment and machinery used during construction could be kept covered with a waterproof tarp to prevent contamination from rainfall runoff.
- HS2-2 Construction could be scheduled by conducting those phases of development which require the greatest amount of earthwork (initial construction phase) to occur during months of low rainfall.
- HS2-3 Fuel tanks could be mounted above ground and over a curbed concrete pad.
- HS2-4 If a spill did occur, contaminants should be contained and removed immediately according to pollution prevention control plans.
- HS2-5 DCL 500 should be handled according to instructions provided in its MSDS; other potential state and local handling practices and regulations for this material should be observed.

Impact HS3 Hazardous substances used or generated during power plant operations could be spilled and released to the environment.

Impacts

Chemicals used at the proposed project would be transported to the site by truck. Storage volumes are determined by rates of consumption, customary delivery volumes available from suppliers, and the reliability of the supply. A summary of the chemicals to be stored and used at the proposed facility is shown in Table 5.9-1.

Chemicals used and stored at the proposed project would be managed in a manner that would contain the material within a bermed area in the event of a spill or failure of a tank. Runoff from the back-up fuel tank storage area is detained prior to discharge into the storm water sump. If contamination from the fuel oil tank does occur, the runoff can be redirected into the oil-water separator for eventual discharge into the sanitary system. If a discharge to the sanitary sewer system were allowed, it would be directed to an enhanced coalescing plate oil/water separator.

TABLE 5.9-1
MAJOR HAZARDOUS SUBSTANCES STORED AT THE PROPOSED POWER PLANT

Substance	Purpose	Maximum Stored Quantity	Characteristics of Containment
Aqueous Ammonia	Air pollution control	45 m ³ (12,000 gallons)	Tank: above grade, welded steel, pressurized. Located outdoors within concrete containment area, sized to contain volume in tank plus 15 cm (6 in) freeboard during the initial period following a total failure of the tank.
Sulphuric acid (93% Concentration)	Water treatment	23 m ³ (6,000 gallons)	Tank: above ground, welded steel. Located indoors, within concrete containment area sized to contain volume in tank plus 15 cm (6 in) freeboard.
Caustic soda (sodium hydroxide) (50% Concentration)	Water treatment	23 m ³ (6,000 gallons)	Tank: above ground, welded steel. Located indoors within concrete containment area sized to contain volume in tank plus 15 cm (6 in) freeboard.
Polymer/organic phosphonate/azole mixture	Water treatment	6 m ³ (1,500 gallons)	Tank: above ground, plastic container. Located indoors within curbed containment area.
Bromine	Water treatment	230 kg (500 lb)	Dry, in pellets, stored in bags. Will be mixed in contained area indoors on an as-needed basis.
No. 2 Fuel oil	Back-up fuel	35,000 barrels	Tank located outside within a dike sized to contain full content of tank plus 30 cm (12 in) freeboard, mounted over impervious lining. Storm water runoff checked for contamination prior to sump discharge.

Leakage or minor spills during loading and unloading are more likely than a complete tank failure. In the unlikely event that a complete tank failure should occur, ammonia or sulphuric acid vapors would be dispersed by wind beyond the boundaries of the proposed power plant. Under certain conditions these fumes could present a threat to the health of neighborhood residents or workers. The level of risk or threat is proportional to a number of factors, including quantity of materials lost, weather conditions (e.g., wind, precipitation, temperature), time of day, and location of leak.

Mitigation Measures

A Spill Prevention Containment and Countermeasure (SPCC) Plan and appropriate training of personnel using procedures outlined in the Federal Resource Conservation and Recovery Act (RCRA) could be instituted.

Many environmental and personnel safety control factors are included in the proposed project design and are outlined in Section 5.14.

Impact HS4 Electrical transmission lines could pose an electric shock hazard.

Impacts

Power lines, as with electrical wiring, can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize the shock hazard, based upon the NESC requirements, which would be followed for this project.

Transmission lines can also induce voltages into objects near the lines. This effect can lead to nuisance shocks if a voltage is induced on something like wire fencing which is on wood posts and, therefore, insulated from ground. Usually this becomes a problem only with lines of voltages above 230-kV. Should problems develop with high- or low-voltage lines, they can be corrected by simple grounding techniques. There is also potential to cut underground cables with trenching equipment which may pose a shock hazard to construction workers.

Mitigation Measures

No mitigation measures are suggested beyond those built into the project.

Impact HS5 Electrical transmission lines could increase the exposure of individuals to electric and magnetic fields.

Impacts

There are no national standards for electric or magnetic fields. Some states have established electric or magnetic field standards; however, the State of Washington has not set a standard for either. BPA has an electric field standard of 9 kilovolts per meter (kV/m) maximum on the right-of-way and 5 kV/m at the edge of the right-of-way. The proposed project's overhead transmission line option would meet this electric field standard. There would be no electrical field produced by the underground transmission line option.

Exposure Assessments. In general, magnetic field exposure assessments are performed by calculating field levels in locations where there are potential long-term exposures to people. This is usually done by assessing the number of homes, schools, or businesses near the proposed project where increases in electric and magnetic field exposures may be created by the proposed project.

A comparative analysis of the potential magnetic field levels between the proposed overhead and underground alternatives has been made. All calculations were based on the rated capacity of the proposed power plant. That is, it was assumed that the power plant would operate as closely as possible to its rated capacity on a daily basis. All magnetic field calculations were made using industry accepted computer modeling techniques. Graphical representations of the magnetic field profiles for the overhead and underground alternatives are shown in Figure 5.9-1.

Overhead Transmission Option. The nearest structure to the proposed location of the new transmission line is an industrial building about 60 meters (200 feet) away. Analysis indicates that the potential magnetic field exposure for the site will average less than 2 mG with a maximum of 4 mG (Refer to Section 4.0, Tables 4.9-2 and 4.9-3 for typical magnetic field exposure levels from common appliances and transmission lines).

Thus, if the overhead option is selected, there will potentially be an increase in magnetic field exposure from the transmission line to those working in the industrial building. This increase would be from a no exposure level (since no line currently exists there) to an exposure of less than 2 mG.

Underground Transmission Option. There would be no substantial electric or magnetic fields produced from the underground transmission option that could affect homes, schools, or businesses near the proposed project.

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BONNEVILLE POWER ADMINISTRATION
Proposed Tenaska Washington II
Generation Project

**Transmission Line Magnetic Field
Profiles at Rated Plant Output**

Source: BPA 1993

**FIGURE
5.9 - 1**

If the underground option is selected, BPA's guidelines of not increasing electric or magnetic exposure to people will be met.

Electric Substation. The electric and magnetic fields from the proposed substation facilities will not increase exposure to the adjacent homes or businesses.

Exposure to Workers. Any electrical generation plant will produce some level of electric and magnetic fields within the plant. It is understood that workers in that plant will be exposed to these fields during the course of performing their job. Presently, there is no way to assess what levels or for what duration exposures might be to those working at the proposed Tenaska Washington II power plant.

Mitigation Measures

No mitigation measures beyond those already considered (i.e., underground option) are suggested for the transmission lines.

Impact HS6 Microwave communications could increase the exposure of individuals to non-ionizing radiation.

Impacts

Communications. Electronic signals to be produced from microwave communications at the substation are low level and limited to specifically assigned government radio frequencies far removed from the radio and TV broadcast frequencies. Broadcast interference across the radio frequency spectrum would not be produced by the equipment installed at this BPA facility.

Exposure to non-ionizing radiation from sources including radio transmitting antennas is an area of increasing public awareness and concern. In an attempt to protect the public and workers, national standards have been and continue to be developed which establish "safe" limits of radiation. There is disagreement within the scientific community regarding the medical basis from which the standards were developed. Until those issues are resolved, the standards are established at conservatively stringent levels. Standards for exposure to the general public are contained in Institute of Electrical and Electronic Engineers (IEEE) C95.1-1991, and in OSHA 29 C.F.R. Section 1910.97 for workers.

Present IEEE standards applying to this site allow a maximum power density of 1.3 milliwatts per square centimeter at 2,000 MHz (microwave transmitters). The OSHA standard limits the maximum power density to 10 milliwatts per square centimeter (all transmitters).

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Expected levels of power density will fall far below the standards, and the expected exposure to the public and workers will be well within the IEEE and OSHA standards. No other standards or regulations apply at this site.

Mitigation Measures

No mitigation measures are required given the low levels of non-ionizing radiation in relation to the accepted standards.

HS6-1 The project would conform to American National Standards Institute (ANSI) and OSHA codes for all workers.

5.10 TRAFFIC AND TRANSPORTATION

5.10.1 Methods of Analysis

Project-generated traffic and transportation were examined with reference to county Level of Service standards for those intersections or roadway sections currently operating at Levels of Service C, D, or E, as defined in Section 4.10.3 and in Table 4.10-1.

5.10.2 Traffic Generated by the Proposed Project

The proposed project would generate traffic during both construction and operation phases. A number of assumptions were used to estimate impacts to existing traffic conditions from the proposed project during construction. These are summarized below and represent a worst-case scenario:

- The construction workforce would peak at 225 to 250 people.
- All construction workers, including those traveling in both trucks and personal vehicles, would arrive to the site between 6:00 to 7:00 am and leave between 3:00 and 4:00 p.m.
- All construction workers would live and travel to/from areas north of the site, specifically Tacoma and Puyallup.
- All workers would choose to follow the same basic route to the site; from Tacoma: south on I-5, east along State Route 512, south on Canyon Road to its terminus with 192nd Street East, and west to an access road to the site; from Puyallup: west along State Route 512, south on Canyon Road to its terminus with 192nd Street East, and west to an access road to the site.
- Public transportation would not be used by construction workers to get to the site.

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- A carpool factor of 1.15 persons per vehicle would apply to construction workers.
- Sixty truck trips per day would occur into and out of the site, 25 of which over the entire construction period would exceed 90 metric tons (100 tons); the remainder would be at or below 45 metric tons (50 tons).
- The permanent workforce at the proposed power plant would number 30 people.

5.10.3 Impacts and Mitigation Measures

Impact T1 Project construction could increase vehicular traffic in the study area.

Impacts

Two types of traffic would be generated from the construction period: truck traffic and construction workers personal vehicles. If it is assumed that 100 percent of this traffic would travel south on Canyon Road and west on 192nd Street East to reach the site during peak-hour times for Canyon Road, the volume of traffic along this route would increase by 13 percent for Canyon Road and 177 percent for 192nd Street East over current levels. Roadway Levels of Service would remain the same for Canyon Road during construction. Canyon Road operates freely most of the time with congestion occurring briefly during commute hours. Construction traffic would flow counter to peak flows and, thus, would not contribute to congestion. Level of service on 192nd Street East would deteriorate from a Level of Service "A" to a Level of Service "B" (as defined in Section 4.10.3 and Table 4.10-1). With construction of the project, Levels of Service are shown in Table 5.10-2. Additionally, because data used for calculating construction traffic assumes a worst-case scenario (i.e., 275 workers, 60 truck trips per day, all traffic at the same time down Canyon Road), traffic impacts would be less than predicted for most of the construction period.

It is expected that a total of roughly 26 truck trips over the entire construction period would exceed 90 metric tons (100 tons): roughly twenty at 100 metric tons (110 tons), three at 145 metric tons (160 tons), one at 172 metric tons (190 tons), and one at 263 metric tons (290 tons). These weights would normally represent several times over the legal limit per axle with a three- or four-axle vehicle. Overweight permits would have to be obtained from Washington Department of Transportation, Pierce County, and other local jurisdictions, depending on the direction from which these units would be delivered. The jurisdictions could require special multiple-axle trucks to carry the units under the permits. Some interruption of traffic could occur where overweight materials are moved.

Construction worker parking would not create competition for on-street parking spaces as parking would be available on-site.

Mitigation Measures

The following mitigation measures are suggested in order to minimize disturbance to existing traffic and transportation conditions:

- T1-1 Construction workers could be encouraged to carpool to site.
- T1-2 Truck trips could be spaced out over entire working day, avoiding peak-hour times.
- T1-3 Use of the railroad for material hauling could be utilized as much as practicable in place of the trucks.
- T1-4 Designated access routes through currently low-use areas should be designed for construction vehicles. Access routes should be consistent with state and county plans/regulations.

Impact T2 Project operation could increase permanent vehicular traffic in the study area.

Impacts

It is estimated that a total of 25 to 30 full-time employees would be required for power plant operation. However, because the proposed power plant would run on a 24-hour schedule, several shifts would be established for power plant operation. Therefore, it is estimated that a total minimum of 18 employees would be at the site during the busiest shift. Assuming all permanent workers would live north of the site and follow the same route taken by construction employees, and assuming each employee drove separately to work, the contribution of vehicles for the proposed project would create an increase of one percent in traffic along Canyon Road. Other streets within the project study would receive less impact because they are outside the anticipated commute corridor. The total number of full-time employees estimated is relatively small and most of the roads in the study area are currently functioning substantially below capacity.

Mitigation Measures

The following mitigation measures are suggested:

- T2-1 Permanent employees could be encouraged to carpool to the site.
- T2-2 Shifts could be scheduled to avoid employees traveling to the site during peak-hour traffic conditions to the extent practical.

5.11 ENERGY AND UTILITIES

5.11.1 Methods of Analysis

Methods used for analysis in this section included discussions with the TPU, the Pierce County Utilities Department, Pierce County Solid Waste Management Department, and review of plans provided by Tenaska. These plans indicated locations, points of connection, and requirements of utility providers.

Project-related utility demands were examined with reference to potential effects on utilities and utility users. Demands for electricity caused by the proposed project in excess of existing and anticipated future needs, or demands that would require relocation of utilities were considered impacts.

5.11.2 Impacts and Mitigation Measures

Impact EU1 Construction and operation of the proposed project would require the use of public utilities.

Impacts

Water Supply. Water requirements for the Tenaska Washington II power plant would be approximately 7 million liters per day (1.9 million gallons per day). The City of Tacoma would provide water supply for the proposed development.

Currently, TPU supplies the Frederickson Industrial Area with approximately 7.5 million liters per day (2 million gallons per day) and has the capability and supply line capacity to supply up to 15 million liters per day (4 million gallons per day). As the Tenaska Washington II project would require approximately 7.5 million liters per day (2 million gallons per day), the capacity of the line would be roughly at maximum with this power plant on line (Linda McCrea, City of Tacoma, pers. comm., March 29, 1993). Water service is not presently provided to the site, but is planned for the potential development of the Tenaska Washington II power plant.

The TPU is conducting a study to determine the adequacy of the existing system and future needs of water supply for the Frederickson area. Preliminary indications are that the existing

supply would be adequate for the expected demands from anticipated industrial development in the Frederickson area for five years past the Tenaska Washington II power plant start-up date. If results of the study indicate that future water supply may be inadequate for anticipated growth in this area, other water resources would be investigated. TPU has indicated that it is willing to continue supplying the needs of Tenaska past the present capacity with the understanding that Tenaska would help fund a new water supply line to the area when and if needed. Additional water supply would be provided with the construction of an additional trunkline from a local reservoir and possibly from local wells. If wells were used in the area, they would be dug at approximately 305 meters (1,000 feet) in depth, far below local wells currently supplying residents in the area and contained within a separate aquifer. No impacts to the shallower aquifer are anticipated from this action. In addition, use of these deeper wells would be primarily limited to periods when water supply from the Green River and local reservoirs was limited for some reason (e.g., rupture in the supply line or drought) (Linda McCrea, City of Tacoma, pers. comm., March 29, 1993). These sources are expected to provide sufficient water for expected development including the proposed project.

Wastewater Disposal. Waste water would be generated from storm water runoff from the process equipment area, demineralizer regeneration water, cooling tower blowdown (discharge from accumulated wastes), and boiler blowdown. The amount generated would depend on the size of the storm. A detention pond has been designed for the project to handle runoff anticipated for a 100-year flood occurrence. The process equipment area and other areas containing potentially hazardous materials will be curbed to contain runoff. These waste waters would be directed to a sump with an oil-water separator. The oils and greases removed would be collected and disposed of by a licensed disposal contractor. All polluted or potentially polluted wastewater from the project would be discharged into the Pierce County sanitary sewer. This would include cooling tower blowdown, process wastewater, sanitary wastewater and storm water runoff from areas that could potentially be contaminated with oil or chemicals. Unpolluted storm water runoff would be routed to an infiltration system where it would percolate into the ground. A more detailed description of the drainage system can be found in Section 5.3.

About 380,000 liters per day (100,000 gallons per day) of process waste water would be discharged into the sanitary system. The sanitary system treats up to 43.5 million liters per day (11.5 million gallons per day) and has sufficient capacity to accommodate flow from the proposed project. (Jim Landen, Chambers Creek Treatment Plant, pers. comm., April 21, 1993).

Solid Waste Disposal. Solid waste generated from the site would mostly consist of packing crates, wastes from maintenance, and wastes from normal employee activities. Solid waste

would likely be collected by LeMay Disposal for disposal at the Land Recovery landfill. Landfill options are currently being investigated by the Solid Waste Management Division of Pierce County. It is expected that the existing solid waste disposal services would be adequate for the proposed project.

Electricity. Electrical power would be required for construction and as a back-up supply during times when the proposed project was not producing power. Although two power supplies are available, the proposed facility will likely use the TPU's 12.5-kV transmission line. Adequate electricity is available for the proposed project. The net effect on power use and production would be positive because the proposed facility is designed to produce far more energy than it consumes.

Natural Gas. The proposed Tenaska Washington II project would operate on natural gas, which would be transported to the proposed power plant by Northwest Pipeline Corporation. A short feeder pipe or stub would be built to connect the facility to Northwest's pipeline approximately 0.8 kilometer (0.5 mile) southeast of the power plant site. Adequate natural gas supplies are expected to be available for the 20-year life of the proposed project.

Mitigation Measures

No mitigation measures are suggested.

5.12 NOISE

5.12.1 Noise Sources

Construction and operation of the proposed facility would add new noise sources to the environment. The primary operational noise at the Tenaska Washington II power plant would be as listed in Table 5.12-1. All noise levels have been adjusted to the level received at a distance of about 30 meters (100 feet), for ease of comparison.

Construction at the site would last approximately 18 months. Noise emissions of construction equipment that may be used at the site are shown in Table 5.12-2.

5.12.2 Noise Receptors

The closest residents are located along 184th Street East and 50th Avenue East, at a distance of about 490 meters (1,600 feet) from the turbine inlet on the north side of the project site.

TABLE 5.12-1
EQUIPMENT NOISE SOURCES DURING POWER PLANT OPERATION
(dBA)

Equipment	Noise Level at 30 m (100 feet)
HRSG stack with silencer	65
HRSG walls	70
Turbine inlet with silencer	67
Turbine within building	65
Cooling tower (at tower inlet)	74
(at end wall)	60
Transformers	79

Other receptors are commercial and industrial facilities located at shorter distances, typically from about 150 to 300 meters (500 to 1,000 feet). The noise limits for these industrial and commercial noise receptors are 10 to 20 dBA higher than the limits for residential areas.

However, some adjacent industrial property lines are less than about 60 meters (200 feet) from noise producing equipment at the Tenaska Washington II power plant site.

5.12.3 Methods of Analysis

Project-related noise was examined with reference to state and county noise limits. In addition, the project noise *increases* are also examined in an assessment of relative noise level changes. Based upon Federal EPA Region 10 guidelines for noise, the impacts of an increase in community noise levels is assessed as shown in Table 5.12-3.

The impact of increases in noise applies to the time period encompassing the typical noise environment of the receiver — for workers, and 8-hour daytime average (L_{eq}), and for residents, a 24-hour day-night average (L_{dn}).

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**TABLE 5.12-2
TYPICAL CONSTRUCTION EQUIPMENT NOISE (dBA)**

Equipment Type	Noise Level at about 15 meters (50 feet)	Usage¹
Earthmoving:		
Front Loaders	79	0.40
Backhoes	85	0.16
Dozers	80	0.40
Tractors	80	0.40
Scrapers	88	0.40
Graders	85	0.08
Trucks	91	0.40
Pavers	89	0.10
Materials Handling:		
Concrete Mixers	85	0.40
Concrete Pumps	82	0.40
Cranes	83	0.16
Derricks	88	0.16
Stationary:		
Pumps	76	1.00
Generators	78	1.00
Compressors	81	1.00
Impact:		
Pile Drivers	101	0.04
Jack Hammers	88	0.10
Rock Drills	98	0.04
Pneumatic Tools	86	0.16
Other:		
Saws	78	0.04
Vibrators	76	0.40

¹ Fraction of the time the equipment is operating at the level shown when it is being used at a construction site.

Source: Taken from "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances." Prepared by Bolt, Beranek, and Newman for the U.S. Environmental Protection Agency, December 31, 1971.

**TABLE 5.12-3
IMPACT OF NOISE INCREASE**

Increase	Impact
0 to 5 dB	Slight
5 to 10 dB	Significant
10 to 15 dB	Serious

5.12.4 Impacts and Mitigation Measures

Impact N1 **Operation of the Tenaska Washington II power plant could increase ambient noise levels.**

Impacts

Noise from equipment and activity at the proposed power plant site would propagate to the surrounding area. The level of noise will diminish as it travels to the receiver primarily due to absorption of noise by the atmosphere and due to the spreading of the noise energy over a larger area. Noise levels were predicted at the property lines bounding the Tenaska Washington II power plant site and at the nearest residence. They are shown in Table 5.12-4.

The allowable noise level at a neighboring industrial property line is 70 dBA. The noise level on a typical urban street is 65 dBA. As indicated in Table 5.12-4, the Tenaska Washington II power plant would result in a maximum noise level at the Tenaska's property line of 66 dBA. Thus the proposed project would comply with noise standards for adjacent industrial property. Noise emitted from alterations to the substation, including new electrical and communication facilities would not appreciably increase the amount of noise generated from the proposed project. (Holeman, BPA, pers. comm., April 23, 1993).

TABLE 5.12-4
PREDICTED NOISE LEVELS (L_{eq})
TENASKA WASHINGTON II POWER PLANT OPERATION
(dBA)

Equipment	Noise Level
Nearest residence	46
West property line	66
South property line	66
North property line	64
East property line	less than 64

The allowable noise level at the nearest residential property is 50 dBA (night time) as specified in Pierce County noise ordinances and state law. The predicted noise level at the nearest residence is 46 dBA assuming wind and temperature conditions that are favorable to the propagation of noise. This value may be raised by a few dBA during strong southwest winds. The standards allow a 5 dBA increase over the limit of 50 dBA for 15 minutes in any hour. Thus the proposed project would comply with noise standards for residential property.

The lowest night-time ambient noise level measured was 44 dBA. If this noise level was prevalent at the nearest residence, the increase in noise level due to the proposed project would be less than 5 dBA. According to EPA criteria, this would be a slight impact.

Mitigation Measures

No mitigation measures beyond those already built into the project are suggested.

Impact N2 Construction of the Tenaska Washington II power plant and substation could temporarily increase ambient noise levels.

Impacts

Noise from construction equipment and activity would propagate to the surrounding area for the duration of construction. As shown in Table 5.12-2, construction equipment noise would be expected to occur for many operating equipment types during the 18-month construction period. Sounds would be noticeable in areas surrounding the property site, including adjacent industries and nearby residences. The sounds would be typical of a new construction activities, and would be intermittent in nature. Intermittent noise from construction of the substation would occur and would be contained within a maximum 15-month period.

Mitigation Measures

The following mitigation measures are suggested in order to reduce noise emanating from the proposed project.

N2-1 Restrict construction operations to the hours of 7:00 a.m. to 6:00 p.m.

N2-2 Ensure proper muffling of combustion engines, including periodic monitoring.

5.13 VISUAL QUALITY

5.13.1 Methods of Analysis

Visual contrast effects would likely be long-term (normally defined as greater than five years) because visual change would last for the life of the proposed project. Quality of the visual environment was based on VQO levels or the synthesis of scenic quality and visual sensitivity. The measure of the adverse response of the visual and aesthetic resources is defined as visual contrast. The degree to which the project adversely affects the aesthetic quality of the landscape depends upon the amount of visual and aesthetic contrast that is created by the project in relation to the existing landscape character. The amount of contrast

between the proposed action and the existing landscape character was assessed by separating the landscape into its major features (landforms, vegetation patterns, and structures), and then predicting the magnitude of change in contrast of each of the basic visual elements (form, line, color, and texture) to each of the features. The ability of the existing landscape to screen out or absorb change was assessed. The existing landscape condition was also factored into the assessment.

Issues identified during scoping included the level of visual contrast, the type and extent of actual physical contrast or aesthetic degradation, and the level of visibility or viewshed disturbance caused by site location, structures and activities proposed for the project. The type of actual physical contrast was examined by evaluating the following criteria: landforms, diversity, soil color and erosion potential, vegetative patterns, and structure compatibility. Several variables were considered in establishing overall visibility levels: view orientation, lighting conditions, seasonal effects, view distance, duration of view, visibility, viewer numbers, and use association. The assessment was based on the effects of visual contrast from identified KOPs which are further described below.

Other criteria used to rate the level of visual change were scale and spatial dominance. The scale of the project modifications were compared to the scale of the entire landscape setting and placement in the viewshed. Spatial dominance was evaluated based upon the complexity of landscape composition, elevations and position of the project to the key observation points, and landscape background of seen structures and facilities. Another scoping issue was a concern of night lighting from various viewer locations.

The selection of key viewing points was based upon the representative or typical condition of the viewers potentially affected by the proposed project. Of the viewpoints initially studied, five were selected as key viewing points, most representative of travellers, residents, or recreationists. The six observation points consisted of two travel routes, two residential locations, and two locations in Mt. Rainier National Park. For residential and travel route KOPs identified in the project area, balloon field studies were conducted. A 1-meter (3-foot) diameter weather balloon was placed at the location of the stack and strung to the approximate stack height. Photographs were taken from each of the viewing locations, with the exception of Mt. Rainier, to record project visibility.

5.13.2 Impacts and Mitigation Measures

Impact VQ1 The proposed power plant could alter visual quality within the Frederickson Industrial Area and its immediate surroundings.

Impacts

Table 5.13-1 provides a summary of visual effects from the proposed project. It would create a long-term low to moderate adverse additive impact to the visual aesthetic resources in the study area. A moderate to strong vertical line and contrast to landforms and low to moderate color, and texture contrast to vegetation patterns would be created by the emission stack and turbine building and other major project facilities including the cooling tower and oil storage tank. The cooling tower would emit a plume with a fog-like appearance containing almost 100 percent water vapor. (Chuck Eliason, Tenaska, pers. comm., March 1993.) If buried, the transmission interconnection cable would create a low short term line and color contrast to soil and vegetation patterns. If above ground, the transmission interconnection line could result in additional impacts.

The project area's landscape character is generally not intact and the surrounding landscape has been previously disturbed. The existing landscape condition contains a number of major and minor disturbances including cleared pipeline, railroad, and transmission line rights of way, a network of access roads, industrial complexes and structures (e.g., gas-fired power plant, electric switching station, and one large sand and gravel pit). These disturbances have disrupted the landscape unity creating some unnatural edges to vegetation patterns, introduced blocky structures to landforms which dominate the landscape and draw visual attention to incongruent patches of color and texture variety. As viewed from the key observation points, the additive increases toward visual change to visual aesthetic resources brought about by the proposed project would be moderate overall.

The view of the project from representative KOP residential locations would result in a moderate, long-term additive impact. The level of existing visual intrusions (e.g., transmission lines, switch yard, industrial structures) causing visual contrast is high. The existing landscape's scrub vegetation would visually absorb a portion of the project. The cluster of coniferous trees (18-24 meters [60-80 feet] tall) located east adjacent to the site would help screen out visibility to taller facilities including the stack. Occasional disruption of the view of Mt. Rainier from the project site may occur during favorable weather conditions due to the cooling tower plume. The visual impacts from the Canyon Road KOP would be low. View duration toward this project site is brief. The sand and gravel pit disturbance and view of Mt. Rainier would draw greater visual attention than views of the project site. The visual impact from the 38th Avenue KOP would be low. The landscape absorption capability is high due primarily to vegetation screening.

**TABLE 5.13-1
VISUAL RESOURCE INVENTORY AND ASSESSMENT**

Key Observation Point	View Direction ¹	View Distance (miles)	Visual Sensitivity Level ²	Existing Landscape Condition ³	Project Visibility ⁴			Visual Impact ²	Comments
					Generation Plant	Emission Stack	Cooling Tower Plume		
Residences near 180th Street and 40th Avenue	SE	0.64	M-H	MAJ	M	M	M-H	M	Emission stack will not skyline the landscape.
Residences near 184th Street and 50th Avenue	SW	0.24	M-H	MAJ	M	M	M-H	M	Project does not affect view of Mt. Rainier.
38th Avenue	ESE	0.73	L-M	MAJ	L	L	M	L-M	Duration of visibility of major project facilities will be minimal.
Canyon Road	W	0.34	L	DD	L-M	L-M	M-H	M	Visual contrast will be an additive impact to the existing disturbed landscape condition.
Mt. Rainier (Round Pass)	WNW	25.0-30.0	H	MIN	NV	NV	NV	NV	Project not visible from any road area in the Park.
Mt. Rainier (Wonderland Trail)	WNW	±27.0	H	MIN	NV-L	L	L-M	L	Existing structure or man-made features potentially distinguishable along segments of the trail include the Boeing Aviation plant, smoke emissions and cooling tower plumes.

¹ S - South, W - West, N - North, E - East

² L - Low, M - Moderate, H - High

³ Min - Minimal Disturbance, Maj - Major Disturbance, DD - Drastic Disturbance

⁴ NV - Not Visible, L - Low, M - Moderate, H - High

Mitigation Measures

The following mitigation measures are suggested to reduce visual impacts:

VQ1-1 Disturbance of the site could be minimized. During construction, clearing of land for project facilities or structures, could use curvilinear boundaries where practicable instead of straight lines. Grading could be done in a manner which would minimize erosion and conform to the natural topography. The clearing of trees and vegetation for the project facilities could be limited to the minimum area required. To the extent practicable, all foliage, particularly the clusters of coniferous trees adjacent to the project site, could remain undisturbed to provide maximum screening of the installation.

Brush or small trees cleared and not otherwise disposed of could be spread in a way to provide cover habitat for small mammals, reptiles and birds. Woody materials could be randomly placed in areas to conform to adjacent vegetation patterns. All timber and other vegetation material without value could be mechanically chipped and spread in a manner that would aid seedling establishment and soil stabilization.

Soil which has been excavated during construction and not used could be evenly backfilled into the cleared area. The soil could be graded to conform with the terrain and the adjacent landscape.

VQ1-2 Simplified structures and coverings could be used to enhance the overall appearance of the project area facilities. Landscaping could be applied in highly visible or sensitive areas to enhance the appearance of the power plant. Selection of trees and other plant materials for landscaping could blend with existing vegetation types and patterns.

Consideration could be given to coloring of facilities structures to blend with the landscape; specifically:

- The colors should be uniform and non-contrasting to reduce contrast with their background. The warmest color tones should be considered for natural settings.
- Exposed concrete color should match surrounding soil color.
- Unless specified otherwise, colors should be selected on the basis of their ability to blend with the land and not the sky.

- The emission stack should be effectively colored to help reduce its vertical dominance. The portion of the stack below skyline should be colored to match predominant landscape color. Above skyline, lighter color tones should be considered.
- Project facilities should be painted a shade darker than the adjacent landscape to compensate for the effects of shade and shadow.
- Paint finishes with low levels of reflectivity (i.e., flat or semi-gloss) should be used.
- Colors equivalent to the Munsell Soil Color Coding System and displayed on the Standard Environmental Color Chart should be considered for all project facilities.

VQ1-3 Exterior night lighting for project facilities could minimize reflective glow to adjacent landowners.

Impact VQ2 The proposed power plant could impair views from Mount Rainier National Park.

Impacts

The project would not be visible from any roaded location in Mt. Rainier National Park. The cooling tower plume may be visible from certain hiking trails located higher on the mountain. This plume would not draw visual attention from the Park. From the Park, the viewshed, which includes the project, contains hundreds of square kilometers (square miles) of landscape; a significant part of which has been modified. Plumes of other stack emissions cooling towers and timber slash burns are presently part of the scene. The project's cooling tower plume itself would not draw visual attention.

Mitigation Measures

No mitigation measures are suggested.

Impact VQ3 Proposed changes to the BPA South Tacoma switching station could alter visual quality within the existing facility.

Impacts

Visual effects from proposed alterations and additions to the existing switching station, including electrical and communication facilities, would create a low, long-term, additive impact to the visual aesthetic resources in the facility. The switching station currently contains a number of major landscape disturbances, including transmission lines and a series of transmission line poles. Addition of structures, including transmission lines, circuit

breakers, disconnect switches, and a control house, and the expansion of the existing substation by approximately 0.07 hectare (0.17 acre) present a minor impact. The landscape at the proposed substation location has been greatly disturbed by the introduction of blocky structures and the removal of vegetation. Addition of structures to the existing switching station will be relatively imperceptible and will present only minor impacts.

Mitigation Measures

- VQ3-1 Consideration should be given to coloring of facilities to blend with landscape as outlined in VQ1 through VQ3.
- VQ3-2 Exterior lighting for project facilities could minimize reflective glow to adjacent landowners.
- VQ3-3 Project facilities could be clustered as closely as possible to existing substation structures in order to concentrate disturbance in one area.
- VQ3-4 Landscaping of vegetation could be used around the perimeter of the project to decrease visibility of proposed industrial structures.

5.14 PROJECT DESIGN FEATURES FOR REDUCING ENVIRONMENTAL IMPACTS

Throughout Section 5.0, "Environmental Consequences," the indication "no mitigation measures are suggested beyond those built into the project" is given for a number of impacts. This determination is based on the project design which incorporated, to the extent practicable, measures to eliminate or avoid potential environmental impacts. The following is a summary of those measures by resource type.

- Geology/Soils: A minimum amount of soil would be disturbed outside of the project footprint; all structures will conform with building standards for seismic risk in the project region.
- Air Quality: Implementation of BACT – the combustion of natural gas or low-sulphur No. 2 fuel oil (in emergency cases) in combination with various emission reduction equipment, including low-No_x and de-No_x filters.
- Water Quality: Discharge of process and cooling waste water to the municipal sewer for treatment; hazardous materials would be stored according to code

and protected from possible spill/leakage. All storm water from storms less than the 100-year return period storm would be stored on the site.

- Energy and Utilities: The project would operate almost 100 percent of the time, thus maximizing efficiency. The most efficient combustion turbine design will be utilized.
- Biology: The footprint of the proposed power plant has been situated to avoid the stand of Douglas fir in the southeastern portion of the site and preserve as much quality habitat as possible. Trees situated throughout the site would be avoided to the extent practicable; portions of the site will be landscaped after construction. Disturbed *Aster curtus* populations will be transplanted.
- Land Use: The project has been situated in an area zoned for light and heavy industry and does not interfere with more sensitive land uses (e.g., residential areas or open space).
- Public Health and Safety: All transmission lines would be constructed in accordance with the NESC. All underground lines would be clearly marked to avoid cutting into them and would be pressure tested at all times to monitor for leakage. There would be power plant isolation valves which could be closed in the event of an emergency at all gas and liquid inlets. In addition, there would be safety valves throughout the facility that would release high pressure liquids or gases before the possibility of an explosion. All gases and liquids vented in this manner would be distributed to a predetermined safe location for release (Chuck Eliason, Tenaska, pers. comm., 1993).
- Noise: Power plant facilities would be housed in structures serving as an acoustical barrier, reducing noise emissions.
- Visual Quality: A large portion of trees would be left surrounding the power plant in order to screen as much of the plant as possible from surrounding viewpoints; portions of the power plant perimeter would be landscaped with trees.

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5.15 SIGNIFICANT ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

No significant adverse impacts were identified. The majority of impacts identified were determined to be minor. Other, more substantial impacts were prevented by incorporating environmental protection features into the project design and operation plan.

5.16 RELATIONSHIP BETWEEN SHORT TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Analysis of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and irreversible or irretrievable commitments of resources is described in Regulations for Implementing the Procedural Provisions of the NEPA (40 C.F.R. Section 1502.16) (CEQ, 1978). Discussion of these topics in the environmental document should include the following subjects:

- Direct and indirect effects of the proposed project and their significance.
- Conflicts between the proposed action and objectives of other agencies (Federal, state, regional and local) in terms of local land use plans and policies
- Environmental effects and recommended mitigation measures for all alternatives of the proposed project.
- Urban quality, historic and cultural resources and design of the built area, including reuse and conservation potential of various alternatives and mitigation measures.
- Energy and natural or depletable resource requirements and conservation potential for the various alternatives and mitigation measures.

The first four topics listed above are discussed in Sections 3.0 and 5.0 and are not addressed below. The fifth topic, energy and natural resources conservation for the various alternatives, is addressed below.

The proposed Tenaska Washington II project was selected for consideration by BPA out of 116 resource proposals because it offered the potential of providing a balance between cost, technical feasibility, and environmental impacts. BPA considers natural-gas fired combustion turbines for energy generation as simple, reliable, and relatively easy to site. In addition, they offer a relatively clean-burning fuel source. The proposed project would use a highly efficient, combined cycle combustion turbine to provide maximum power output.

5.17 IRRETRIEVABLE AND IRREVERSIBLE COMMITMENT OF RESOURCES

In addition to short-term uses and long-term productivity of the environment, project construction would result in direct and indirect commitments of resources. Project construction would require the commitment of building materials for construction of the proposed generation facility, such as concrete, steel, wood, and specific project equipment such as the turbines. Materials which could be re-used or recycled would be salvaged during decommissioning of the power plant.

Project construction and operation would also require the use of fossil fuels, electrical energy, water, and other resources over the life of the proposed project. The project will use approximately 1.3 million cubic meters (45 million cubic feet) of natural gas per day and approximately 6.8 million liters (1.8 million gallons) of water per day. The amounts of these resources to be consumed cannot be accurately determined at this time, because total operating days are not known, and should be considered irretrievable and irreversibly committed to the proposed project.

5.18 CUMULATIVE IMPACTS

Cumulative impacts refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

The Frederickson Industrial Area, as the name implies, is an area intended to be developed for industrial and manufacturing purposes. As additional industries choose to establish facilities in this area, cumulative environmental impacts will become greater in the region. The largest anticipated growth from industry in this area will be from the Boeing expansion expected to employ over 11,000 people per day by the year 2010. It is expected that traffic and associated congestion problems will increase, biological resources (vegetation, wildlife, wetland, and other possible resources) will diminish, and that air quality and the noise environment will be degraded by increased vehicle traffic and industrial activity. In addition, impacts may occur to visual resources and ground water quality.

With respect to air quality, the emissions from the proposed project would not significantly affect the area's ability to meet air quality standards in the future. The area is only marginally in nonattainment for carbon monoxide and ozone. The Washington DOE is developing programs to reduce the emissions of nonattainment pollutants and their precursors.

These programs focus on vehicular emissions as the dominant source of nonattainment pollutants.

The proposed project would add to regional impacts in an incremental fashion as described by resource topic in Sections 3.0 and 5.0. However, these incremental impacts would be modest, relative to other existing and planned facilities in the region.

5.19 IMPACTS OF ALTERNATIVES TO THE PROPOSED ACTION

5.19.1 No Action

Under the No Action alternative, BPA would not acquire power from the Tenaska Washington II project to meet the anticipated needs of BPA. And since no action would be taken, there would be no environmental impacts.

5.19.2 Other Actions

Since the proposed action would reduce, but not eliminate BPA's need for power, other resources would likely be considered independent of the proposed action and the pilot acquisition program. Other resource types potentially available to meet future loads include the following:

- Conservation (commercial, residential, and industrial)
- Renewables (hydropower, geothermal, wind, and solar)
- Cogeneration
- Combustion turbines
- Nuclear power
- Coal and clean coal

To comparatively evaluate these resource types, BPA has prepared a Resource Programs EIS which was published final in February 1993. The environmental effects of each resource type are discussed in detail in the Resource Programs EIS (see Section 2.2).

ENVIRONMENTAL CONSULTATION, REVIEW, AND PERMIT REQUIREMENTS

A number of Federal and state environmental laws, executive orders and administrative mandates must be met by the proposed Tenaska Washington II project. The following provides a description of relevant regulatory requirements and issues of environmental policy, and a summary of required permits.

6.1 ENVIRONMENTAL POLICY

6.1.1 National Environmental Policy Act (NEPA)

NEPA is a national charter for protection of the environment. NEPA applies to all Federal projects or projects that require Federal involvement. BPA's potential purchase of power from Tenaska requires that BPA assess the potential environmental effects of the proposed project and describe them in an Environmental Impact Statement (EIS). This EIS for the Tenaska Washington II project was prepared to satisfy NEPA requirements.

6.1.2 Washington State Environmental Policy Act (SEPA)

SEPA (43.21C RCW) is Washington's functional equivalent of NEPA. It is intended to help state and local government decision-makers consider environmental values when reviewing proposed projects. SEPA contains specific policies and goals which apply to action at all levels of state government, except the judiciary branch and the state legislature. SEPA has four primary purposes listed: to declare a state policy which will encourage productive and enjoyable harmony between people and their environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere; to stimulate the health and welfare of people; and to enrich the understanding of ecological systems and natural resources important to the state and the nation.

The SEPA process begins when a permit application is submitted to an agency or when an agency proposes to undertake an official action. Prior to taking any action (issuing permits or approvals) on a nonexempt project, agencies must follow specific procedures to make sure that appropriate consideration has been given to the environment. The severity of potential environmental impacts associated with a proposed action would determine whether a state EIS is required.

Because many projects require both state and Federal actions, both NEPA and SEPA apply. In order to avoid duplication of effort, SEPA rules allow the adoption of a Federal EIS to

satisfy the SEPA requirements. In the case of the Tenaska Washington II project, the state lead agency, Pierce County would satisfy SEPA by adopting the Federal EIS after the county has performed its own review of the document. Pierce County would not take action on the project until seven days after it issues an "adoption form".

6.2 THREATENED AND ENDANGERED SPECIES AND CRITICAL HABITAT

The Endangered Species Act (16 U.S.C. 1536) provides for conserving threatened and endangered species of wildlife and plants. Federal agencies must ensure that the proposed action does not jeopardize the continued existence of any endangered or threatened species, or cause the destruction or adverse modification of their critical habitat. Sources of information for the potential occurrence of sensitive species in an area include both Federal and state lists.

A letter was sent to the USFWS requesting a list of threatened and endangered species in the vicinity of the proposed power plant. No listed species occur at the site. However, a recent survey determined the presence of a population of white-top aster (*Aster curtus*), a Federal candidate species (C2) (Salix Associates, 1993). White-top aster is designated as sensitive by the State of Washington (1990). Potential impacts of the proposed project and its alternatives on listed species are discussed in Section 5.5.

6.3 FISH AND WILDLIFE CONSERVATION

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 et. seq.) encourages Federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. The Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) requires Federal agencies undertaking projects affecting water resources to consult with the USFWS and the state agency responsible for fish and wildlife resources to conserve or improve wildlife resources. Water resources that promote fish and wildlife habitat have not been identified at the proposed Tenaska Washington II project site.

6.4 HERITAGE CONSERVATION

Congress has passed many Federal laws to protect the nation's historical, cultural, and prehistoric resources. These include the NHPA, the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, the National Landmarks Program, and the World Heritage List. A cultural resource is an object, structure, building, site, or district that provides irreplaceable evidence of natural or human history of national, state, or local significance. Cultural resources include National Landmarks, Natural Landmarks, archaeological sites, and properties listed (or eligible for listing) on the NRHP.

Construction projects such as Tenaska Washington II could affect historic properties and other cultural resources. An archival search and field survey were conducted by Tenaska as described in Sections 4.7 and 5.7. No cultural resources were identified or discovered. A copy of the cultural resources survey report has been sent to the Washington State Historic Preservation Office.

6.5 STATE, AREA-WIDE, AND LOCAL PLAN AND PROGRAM CONSISTENCY

6.5.1 Land Use

Pierce County's 1962 Generalized Comprehensive Plan directs land use into specific zones; for example, the 1962 Plan encourages the development of shopping and service facilities to meet the needs of the "Suburban Residential" zone. Pierce County is currently revising the 1962 Plan to conform to the 1990 Growth Management Act. The revised plan is expected to be adopted by July 1994.

The proposed Tenaska Washington II project would alter land use at the site from vacant to industrial use. The site is located within an area zoned for heavy industrial use, thus, the project would be consistent with prevailing land use designations.

6.5.2 Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act)

The Pacific Northwest Electric Power and Conservation Planning Council (Council) has been established according to the Northwest Power Act (Pub.L. No. 96-501). The goal of the Council's 1991 Northwest Conservation and Electric Power Plan (Plan) is to "assure the Pacific Northwest of an adequate, efficient, economical and reliable power supply" (Council, 1991). One of the Council's authorities is a Section 6(c) review, as directed in the Northwest Power Act (16 U.S.C. Sections 839-839h) (Supp. V 1981). Section 6(c) requires both the BPA Administrator and the Council to determine that a project of at least 50 aMW and 5-years duration is consistent with the Plan. BPA has conducted a formal review pursuant to Section 6(c) of the Northwest Power Act. The BPA administrator has determined that the proposal to acquire up to 240 aMW of firm energy from the Tenaska Washington II project is consistent with the Northwest Power Plan. The Council found by unanimous vote that the proposal is consistent with the Northwest Power Plan.

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6.5.3 Notice to the Federal Aviation Administration (FAA)

Construction of tall facilities requires that notice be given to the FAA, specifically, any facility 61 meters (200 feet) or taller above ground level. No structures exceeding 61 meters (200 feet) are planned at the Tenaska Washington II project.

Additionally, proximity of a proposed facility to an airport requires that notice be given to the FAA. The closest airport to the proposed project is Thun Field Airport, located roughly 4.8 kilometers (3 miles) due east of the site. A second airport, Spanaway Airport, lies 5.1 kilometers (3.2 miles) due west of the site. Both of these airports are of sufficient distance from the proposed site that any airplanes approaching for landing or taking off would be required to be at a minimum of 300 meters (1000 feet) over the site. This elevation would preclude any potential impacts to airplanes from the discharge of hot gases from the power plant stack which would not rise more than 15-30 meters (50-100 feet) from its point of discharge to the air (Chuck Eliason, Tenaska, pers. comm., 1993.) There is also a small airstrip approximately 1,219 meters (4,000 feet) south of the proposed plant site.

The McChord Air Force Base is located approximately 10 kilometers (6 miles) northwest of the proposed site. Aircraft approaching and taking off from this base would not be affected by the proposed power plant's facilities and no regulation would apply.

6.5.4 Construction-Related Permits

Grading, building, and related permits would be required from Pierce County. The County Department of Permits and Land Services regulates development activities via Ordinance No. 90-132, Site Development Regulations.

6.6 COASTAL ZONE MANAGEMENT PROGRAM CONSISTENCY

The proposed project is not in the coastal zone, nor will it directly affect the coastal zone.

6.7 FLOODPLAINS

The project site is not within in a floodplain or area which is susceptible to flooding.

6.8 WETLANDS

A review of NWI maps and a field survey for the potential presence of jurisdictional wetlands resulted in finding no wetlands at the project site. Thus, construction at the Tenaska

Washington II power plant site would not require permits for alteration of wetlands under Section 404 of the Clean Water Act or the Washington Shoreline Management Act.

6.9 FARMLANDS

The Farmland Protection Policy Act (Act) (7 U.S.C. 4201 et. seq.) directs Federal agencies to identify and quantify adverse impacts of Federal programs on farmlands. The Act's purpose is to minimize the amount of Federal programs that contribute to unnecessary and irreversible conversion of agricultural land to non-agricultural uses.

The site is currently vacant and zoned for heavy industrial use. The SCS indicated that no prime or unique farmland exists at the site.

6.10 RECREATION RESOURCES

No public recreation occurs at the proposed project site as it is privately owned and zoned for Heavy Industrial use. It is unlikely that the proposed project would interfere with the present use of any recreation resource in the vicinity.

6.11 GLOBAL WARMING

Several additional greenhouse gases would be emitted by the proposed project. These may include CO₂ and criteria air pollutants (Federally regulated) such as NO_x, PM₁₀, and VOCs. Emission levels of these gases by the proposed project would be below the PSAPCA's threshold standards for both emissions and ambient air quality. No permit requirements currently exist specially for greenhouse gases.

6.12 PERMIT FOR STRUCTURES IN NAVIGABLE WATERS

The proposed project does not include work or structures that are in, on, or over any navigable waters of the United States as defined in the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

6.13 PERMIT FOR DISCHARGES INTO WATERS OF THE UNITED STATES

Discharge of dredged or fill material into waters of the United States is regulated by the Army Corps of Engineers pursuant to Section 404 of the Clean Water Act. The proposed project is located in an upland area and there is no proposed discharge of dredged or fill materials into waters of the United States.

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6.14 PERMIT FOR RIGHT-OF-WAY ON PUBLIC LANDS

The proposed project would be located on private land.

6.15 ENERGY CONSERVATION AT FEDERAL FACILITIES

The proposed project does not include the operation, maintenance, or retrofit of an existing Federal building, or the construction or lease of a new Federal building.

6.16 POLLUTION CONTROL

6.16.1 Air

The Clean Air Act is the principal Federal law governing air pollution control. It was most recently amended in 1990. In the project area, authority for ensuring compliance with the provisions of the Clean Air Act is delegated to the PSAPCA. Emissions produced by the proposed Tenaska Washington II project must meet standards established by that agency. The Tenaska Washington II project would comply with all applicable standards as described in Section 5.4.

6.16.2 Water

The Clean Water Act, as amended, is the principal Federal law governing water pollution control. The Clean Water Act was passed in 1972 and amended in 1977 and 1987. Currently it is undergoing review and is expected to be formally amended in either 1993 or 1994. The Clean Water Act authorizes Federal and state regulation of discharges into waters of the United States and municipal sewer systems. The primary instrument for implementing the Clean Water Act is the NPDES. An NPDES permit would not be required for discharging storm water from the proposed project, as determined by the Washington DOE. A combination of design features and operating practices will, however, be implemented at the Tenaska Washington II power plant site to prevent or reduce storm water pollution.

Washington State has adopted groundwater quality standards (WAC 173-200) that the Washington DOE is authorized to administer. A storm water management plan that meets these standards would be implemented by Tenaska. Other regulatory requirements related to potential groundwater contamination by hazardous materials are addressed in Section 4.9. These include the Preparedness and Prevention measures, Contingency Plan, and Spill Prevention Control Countermeasure Plan, which would be submitted to Ecology for review and to the Tacoma-Pierce County Health Department for approval of compliance with regulatory requirements.

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The only aqueous wastes generated at the proposed site would be sanitary sewage and cooling tower blowdown. Both would be discharged to the Pierce County sewage system. Compliance with the Clean Water Act requirements for discharge of these wastewaters to the waters of the United States would be the responsibility of Pierce County. Pierce County is currently in compliance with the Clean Water Act requirements.

6.16.3 Solid and Hazardous Waste

6.16.3.1 Solid Waste

Solid waste generated at the proposed project site would consist mostly of packing crates, wastes from maintenance, and wastes from normal employee activities. It would probably be collected by LeMay Disposal for disposal at the Land Recovery Municipal Landfill.

6.16.3.2 Hazardous Waste

Management of hazardous wastes during construction and operation of the proposed power plant are discussed in Section 5.9. The Washington DOE is the primary agency responsible for regulation of hazardous and dangerous wastes in the state. A Dangerous Waste Permit from the Washington DOE may be required for the treatment, storage and disposal of dangerous waste. Under the Washington State Dangerous Waste Regulations (173-303 WAC) the Washington DOE implements the State's Hazardous Waste Management Act and parts of the RCRA. In Washington, dangerous wastes are defined to include EPA-identified hazardous wastes, as well as additional wastes that are regulated in Washington because they are toxic, persistent in the environment, or carcinogenic.

Environmental review requirements concerning hazardous waste would include preparing Preparedness and Prevention Measures, Contingency Plan, and Spill Prevention Control Countermeasure Plan documents for submittal to the Washington DOE and Tacoma-Pierce County Health Department.

6.16.4 Safe Drinking Water

The proposed project would receive its drinking water from TPU which is obligated to comply with the provisions of the Safe Drinking Act.

The Federal Sole Source Aquifer program is designed to protect aquifers that supply 50 percent or more of the drinking water for a given area and for which there are no reasonably available alternative sources should the aquifer become contaminated. The program requires EPA review of any Federally funded project for protection of groundwater if a sole source

aquifer exists in the area. The Clover-Chambers Creek Basin aquifer system was formally designated as a sole source aquifer on December 9, 1993.

The proposed project would comply with Federal, state, and local regulations regarding contamination prevention of surface and ground waters.

6.16.5 Noise

The proposed project is subject to maximum allowable levels of noise by Pierce County ordinance and state law (WAC 173-63), as measured at the property line of adjacent occupied land. As discussed in Section 5.12, regular operation of the proposed project would comply with noise standards for adjacent industrial and residential property. Potential noise-related impacts of project construction and suggested mitigation measures are discussed in Section 5.12.

6.16.6 Pesticides

The proposed project would not use or produce pesticides, and would not be affected by regulation regarding the purchase, use, storage, or disposal of pesticides.

6.16.7 Toxic Substances Control Act (TSCA)

The TSCA requires notification to EPA of new chemicals and regulates the production, use, and disposal of toxic substances. Of particular interest to the production of electricity is the regulation of polychlorinated biphenols (PCBs). EPA banned the manufacture, processing, distribution in commerce, and use of PCBs on January 1, 1978 except in totally enclosed electrical equipment or under specific authorized uses.

The proposed project would not involve the distribution, use, or disposal of PCBs.

6.16.8 Asbestos

There would be no asbestos used in the proposed project.

6.16.9 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

A Phase I Environmental Site Assessment was completed for the proposed project site which indicated that no hazardous materials are present at the site. A study that included groundwater monitoring was completed for a site located adjacent to and south of the

proposed Tenaska site, which found no elevated levels of hazardous materials. These studies suggest that the proposed project would not involve liability for clean-up of past or present hazardous wastes at the site or involve selling or transferring real property where any type of activity relating to hazardous substances has occurred.

6.16.10 Radon

There is no evidence to suggest that the proposed project area is affected by regulations concerning radon gas, or would be affected by the Radon Gas and Indoor Air Quality Research Act of 1986 (42 OSC 7401).

6.17 PERMITS

Permits would need to be obtained from a number of agencies before power plant construction and operation could begin. It is known that development of the proposed project would require the following Federal, state, or local permits:

- New Source Review and the subsequent permits, including the Air Toxics Emission Permit/Operating Permit for emitting pollutants into the air from the PSAPCA.
- Grading and building permits from Pierce County.
- Review per Section 309 of the Clean Air Act by the EPA.
- Industrial Waste Discharge Permit from the Washington DOE.
- Natural Gas Import Authorizations from the FERC.
- Determination of Exempt Wholesale Generator from the FERC.
- Critical Area Review by Pierce County.
- NPDES storm water permit for construction (NPDES storm water permit for operation is not required).

Possible permits that may need to be obtained for development of the proposed project include the following:

- RCRA compliance (administered by the Washington DOE).
- Dangerous Waste Permit for Treatment, Storage, and/or Disposal from the Washington DOE.
- Special Motor Vehicle Permit for any over-weight or over-sized vehicle from the Washington Department of Transportation.
- Miscellaneous local permits for operating a commercial or private business.
- Encroachment permits from Chehalis Western Railroad and Pierce County.

7.1 REPORT AUTHORS

Preparer	Experience and Expertise
Nandranie Tuck Project EIS Manager	B.S. Geography Graduate coursework in environmental sciences and natural resources laws and policies, 5 years teaching ecology and earth sciences, 11 years environmental analysis and project management; NEPA compliance and facility siting; field research and policy analysis of wetlands, land use and water use.
Ronald H. Holeman Project Manager	Mathematics/Engineering 29 years of experience Research, Development & Demonstration, including technical analysis of conventional thermal and renewable generation resources, project management.
Roxane J. Freeman EIS Reviewer	B.A. Economics; J.D. Financial analysis, contract drafting and negotiations.
Randall Leonard Engineering Coordinator Utility Systems & Applications, Inc.	M.S., Wildlife and Range Resources 12 years of experience NEPA compliance, project management, environmental and engineering planning, resources analysis, applied research.
Jon French Engineering and Transmission Issues	B.S. Electrical Engineering, P.E. Oregon 22 years experience High voltage transmission, substation design, project management, system planning.

Preparer**Experience and Expertise**

Colleen Spiering
Electric and Magnetic Field
Effects

Master of Public Health
18 years experience
Environmental compliance, public involvement,
health related EMF analysis, health education.

Other project support, both technical and in report preparation, was provided by staff at Woodward-Clyde Consultants and Bonneville Power Administration. The air quality studies were overseen by William Steiner of Woodward-Clyde Consultants, in Oakland, California. The archaeology study was performed by J. Scott King of Historical Research Associates, Inc., in Seattle, Washington. The noise study was performed by Michael R. Yantis Associates, Inc., of Bellevue, Washington.

7.2 PERSONS CONSULTED**Chambers Creek Wastewater Treatment Plant**

Jim Landan, Chief Operator, April 21, 1993.

City of Tacoma Public Utilities Department

Staff

Washington Department of Ecology

Burt Bowen, Groundwater Section; March 25, 1993.

Kurt Cook, Groundwater Section.

Pat Hartigan, Storm Water Section.

Gary Kruger, Environmentalist III, Storm Water Division; March 24, 1993.

Helen Presley, Storm Water Section.

U.S. Environmental Protection Agency (EPA)

Dru Keenan, State Groundwater Protection Coordinator; March 23, 1993.

Johnathan Williams.

Mount Rainier National Park, Washington

Staff

Pierce County

Sally Sherard.

Janine Redmond.

Phil Pinard.

Pierce County Solid Waste Management Department

Staff

Pierce County Utilities

Steve Elseth, Principal Engineer, Water Division; March 23, 1993.

Jane Evancho, Resource Planning Coordinator, Water Quality Division; March 29, 1992.

Robin Ordonez; March, 1993.

Soil Conservation Service

James (Skippy) Moore, District Conservationist; March 26, 1993.

Tacoma-Pierce County Chamber of Commerce

Gary Bracket.

Tenaska Washington Partners II, L.P.

Chuck Eliason, Engineer; March 11, 1993.

David Johnson; January, 1993.

Mike Lebens; March, 1993.

U.S Department of Fish and Wildlife

Michelle Eames, Biologist; March 23, 1991.

Washington Department of Wildlife

Lea Knutsen, Biologist; February 3, 1993.

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**LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS
TO WHOM COPIES OF THE STATEMENT ARE SENT**

FEDERAL AGENCIES

Advisory Council on Historic Preservation (ACHP)
Argonne National Laboratory
Federal Energy Regulatory Commission (FERC)
National Park Service (NPS)
Pacific Northwest Electric Power and Conservation Planning Council
U.S. Soil Conservation Service (SCS)
U.S. Environmental Protection Agency (EPA)
U.S. Fish and Wildlife Service (USFWS)
U.S. Army Corps of Engineers (Corps)
U.S. Geological Survey (USGS)

STATE OF WASHINGTON

Department of Natural Resources
Department of Transportation
Department of Health
Department of Fisheries
Department of Ecology
Department of Wildlife
Energy Facility Site Evaluation Council
Parks and Recreation Commission
Puget Sound Air Pollution Control Agency
Washington State Office of Archaeology and Historic Preservation

LOCAL

City of Tacoma
City of Tacoma Department of Utilities Water Division
City of Tacoma Public Utilities
Local 82 Plumbers Union and Pipefitters Union
Pierce County Fire Department
Pierce County Library
Pierce County Protection
Pierce County Planning Department
Pierce County Public Works
Port of Tacoma
Puget Power and Light
Puyallup Chamber of Commerce
Seattle City Light
Tacoma City Light
Tacoma Public Utilities

TRIBES

Muckleshoot Indian Tribe

Nisqually Tribe: Planning Office

Puyallup Tribe: Environmental Planner
Fisheries Biologist
Director, Land Use Department

REGIONAL DEPOSITORY LIBRARIES

University of Moscow Library
Moscow, Idaho

Nevada State Library
Carson, Nevada

University of Montana
Maurene and Mike Mansfield Library
Missoula, Montana

San Francisco Public Library
San Francisco, California

Portland State University
Millar Library
Portland, Oregon

State of California Regional Depository
Library
Sacramento, California

Washington State Library
Olympia, Washington

State of Oregon Library
Salem, Oregon

STATE DEPOSITORY LIBRARIES

Bellevue Public Library
Bellevue, Washington

Everett Public Library
Everett, Washington

Western Washington University
Mable Zoe Wilson Library
Bellingham, Washington

Evergreen State College
Daniel J. Evans Library
Olympia, Washington

Eastern Washington University
JFK Library
Cheney, Washington

North Olympic Library System
Port Angeles, Washington

Highline Community College Library
Des Moines, Washington

Washington State University
Holland Library
Pullman, Washington

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Library
Ellensburg, Washington

Seattle Public Library
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9th Circuit Library
Seattle, Washington

Gonzaga University
School of Law Library
Spokane, Washington

Spokane Public Library
Spokane, Washington

Tacoma Public Library
Tacoma, Washington

University of Puget Sound
Collins Memorial Library
Tacoma, Washington

Port Vancouver Regional Library
Vancouver, Washington

Whitman College
Penrose Memorial Library
Walla Walla, Washington

OTHER INTERESTED ORGANIZATIONS

Air Products and Chemicals
Alcan Aluminum Ltd.
AMA Timber Products
Building & Construction
Carpenters Employers
CE Exploration
Central Lincoln PUD
Century Contractors West
City Club of Tacoma
Eatonville Chamber of Commerce
EBASCO Environmental
Economic Development Board for
Tacoma and Pierce County
Emergency Medical Services
Environmental Dynamics
FCCCC
GE Bridges & Associates
General Electric
General Electric
Graham Grange No. 962
Graham Greater Business
Graystone
Great Northwest Taxi
HDR Engineering
Independent Power

League of Women Voters
Leslie Associates
National Electrical
NE Energy
Northwest Pipeline Co.
Northwest Pallet
Northwest Power Planning Council members
and offices
Olympic Pipe Line Co.
Parametrix Inc.
Pomona Grange
Puget Sound Power & Light
Puyallup Rotary
Rand-Land Investment
Randles Sand & Gravel
Seattle City Light
STRA
SW Research Institute
Tacoma Audubon Society
Taylor Economic Research
Tenaska Washington Partners II, L.P.
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Washington Environmental

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Zurn/Nepco
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9.0
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Adsorption	The accumulation of a material at the interface between two physical phases, for example, materials that are removed from water onto soil particles.
Alluvial deposits	Material such as sand or silt, deposited on land by streams.
Aquifer	A geologic formation or structure that contains and transmits water in sufficient quantity to supply the needs for water development. Aquifers are usually saturated sands, gravel, or fractured rock.
BACT	Best Available Control Technology
Best Management Practices	A practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.
Biofiltration swale	The use of natural materials and vegetation to trap and remove pollutants from water using a shallow drainage ditch.
Circuit breakers	A switching device that is capable of closing or interrupting an electrical circuit under over-load or short-circuit conditions as well as under normal load conditions.
Control and protective relaying	Protective relays are electrical devices designed to interpret input conditions (which reflect the operation of another piece of equipment) in a prescribed manner, and, after specified conditions are met, to respond by controlling equipment operation to protect an electrical circuit. For example, controlling the opening of a power circuit breaker when a fault occurs to protect the circuit from extensive damage.

Criteria Pollutant	Any one of six pollutants (nitrogen oxides [as NO ₂], carbon monoxide [CO], ozone [O ₃], sulfur oxides [as SO ₂], fine particulate matter [PM ₁₀], and lead [Pb]) that is regulated under the Clean Air Act. These pollutants have National Ambient Air Quality Standards (NAAQS) established using guidelines based on human health and welfare.
DEIS	Draft Environmental Impact Statement.
Disconnect switches	A power system switch used to open a circuit in which only a negligible amount of current, or no current, is flowing. Disconnect switches are typically manually or motor operated and are not used to interrupt a circuit under load.
EIS	Environmental Impact Statement.
Electric Field	An energy field produced by voltage, measured in kilovolts per meter.
Evapotranspiration	Loss of water to the atmosphere through evaporation (loss from wet surfaces) and transpiration by plants.
FEIS	Final Environmental Impact Statement.
Gleization	A chemical reduction process (of iron) in saturated and/or nearly saturated soils which causes the soil to appear grayish in color and/or exhibit mottling (bright colored spots in the soil).
Geologic hazard	A geologic condition, either natural or man-made, that poses a potential danger to life and property, e.g., landslides.
Groundwater infiltration system	A bed, ditch, pond or basin which allows storm water runoff to seep into the ground, often using crushed stone or gravel to increase the permeability of the soil.
Habitat	The environment occupied by individuals of a particular species, population or community.

Hazardous materials	Substances which, if released in an uncontrolled manner, can be harmful to people, animals, property, and/or the environment (Planning Guide and Checklist for Hazardous Materials Contingency Plans, Federal Emergency Management Agency, July 1981).
Herpetofauna	Reptiles and amphibians.
Hydric (soil)	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (able to grow in saturated areas) vegetation.
Impact	Pertains to the environmental consequences, either positive or negative in desirability, of proposed projects or activities.
LAER	Lowest Achievable Emission Rate.
Magnetic field	An energy field produced by the movement of electrons in a wire (current), measured in milligauss (mG).
Mitigation	Actions to avoid, minimize, reduce, eliminate, or compensate for the impact of a proposed activity or management practice.
Non-point source	Water contaminant that cannot be traced to a specific point of origin, but rather comes from many different non-specific sources.
NPDES	National Pollution Discharge Elimination System.
PDEIS	Preliminary Draft Environmental Impact Statement.
PFEIS	Preliminary Final Environmental Impact Statement.
PSAPCA	Puget Sound Air Pollution Control Authority.
Parent material	The unconsolidated material from which soil develops.
Percolation	The downward movement of water through the soil.

Profile (soil)	A vertical section of the soil extending through different layers (horizons).
Permeability (soil):	The quality of soil that enables water to move downward through the profile, measured as the number of centimeters (inches) per hour that water moves downward.
Physiographic province	A region of similar structure and climate that has a unified geomorphic (pertaining to surface form) history.
RCRA	Resource Conservation and Recovery Act. Federal regulations addressing management of hazardous waste. In Washington State these are implemented through the adopted state regulations, Washington State Dangerous Waste Regulations (173-353 WAC).
RPEIS	Resource Programs Environmental Impact Statement. An EIS prepared by BPA in February 1993 that comparatively evaluates resource types for acquisition.
Runoff	Water from precipitation or irrigation that flows over the ground surface and returns to streams or other water bodies. It can collect pollutants from the air or land and carry them to the receiving waters.
Surface water	Any water, temporary or permanent, which is above the ground surface, observable with the unaided eye.
Total suspended particulates (TSP)	The total volume of small particles suspended in a water column, expressed in percent.
Transpiration	The process in plants by which water vapor is released into the gaseous environment.
Visual quality objective (VQO)	Categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape.
Volatile organic compounds (VOCs)	Any organic compound containing hydrogen and carbon that has the tendency to react photochemically in the atmosphere and produce smog.

Water table

The upper limit of the soil or underlying rock material that is wholly saturated with water.

Watershed

The area drained by a single river system.

APPENDIX A
COPY OF NOTICE OF INTENT

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U.S. DEPARTMENT OF ENERGY
Bonneville Power Administration

Proposed Tenaska Washington II Generation
Competitive Acquisition Project
Notice of Intent to Prepare an Environmental Impact Statement
and Notice of Scoping Meeting

AGENCY: Bonneville Power Administration (BPA), DOE.

ACTION: Notice of Intent to prepare an Environmental Impact Statement (EIS) and conduct a Scoping Meeting.

SUMMARY: BPA plans to prepare and consider an EIS on its proposal to purchase firm power produced by the proposed Tenaska Washington II Generation Project. This project was proposed by Tenaska Power Partners in response to competitive bidding by BPA. BPA will evaluate the environmental effects associated with the proposed project to aid in its decision whether or not to purchase the power output from the plant.

The proposed project would be located within the Frederickson Industrial Park near Tacoma in Pierce County, Washington. The facility would consist of one General Electric Frame 7FA combustion turbine-generator, one heat recovery steam generator with supplemental firing capability, and one steam turbine-generator, all together having a nominal output of 240 average megawatts (aMW).

The primary fuel would be natural gas and the back-up fuel would be oil. The natural gas would be delivered by an existing pipeline adjacent to the project site and connected to the facility by a short feeder pipe or stub. The back-up fuel would be delivered to the site by truck and stored on site. A cooling tower would be built on the site to cool the water before it is discharged into the Pierce County Sanitary Sewer System. Water for steam supply and cooling would be purchased from the City of Tacoma.

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The electrical power generated at the plant would be sold to BPA for marketing through the regional power grid. In order to connect the proposed generation project to the Bonneville Power transmission system, a new 230-kV line with overhead ground wire, approximately one mile long, would be required. This line would connect the new generation plant to BPA's South Tacoma 230-kV Switching Station. At the South Tacoma Station, BPA would expand and modify existing facilities to include 230-kV power circuit breakers, disconnect switches, control and protective relaying, communications, and a control house. The South Tacoma Station would be tied into the existing White River-Cowlitz Tap-Olympia 230-kV transmission line. Further details of the South Tacoma expansion would be determined during the preliminary and final design stages.

DATES: A public meeting will be held on September 29, 1992, at Bethel High School, 22215 38th Avenue East, Spanaway, Washington, to discuss the scope of the EIS for the Tenaska Washington II Generation Project.

During the scoping period, BPA is asking the public to identify significant issues that should be considered in the EIS. Comments on the scope of the EIS should be submitted to the address below by October 30, 1992.

After the scoping period, an Implementation Plan for the EIS will be prepared and made available to the public for information. The Draft EIS is scheduled to be circulated for public review and comment in the summer of 1993, and notice as to how copies may be obtained will be published at that time. A public hearing will be held during the 45-day comment period. Copies of the Draft EIS will be available from BPA's Area Offices and from BPA's Public Information Center. The Final EIS should

be available in the winter of 1993. A Record of Decision is expected to be issued in the spring of 1994.

ADDRESS: Written comments on the scope of the EIS should be submitted to the Public Involvement Manager, Bonneville Power Administration, P.O. Box 12999, Portland, Oregon 97212.

FOR FURTHER INFORMATION CONTACT: Ms. Nandranie Tuck, EIS Manager at 503-230-4389 or Mr. Charles Alton, Environmental Coordinator at 503-230-5878, or you may call the Public Involvement Office at 503-230-3478 in Portland; the toll free number is 800-622-4519.

Information may also be obtained from:

Mr. George Bell, Lower Columbia Area Manager, Suite 243, 1500 NE. Irving Street, Portland, Oregon 97232, 503-230-4551.

Mr. Robert N. Laffel, Eugene District Manager, Room 206, 211 East Seventh Avenue, Eugene, Oregon 97410, 503-465-6592.

Mr. Wayne R. Lee, Upper Columbia Area Manager, Room 561, West 920 Riverside Avenue, Spokane, Washington 99201, 509-353-2515.

Mr. George E. Eskridge, Montana District Manager, 800 Kensington, Missoula, Montana 59801, 406-329-3060.

Mr. Ronald K. Rodewald, Wenatchee District Manager, Room 307, 301 Yakima Street, Wenatchee, Washington 98801, 509-662-4377, extension 379.

Mr. Terence G. Esvelt, Puget Sound Area Manager, Suite 400, 201 Queen Anne Avenue North, Seattle, Washington 98109-1030, 206-553-4130.

Mr. Thomas V. Wagenhoffer, Snake River Area Manager, 101 West Poplar, Walla Walla, Washington 99362, 509-522-6226.

Ms. Ruth Bennett, Idaho Falls District Manager (Acting), 1527 Hollipark Drive, Idaho Falls, Idaho 83401, 208-523-0276.

Mr. Thomas H. Blankenship, Boise District Manager, Room 494, 550 West Fort Street, Boise, Idaho 83724, 208-334-9137.

For general information on DOE's NEPA review procedures or status of a NEPA review, contact Carol M. Borgstrom, Director, Office of NEPA

Oversight, EH-25, U.S. Department of Energy, 1000 Independence Avenue,

SW, Washington, D.C., 20585; phone (202) 586-4600 or (800) 472-2756.

SUPPLEMENTARY INFORMATION:

Background

BPA is a Federal power marketing agency with statutory responsibilities to supply electrical power to its utility, industrial, and other customers in the Pacific Northwest. According to BPA's current load/resource balance study, the demand for energy now exceeds supply by about 400 aMW. The load/resource balance forecast projects a deficit of 1,500 to 2,600 aMW of energy by the year 2000. The underlying need for action is to satisfy BPA's customers' demand for electrical energy.

Guided by the recommendations in BPA's 1990 Resource Program, BPA has commenced a dynamic and multifaceted pilot resource acquisition effort to test various approaches for acquiring a diverse portfolio of cost-effective, reliable, and environmentally sound resources. One acquisition approach being tested is an all-source competitive bidding process to acquire about 300 aMW of energy.

In response to BPA's request for proposals under the competitive bidding process, over 100 proposals totalling 5,300 aMW of generation and 116 aMW of conservation energy were submitted.

Through an analysis of system cost, project viability, preliminary environmental evaluation and discussion with the developers BPA has proposed 17 conservation and 3 generation projects for further consideration and review toward satisfaction of the 300 aMW target. Tenaska and each of the remaining 19 proposals will be evaluated independently as they are neither connected to nor dependent upon each other for their justification. This EIS will include at a minimum the no action alternative.

Since the proposed Tenaska project would satisfy only a small portion of BPA's overall energy needs for this decade, whether or not BPA acquires the Tenaska energy output would not foreclose future considerations of other potential energy resources available to BPA through its various acquisition approaches.

Environmental Analysis

The Tenaska Washington II Generation Project would be used as "hydrofiring power" to guarantee the availability of energy from the hydropower system, which is subject to fluctuations due to weather variations.

The proposed combustion turbine would be operating as a combined cycle system. This turbine configuration is highly efficient because the waste heat from the turbine exhaust is captured to create steam for the steam turbine generator which also produces electricity.

The use of "cleaner burning" natural gas in combination with steam injection into the turbine and Selective Catalytic Reduction (SCR) would significantly reduce air emissions of this combustion turbine. The additional SCR and steam injection would reduce nitrous oxide emissions to less than four parts per million (ppm). This is significantly below the current state threshold of 7-9 ppm. Additionally, the developer would fund cost-effective proposals for offsetting carbon dioxide emissions.

The site is designated as "M2" Heavy Industrial. There is property zoned Suburban-Agricultural (SA-12) within a quarter of a mile from the site. Residential zoned property is one-half mile from the site and is separated from the proposed plant property boundary by an existing railroad line, an oil products pipeline right of way, vacant M2 Heavy

Industrial zoned property, and a 230-kV transmission line corridor.
Further from the site are farmers and ranchers. Visual, auditory and air
quality impacts upon area residents, tree farmers and ranchers will be
carefully considered in the environmental analysis.

Issued in Portland, Oregon, on August 31, 1992.

(Sgd.) Steven G. Hickok

FOR

Randall W. Hardy
Administrator
Bonneville Power Administration

APPENDIX B
GEOLOGY, SOILS, AND HYDROLOGY

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APPENDIX B

GEOLOGY, SOILS, AND HYDROLOGY

B.1 GENERAL CHARACTERISTICS

The proposed power plant site is located on an approximately 6.4-hectare (16-acre) parcel of undeveloped land. Topographic relief at the site is moderate and characterized by historical glacial activity. Soils of the area are very permeable, and most rainfall infiltrates rapidly into the groundwater system. Clover Creek and Chambers Creek provide the primary surface drainages for the project site watershed.

B.2 GEOLOGY AND SOILS

B.2.1 Geology

The project site is geographically situated in the northern section of the Puget Trough Province (Puget Sound Basin) of western Washington. This lowland province is bounded on the east by the Cascade Mountains and on the west by the Olympic Mountains and Willapa Hills. Its physiographic and geologic boundary extends north to the Canadian border, and south into Oregon through the Willamette Valley (Franklin and Dyrness, 1988).

Several glaciations, all occurring during the Pleistocene era (2.5 million to 10,000 years before the present), have influenced the geology of the southeastern Puget Sound lowland region (Walters and Kimmel, 1968). The most recent deposits in the region are Vashon deposits, from the Vashon glaciation. The Vashon glacier was the most recent glacier affecting the southern Puget Sound region. Its most southern point was located approximately 16 to 24 kilometers (10 to 15 miles) south of Olympia, Washington. Although this is north of the project site, deposits from glacier melt-water streams are common as far south as Toledo, Washington (Franklin and Dyrness, 1988). These deposits are unconsolidated in nature and consist of mixtures of boulders, cobbles, gravels, sands, silts and clays (Walters and Kimmel, 1968). Parent material for the Vashon deposits include geologic formations in the northern Cascades and the coast range of Canada (Brown and Caldwell, et al., 1985).

The surficial geology of the general area is composed of Vashon recessional outwash. This outwash is a mixture of stratified sand and gravel deposited by melt-water streams during the Vashon glacial retreat, with particle sizes ranging from 0.32 centimeter (one-eighth inch) to approximately 15 centimeters (6 inches) (Walsh, et al., 1987; Battie, et al., 1975). This material is fairly well-sorted and quite permeable, becoming finer in grain and less permeable with increasing distance from the glacier (Brown and Caldwell, 1985). Geologic maps of

Washington, including the Southwest Washington Quadrant and the South Half of Tacoma Quadrangle, confirm the presence of Vashon outwash for the site (Walsh, 1987; Walsh, et al., 1987).

Steilacoom Gravel, a specific unit of Vashon recessional outwash deposited by high-velocity streams and rivers occurs over the site. This deposit is composed of coarse gravel (2.5-centimeter [1-inch] pebbles), with sand occurring between gravel particles (Walters and Kimmel, 1968; Earth Consultants, 1989; Dames & Moore, 1980). Steilacoom Gravel occurs over the project site and surrounding area. It is typically about 12 to 18 meters (about 40 to 60 feet) thick (Earth Consultants, 1989).

The Vashon Till, a mixture of clay, silt, sand, gravel, and boulders, typically underlies the Steilacoom Gravel separating this upper aquifer from a lower aquifer, the Vashon Advance Outwash. There is evidence in the project vicinity (well borings from the Boeing Plant and from Spanaway) indicating that the Vashon Till is not present beneath the project site.

The Vashon Advance Outwash at the project site generally ranges from 8 to 15 meters (25 to 50 feet) in thickness (Brown and Caldwell, et al., 1985). Vashon Advance Outwash was deposited by glacier melt-water streams as the glacier advanced and consists mostly of coarse-grained materials (sands, gravels, cobbles and boulders). High permeability due to the coarse nature of the rock materials is a contributing factor in making Vashon Advance Outwash the primary supply source for domestic wells in the region (Walters and Kimmel, 1968).

B.2.2 Geologic Hazards

The primary geologic hazards in the project area are those related to earthquakes. Earthquakes in the Northwest are associated with the movement of tectonic plates, which make up the outermost 100-kilometer (60-mile) layer of the earth. The subduction of the small Juan de Fuca plate (off the Northwest coast) beneath the North American plate is believed to be the primary cause of earthquakes in western Washington and Oregon. Most of the largest earthquakes in the Puget Sound region have occurred between Olympia and the Canadian border. The largest recorded earthquakes for this area have occurred in Olympia in 1949 (7.1 magnitude on the Richter scale) and between Tacoma and Seattle in 1965 (6.5 magnitude) (Noson, et al., 1988).

Evidence has increased in recent years indicating that western Washington and Oregon are subject to both (1) a greater risk of shallow-crustal earthquakes than had been previously thought and (2) large subduction zone earthquakes, a type which has not occurred in the region for about 300 years. In response to the growing body of evidence, it has been proposed that the seismic hazards and building design criteria for western Washington and

Oregon be increased to seismic zone 3 from the current designation as seismic zone 2 (Walsh, 1993).

B.2.3 Soils

Soils in the Puget Sound basin were formed in glacial materials and reflect the underlying geology; the soils are formed under the influence of coniferous forests and grassland (Franklin and Dyrness, 1988). The Soil Conservation Service (SCS) has identified the soils at the site as Spanaway gravelly sandy loam. On the general soil map for Pierce County, the Spanaway Association is characterized by nearly level, somewhat excessively drained soils.

Mixed on the surface with volcanic ash, Spanaway soil exhibits moderately rapid permeability and slow surface water runoff. Approximately 36 centimeters (about 14 inches) of the uppermost soil profile is typically black, gravelly sandy loam increasing with depth to about 152 centimeters (about 60 inches) below the surface.

The SCS indicates that the engineering properties of Spanaway soil do not present limitations for construction and urban development. Slopes are generally between 0 and 6 percent, and there is little erosion hazard. Surface water readily percolates downward due to the gravelly structure of the soil, making protection of groundwater supplies from above ground contaminants a concern (SCS, 1979).

Spanaway soil is classified within the coarse-grained soil division of the Unified Soil Classification System (Unified). From around 0 to 46 centimeters (around 0 to 18 inches), Spanaway soil is described as "sands with fines" and "gravels with fines." From about 46 to 152 centimeters (about 18 to 60 inches), the soil is described as "clean gravel" with sand mixed in, and little or no fines (Unified).

Test pits dug at the site indicated that the topsoil is composed of glacial outwash sands and gravels and fine-grained alluvial deposits. Beneath this is a layer of coarse sands and gravels with a variable silt, gravel, and cobble content (Dames & Moore, 1980). In general, the sands and gravels encountered within a few feet of the topsoil layer contain more silt- and clay-sized particles than deposits encountered at depths below approximately 2 meters (6 feet). In almost every test pit, a thin layer of topsoil consisting of dark brown sandy silt with organic material was encountered at the surface and is believed to mantle much of the area (Dames & Moore, 1980). A test pit dug in close proximity to the proposed project site exhibited the following profile:

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0 - 8 centimeters	(0 - 3 inches)	Dark brown silty fine sand with roots (topsoil)
8 centimeters - 0.5 meters	(3 inches - 1.5 feet)	Dark brown silty fine to coarse gravel with sand, cobbles, and occasional roots
0.5 - 3 meters	(1.5 - 10 feet)	Gray and brown sandy gravel with cobbles and occasional boulders. (Dames & Moore, 1980)

B.3 GROUNDWATER AND SURFACE WATER

B.3.1 Groundwater

The proposed project site lies within the southern region of Pierce County, in an area bordered on the south and east by the Nisqually, Ohop, and Puyallup Valleys. Glacial recessions from the Pleistocene epoch have left behind unconsolidated deposits composed of boulders, cobbles, gravel, sand, and clay. In general, the deposits are porous and easily transmit water to depths of over 600 meters (2,000 feet) (Brown and Caldwell, 1985).

B.3.2 Surface Water

There are no surface water streams located on the proposed project site due to the highly permeable nature of the soils. Clover Creek originates northeast of the project site from a groundwater spring and flows westward down the basin, approximately 1,220 meters (4,000 feet) north of the project site. A pond located approximately 365 meters (1,200 feet) south of the site is the only other surface water feature. There is no evidence of any existing wells or storm water catch basins on the project site (ENSR, 1993).

APPENDIX C
AGENCY RESPONSE LETTERS

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501-2192
(206) 753-9440 FAX: (206) 753-9008

March 5, 1993

Daniel Raider, Senior Staff Scientist
Woodward-Clyde Consultants
111 S.W. Columbia, Suite 990
Portland, Oregon 97201

FWS Reference: 1-3-93-SP-327

Dear Mr. Raider:

This is in response to your letter dated February 3, 1993, and received in this office on February 5, 1993. Enclosed is a list of candidate species that may be present within the area of the proposed Tenaska Cogeneration project to construct and operate an electrical generation plant with a 248-megawatt capacity located 12 miles southeast of Tacoma, in Pierce County, Washington. The list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973, as amended (Act). We have also enclosed a copy of the requirements for the Bonneville Power Administration (BPA) compliance under the Act.

To the best of our present knowledge, there are no listed species within the area of the subject project. However, candidate species may occur in the vicinity of the project.

Candidate species are included simply as advance notice to federal agencies of species which may be proposed and listed in the future. However, protection provided to candidate species now may preclude possible listing in the future. If early evaluation of your project indicates that it is likely to adversely impact a candidate species, the BPA may wish to request technical assistance from this office.

In addition, please be advised that federal and state regulations may require permits in areas where wetlands are identified. You should contact the Seattle District of the U.S. Army Corps of Engineers for federal permit requirements and the Washington State Department of Ecology for state permit requirements.

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Your interest in endangered species is appreciated. If you have additional questions regarding your responsibilities under the Act, please contact Jim Michaels or Jennifer King of my staff at the letterhead phone address.

Sincerely,

A handwritten signature in black ink, appearing to read "D.C. Frederick", written over a horizontal line.

David C. Frederick
Field Supervisor

jlk/kr
SE/BPA/1-3-93-SP-327/Pierce
Enclosures
c: WDW, Olympia (Nongame)
WNHP, Olympia

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE
SPECIES WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED
TENASKA COGENERATION PROJECT
IN PIERCE COUNTY, WASHINGTON
(T19N, R3E, S36)
1-3-93-SP-327

LISTED

None

PROPOSED

None

CANDIDATE

Mountain quail (*Oreortyx pictus*) - may occur in the vicinity of the project.

Northern red-legged frog (*Rana aurora aurora*) - may occur in the vicinity of the project.

Spotted frog (*Rana pretiosa*) - may occur in the vicinity of the project.

Tacoma western pocket gopher (*Thomomys mazama tacomensis*) - may occur in the vicinity of the project.

Attachment A

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c)
OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

- Requires:
1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;
 2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and
 3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 3704 Griffin Lane SE, Suite 102, Olympia, WA 98501-2192.

* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal action such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

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U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

CONVERSATION RECORD

		TIME 11:30 a.m.	DATE 12/9/93		
LOCATION OF VISIT/CONFERENCE Call Portland, OR		ROUTING			
NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU Jodi Bush		TYPE	NAME	ORG. CODE	
		Visit			
		Conference			
		☒ Telephone			
		☒ Incoming			
ORGANIZATION/OFFICE U.S.D.I. Fish & Wildlife Service		TELEPHONE NO. (206) 753-9440	☒ Outgoing	Kathy Pierce	RAE
		Other (Specify)			

SUBJECT

Endangered Species Act Requirements for the Proposed Tenaska Washington II Generation Project.

SUMMARY

I contacted Jodi Bush, Fish & Wildlife Biologist, Ecological Services, U.S. Fish & Wildlife Service in Olympia, Washington to verify and update the list of threatened and endangered species that may be present in the area of the proposed Tenaska Washington II Generation Project. The original species list was dated March 5, 1993. Ms. Bush confirmed that no species were listed as threatened or endangered and that no new species had been added as candidates. We agreed that a documentation of our telephone conversation provided adequate verification and update. The new FWS Reference is: 1-3-94-SP-087.

ACTION REQUIRED

Prepare written documentation verifying no changes to the March 5, 1993 list fulfilling our responsibilities under the Endangered Species Act of 1973, as amended.

SIGNATURE Katherine D. Pierce	TITLE Environmental Specialist	DATE 12/9/93
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ACTION TAKEN

Written documentation prepared for inclusion in the Final EIS for the Proposed Tenaska Washington II Generation Project.

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SIGNATURE Katherine D. Pierce	TITLE Environmental Specialist	DATE 12/9/93
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WASHINGTON STATE DEPARTMENT OF
Natural Resources

Jennifer M. Belcher
~~XXXXXXXX~~
Commissioner of Public Lands

February 10, 1993

PO Box 47000
Olympia WA 98504-7000

Daniel Raider
Woodward-Clyde Consultants
111 SW Columbia - Suite 990
Portland OR 97201

SUBJECT: Proposed Tenaska Cogeneration Project - Pierce Co.
(T19N R03E S36)

We've searched the Natural Heritage Information System for information on rare plants, high quality native wetlands and high quality native plant communities within a radius of two miles of your study area.

We have a record of a state sensitive plant, Aster curtus (white-top aster), occurring in the vicinity of your project. The population of white-top aster is reported to occur in Section 12, Township 18 North, Range 03 East. I have enclosed a fact sheet on Aster curtus for your information.

The Natural Heritage Information System is a cooperative effort between the Department of Natural Resources' Washington Natural Heritage Program and the Department of Wildlife's Nongame Program. The Washington Natural Heritage Program is responsible for information on the state's endangered, threatened, and sensitive plants as well as high quality native plant communities and wetlands. The Nongame Program manages and interprets data on wildlife species of concern in the state. For information on animals of concern in the state, please contact the Nongame Program, Washington Department of Wildlife, 600 Capitol Way North, Olympia, WA 98501-1091.

The Natural Heritage Information System is not a complete inventory of Washington's natural features. Many areas of the state have never been thoroughly surveyed. There may be significant natural features in your study area that we don't yet know about. This response should not be regarded as a final statement on the natural features of the areas being considered and doesn't eliminate the need or responsibility for detailed on-site surveys.

I hope you'll find this information helpful.

Sincerely,

Sandy Norwood, Environmental Review Coordinator
Washington Natural Heritage Program
Division of Land & Water Conservation
PO Box 47047
Olympia, WA 98504-7047
(206) 902-1667

enclosure

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NAME: *Aster curtus* Cronq. - white-top aster (ASCU)
 FAMILY: Asteraceae - Aster family
 STATUS: Federal: Candidate, 1990
 F.R.; State: Sensitive
 PROMINENT CHARACTERISTICS: Perennial from creeping rhizomes, small and simple, 1-3 dm. (4-12 in.) tall; usually with a single compact cluster of heads, flowers nearly rayless, not showy. Identifiable late August through October.
 HABITAT: Native prairies of the Puget Trough and Willamette Valley, associated with Idaho fescue (*Festuca idahoensis*) in WA.
 RANGE: Regional endemic; Puget Trough in WA; south from Vancouver Island, BC, to Willamette Valley, OR.
 OCCURRENCE SUMMARY: Known from several recent sites. Many historic sites have been destroyed.
 THREATS: Loss of habitat due to agriculture, grazing, urban development and forest invasion; threats from herbicides, ORV's and military activities.
 LAND OWNERSHIP/MANAGEMENT: DOD, WDW, DNR, PVT

Adapted from:

An Illustrated Guide to the Endangered, Threatened, and Sensitive Vascular Plants of Washington. Washington Natural Heritage Program 1981.

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APPENDIX D
REVIEW OF BIOLOGICAL AND
EPIDEMIOLOGICAL STUDIES RELATING TO EMF

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APPENDIX D

**REVIEW OF BIOLOGICAL AND
EPIDEMIOLOGICAL STUDIES RELATING TO EMF**

Much attention at present is focused on several recent reports suggesting that workers in certain electrical occupations and people living close to power lines have a small increased risk of leukemia and other cancers (Sagan, 1992). The evidence, however, does not conclusively prove that a cause-and-effect relationship between electric or magnetic fields and cancer exists.

A study in Denver, Colorado, (Wertheimer and Leeper, 1979) and one in Sweden (Tomenius, 1986) first reported that some cancer risks were about 2-3 times greater for children living near certain types of power lines assumed to be carrying high current. Those researchers suggested that the finding may be related to the magnetic fields of 2-3 mG produced in homes by such lines. The possibility could not be ruled out, however, that other factors, or chance, may be involved. If certain power lines actually do influence cancer rates, this would mean that two or three children out of 10,000 children exposed to such lines would develop cancer each year, compared to the normal rate of 1 in 10,000 per year (Ahlbom et al., 1987).

Another study from Denver (Savitz et al., 1988) indicated results that were generally consistent with the earlier work on childhood cancer by Wertheimer and Leeper (1979). However, the relative risk¹ in the new study (1.5) was smaller than that reported earlier (2-3). It was also on the borderline of statistical significance. Results of another study, from the Seattle area, found no association between power lines and leukemia in adults (Severson et al., 1988). An earlier power line study in Denver by Wertheimer and Leeper (1982) also found no increase in adult leukemia. However, the earlier Denver study did find an increased risk for some other types of adult cancers.

A study done in Los Angeles County, California, provided additional support for an association between childhood leukemia risk and high current power lines (Long et al., 1991). The odds ratio for very high current lines compared to very low current and underground was 2.15. Associations with actual measured electric and magnetic fields, however, were weaker and not statistically significant.

¹ Results of case-control studies are given in terms of relative risk (or odds ratio). A relative risk of 1.0 means that exposure to some factor (assumed to be EMF in this case) is the same for people with a disease (cases) as for people without the disease (controls). A value of 2 means cases were exposed to the factor twice as often as the controls. This establishes a "statistical association" between the disease and the factor. This may or may not represent a cause-and-effect association, however.

A new study done in Sweden found that the relative risk for leukemia in children living near transmission lines was 3.8 where magnetic fields were greater than 3 mG (Feychting and Ahlbom, 1992). Preliminary information on a larger study done in Denmark indicates no increased risk of leukemia for children living near transmission lines in that country (Olsen, 1992). However, there was an elevated risk of lymphoma reported in the Danish study.

Studies in Rhode Island (Fulton et al., 1980), in Taiwan (Lin and Lu, 1989) and in England (Myers et al., 1985) found no significant association between childhood cancer and power lines. Other community studies in England found no consistent evidence to support a power line-cancer association (Coleman et al., 1985; McDowall, 1986).

A study in Washington State first reported that men in various "electrical occupations" had died more frequently from leukemia than men in other occupations (Milham, 1982). Other studies reported similar findings, suggesting an increased risk of around 20 to 50 percent (Savitz and Calle, 1987; Coleman and Beral, 1988). However, the studies were primarily based on information only from death certificates (i.e., job title and cause of death). It, therefore, was not possible to determine whether the preliminary findings were related to electric and magnetic fields, or to other exposures such as those from chemicals.

Research on electric and magnetic fields and cancer was reviewed in a draft report by the U.S. Environmental Protection Agency (EPA, 1990). The EPA concluded that magnetic fields are a possible but unproven cause of cancer in humans and more research is needed. The EPA's Science Advisory Board (SAB) also reviewed the issue and reached a similar conclusion. The SAB, however, recommended that the EPA report should be rewritten to correct inconsistencies in the report (SAB, 1991).

In addition to research on humans and laboratory animals, several studies have investigated possible effects of transmission line electric and magnetic fields on plants, wildlife, and domestic animals (BPA; Lee, et al., 1989). Crop growth is not noticeably affected by even the largest transmission lines. Trees that are allowed to grow too close to transmission line conductors can be damaged by the strong electric fields near the conductors. Normally, trees are not allowed close to conductors to prevent electrical flashover, i.e., spontaneous arcing of electrical current from lines to trees.

Studies have shown that honey bees in commercial hives can be adversely affected by strong transmission line electric fields. Shocks received by bees while in the hive cause decreased honey production and increased mortality. As a precaution, BPA recommends that bee hives not be placed directly on the transmission line right-of-way.

Wildlife do respond to effects (e.g., changes in food supply), of cleared rights-of-way. However, there is no evidence that their behavior is noticeably affected by the presence of electric and magnetic fields. Few studies have attempted to determine whether wildlife may be affected by long-term exposure to these fields. As noted above, some effects of electric and magnetic fields have been found in laboratory animal studies. It is not known whether such effects occur in wildlife similarly exposed to these fields.

Several studies have looked at the behavior and production of livestock raised near transmission lines. These studies found no indication that electric or magnetic fields have any major effects on livestock. Most of the studies were not designed to detect any subtle field effects, however, more detailed information on the potential health effects of electric and magnetic fields can be found in a free BPA publication (incorporated here by reference): "Electrical and Biological Effects of Transmission Lines: A Review (1989)." (Copies may be ordered by calling BPA's document request line at (800) 622-5420.)

APPENDIX E
BIOLOGICAL RESOURCE SURVEY METHODS,
LIMITATIONS AND DESCRIPTIONS OF STATE- AND
FEDERAL-DESIGNATED CANDIDATE SPECIES

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APPENDIX E

**BIOLOGICAL RESOURCE SURVEY METHODS,
LIMITATIONS AND DESCRIPTIONS OF STATE- AND
FEDERAL-DESIGNATED CANDIDATE SPECIES**

E.1 SURVEY METHODS

The focus of the survey was threefold: (1) to describe in general terms the vegetation and wildlife habitats, (2) to identify sensitive and protected species of plants and animals, including Federal- and state-listed rare, threatened, and endangered species, candidate and proposed species and species of special concern that occur or may occur, and (3) identify any wetlands on site.

Literature Review

Prior to the field survey, existing information was obtained and U.S. Fish and Wildlife Service (USFWS) and Washington Department of Wildlife (WDW) and Washington Department of Natural Resources (DNR) personnel were consulted for pertinent background information. Literature reviewed included the WDW's *Species of Concern List* (WDW 1991a), the WDW *Management Recommendations for Washington's Priority Habitats and Species* (WDW 1991b) and the Washington State Department of Natural Resources' (DNR) *Endangered, Threatened and Sensitive Vascular Plants of Washington* (DNR 1990). Requests for information regarding any sensitive species which may be present in project vicinity or at the project site were sent to DNR (dated 15 January 1993) and USFWS (dated 3 February 1993). In addition, the WDW Priority Habitat and Species (PHS) data base was consulted for information on any sightings of sensitive species at the site or in the vicinity. Other information consulted included a U.S. Geological Survey (USGS) 7.5-minute topographic map (Frederickson quadrangle), a National Wetland Inventory (NWI) map, and an aerial photo of the site.

Three reports were reviewed as resource materials in the preparation of this report. The first was the *Topical Outline: Frederickson Generation Project*, prepared for BPA (Science Applications International, 1992). The second was the *Frederickson Power Production Facility Siting Study* (WCC 1992) and the third was the *Tenaska Siting Report* (WCC 1992).

The topical outline provided a preliminary evaluation of environmental issues that would be addressed in the EIS and a site description. However, this report describes conditions for a nearby site located nearby the currently proposed site. The study and siting report detail plant and wildlife species observed at the currently proposed site during a field survey. These

reports were used to supplement information gathered during the latest field survey (February 2, 1993), as described in Section 4.5.1. Discussions with personnel at WDW (Lea Knutsen, personal communication, February 1, 1993) and at USFWS (Michelle Eames, personal communication, March 23, 1993) did not provide information regarding sensitive species/habitats beyond that indicated in these agencies' response letters.

Field Survey

A field survey of the present site was performed on February 2, 1993. This survey included walking the perimeter of the site and a meandering ground transect survey of the interior. Plant species and communities, and wildlife and sensitive species observed were described and noted on the aerial photo. Tree height estimates and diameter-at-breast-height (DBH) measurements were performed. Percent coverage estimates for species over the entire project site were made while in the field. Any unknown plants that could not be readily identified in the field were collected, later identified and verified.

A wetlands survey was performed, concurrent with the vegetation and wildlife survey, according to criteria set forth in the Army Corps of Engineers' (Corps) Federal manual for identifying and delineating jurisdictional wetlands (Federal Interagency Committee for Wetland Delineation).

Limitations

The site was surveyed in early February when an unusually cold spell caused snow and low temperatures throughout the Pacific Northwest. This time of year severely limited the number of identifiable herbaceous plants, compared to those identifiable later in the growing season (late March through October). In addition, many wildlife species which are detectable during the spring, summer, and fall were either absent or inactive. As a consequence the list of plant and animal species developed during the survey is limited by the season in which field studies were conducted. However, a survey conducted by Woodward-Clyde in August 1992, near the end of the growing season, has been used to supplement information gathered for the February survey. Due to a report in the fall of 1993 of a sensitive plant species (white-top aster, *Aster curtus*) in close proximity to the project site, an intensive field survey for this Federal Candidate species was conducted (Salix Associates, 1993). At the time of the survey (early November), the flowering stems of white-top aster were in seed and easily recognizable due to distinct characteristics.

It is probable that white-top aster was not abundant at the time of the August 1992 survey due to prolonged drought conditions. The 1993 season was a particularly strong one for most wildflowers in response to sufficient rainfall.

E.2 DESCRIPTION OF STATE- AND FEDERAL-DESIGNATED CANDIDATE SPECIES

Descriptions of State- and Federal-designated Candidate Species identified during report preparation are provided below.

Western bluebird: The closest record of this Federal-designated sensitive and state-designated candidate species is approximately 3 km (2 miles) west/northwest of the project site. This species requires nesting cavities in large trees or nest boxes for breeding habitat. Like other bluebirds, this species migrates by day, and is found in small flocks when out of the nesting season (Robbins et al., 1983). Potential breeding habitat for this species could exist at the site if any of the trees there contain suitable nesting cavities. In addition, open upland weedy fields surrounding the forested areas at the site could provide suitable foraging habitat. Western bluebirds were not observed during the field visit or for the field survey performed for the Tenaska Siting Report (Woodward-Clyde 1992) and no nesting cavities were observed. It is probable that the field survey for the Siting Report was too early in the summer to detect breeding activity. The winter field visit occurred at a time when bluebirds were not present (they winter farther south). The likelihood of this species inhabiting the project site is moderate to low as the forested area on site is relatively isolated and small.

Western gray squirrel: The closest record of this state-designated candidate species is approximately 5.5 km (3.5 miles) southwest of the project site. This species' habitat extends through western Oregon into central and western Washington. Primarily found in oak groves, this species mostly feeds on acorns, which they gather and bury in preparation as a winter food source. This species uses abandoned woodpecker or flicker holes for a brood den (Ingles 1965). Douglas-fir and oak stands at the project site could provide a source of food for the western gray squirrel. The trees, however, are in a relatively isolated and small clump, which is less suitable than a larger, more extended patch of habitat. No western gray squirrels were observed either for this field survey or that of the Tenaska Siting Report (Woodward-Clyde 1992). At best, it is likely that this species would make only occasional use of this site.

Great blue heron: The closest sighting of this state-monitored species to the project site is 9.5 km (6 miles) southwest. This species is common in fresh as well as saltwater environments (Robbins et al., 1983). In addition, this species also requires large trees for breeding and nesting habitat. Neither water sources nor large trees occur at the project site. No great blue herons were observed during field surveys and it is highly unlikely that this species occurs there.

Purple martin: The closest record of this Federal-designated sensitive and state-designated candidate species is 7 km (4.5 miles) southwest of the project site. This species is locally common where there are multi-celled nesting boxes, cavities or gourds (Robbins et al., 1983). This condition does not exist at the project site. Martins were not observed during field surveys and they are unlikely to occur there.

Bald eagle: The closest record of this Federal-designated and state-designated threatened species is 6.5 km (4 miles) east of the project site. Bald eagles forage almost exclusively on fish, waterfowl and other water-associated birds. All of these potential food sources require aquatic habitats, none of which occur at the site. In addition bald eagles, require large trees for nesting. No trees of a size or configuration suitable as nesting trees for this species are present at the site. No bald eagles were observed during field survey and no recorded nests are located at the site. It is highly unlikely this site, which consists primarily of weedy upland fields and a small patch of Douglas-fir and Oregon white oak trees, would provide any foraging habitat value for bald eagles.

Fisher: The closest record of this Federal-designated candidate 2 and state-designated candidate species is approximately 10.5 km (6.5 miles) east of the project site. This species is found across Oregon and Washington forests. The observation of this species was made in a largely forested area, unlike the more developed habitat found at the project site or within the vicinity (Woodward-Clyde Consultants, 1992). Fishers avoid open areas lacking forest canopy (Douglas and Strickland 1987). No observations of this species were made during field surveys and it is highly unlikely that they occur due to lack of suitable habitat.

White-top aster: This Federal-designated candidate and state-designated sensitive species is found in native prairies of the Puget Trough and the Willamette Valley (WNHP 1981). White-top aster is associated with Idaho fescue (*Festuca idahoensis*). Suitable white-top aster habitat is threatened by expanding agricultural practices, grazing and urban development. White-top aster and Idaho fescue have both been observed at the project site. A map showing the locations of the white-top aster populations is found in Figure 5.5-1 of the text.

Mountain Quail: This Federal-designated candidate species is common in mountain regions in mixed woodlands and chaparral. Although the project site is not located in a mountainous region and true chaparral habitat is not present at the site, chaparral-like conditions are present in the upland weedy fields; a low, closed canopy composed primarily of non-deciduous shrubs. No mountain quail were observed during field surveys. There is a moderate to low likelihood of this species utilizing the site.

Northern red-legged frog and spotted frog: Both of these Federal-designated candidate species require a seasonal or perennial water source for suitable habitat. No water sources occur at the site and it is highly unlikely that either of these species are present there.

Tacoma western pocket gopher: This Federal-designated candidate species is found along the lower Umpqua River in western Oregon and from prairies to alpine meadows west of the Cascade Mountains in Washington, Oregon and northern California. As it digs for food, this species burrows in an area up to 185 square meters (2000 square feet) (Ingles 1965). The western pocket gopher does not hibernate or become inactive at any time of the year and may burrow through snow, feeding on stems of grass and other plants at ground surface. Evidence of burrowing systems were observed at the project site, although it was not determined whether this was from pocket gophers or moles (*Scapanus* sp.).

TABLE E-1
PLANTS OBSERVED AT THE TENASKA SITE ON
AUGUST 13, 1992, FEBRUARY 2, 1993, AND NOVEMBER 1993

Common Name	Scientific Name
Trees	
Douglas-fir	<i>Pseudotsuga menziesii</i>
Oregon white oak	<i>Quercus garryana</i>
Shrubs	
Cascara	<i>Rhamnus purshiana</i>
Douglas-fir	<i>Pseudotsuga menziesii</i> (young)
Elderberry	<i>Sambucus</i> spp.
Indian plum	<i>Oemleria cerasiformis</i>
Low Oregon grape	<i>Mahonia (Berberis) nervosa</i>
Mock orange	<i>Philadelphus lewisii</i>
Mountain ash	<i>Sorbus</i> sp.
Oregon white oak	<i>Quercus garryana</i> (young)
Ponderosa pine	<i>Pinus ponderosa</i>
Scotch broom	<i>Cytisus scoparius</i>
Serviceberry	<i>Amelanchier alnifolia</i>
Snowberry	<i>Symphoricarpos albus</i>
Tall Oregon grape	<i>Mahonia (Berberis) aquifolium</i>
Herbs	
Bearberry	<i>Arctostaphylos uva-ursi</i>
Blue wildrye	<i>Elymus glaucus</i>
Blueleaf strawberry	<i>Fragaria virginiana</i>
Bracken fern	<i>Pteridium aquilinum</i>
Bull thistle	<i>Cirsium vulgare</i>
Camas sp.	<i>Camassia</i> sp
Colonial bentgrass	<i>Agrostis tenuis</i>
Common St. John's Wort	<i>Hypericum perforatum</i>

TABLE E-1
PLANTS OBSERVED AT THE TENASKA SITE ON
AUGUST 13, 1992, FEBRUARY 2, 1993, AND NOVEMBER 1993 (Continued)

Common Name	Scientific Name
Herbs (continued)	
Common velvetgrass	<i>Holcus lanatus</i>
Early blue violet	<i>Viola adunca</i>
English plantain	<i>Plantago lanceolata</i>
Goatsbeard sp.	<i>Tragopogon</i> sp.
Goldenrod sp.	<i>Solidago</i> sp.
Harebell sp.	<i>Campanula</i> sp.
Hawthorne sp. (introduced)	<i>Crataegus</i> sp. (<i>monogyna</i> ?)
Idaho fescue	<i>Festuca idahoensis</i>
Kentucky bluegrass	<i>Poa pratensis</i>
Marguerite	<i>Chrysanthemum leucanthemum</i>
Nightshade sp.	<i>Solanum</i> sp.
Orchardgrass	<i>Dactylis glomerata</i>
Red clover	<i>Trifolium pratense</i>
Red fescue	<i>Festuca rubra</i>
Self-heal	<i>Prunella vulgaris</i>
Sheep sorrel	<i>Rumex acetosella</i>
Silver hairgrass	<i>Aira caryophyllea</i>
Spotted cat's ear	<i>Hypochaeris radicata</i>
Stinging nettle	<i>Urtica dioica</i>
Tall fescue	<i>Festuca arundinacea</i>
Tansy ragwort	<i>Senecio jacobea</i>
Trailing blackberry	<i>Rubus ursinus</i>
White-top aster	<i>Aster curtus</i>
Wooly sunflower	<i>Eriophyllum lanatum</i>

Source: Woodward-Clyde Consultants, 1992 and 1993, and Salix Associates, 1993.

TABLE E-2
WILDLIFE (OR RECOGNIZABLE SIGNS) OBSERVED AT THE TENASKA SITE
ON AUGUST 13, 1992 AND FEBRUARY 2, 1993

Common Name	Scientific Name
Mole	<i>Scapanus</i> (sp.)
Pocket gopher	<i>Thomomys</i> (sp.)
American robin	<i>Turdus migratoris</i>
Barn swallow	<i>Hirundo rustica</i>
Dark-eyed junco	<i>Junco hyemalis</i>
House finch	<i>Carpodacus mexicanus</i>
Mourning dove	<i>Zenaida macroura</i>
European starling	<i>Sturnus vulgaris</i>
Band-tailed pigeon	<i>Columba fasciata</i>
Great horned owl	<i>Bubo virginianus</i>

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APPENDIX F
ARCHAEOLOGICAL RESOURCE SURVEY METHODS

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APPENDIX F

ARCHAEOLOGICAL RESOURCE SURVEY METHODS

Prior to field surveys a pre-survey investigation was completed. The investigation consisted of three stages, including:

- Review of Pierce County archaeological survey reports and site and historic structure records from the Washington State Office of Archaeology and Historic Preservation (OAHP)
- Examination of General Land Office (GLO) plats and relevant archaeological, ethnohistorical, and historical publications and reports available from the University of Washington
- Review of a U.S. Geological Survey 7.5 minute topographic map (Frederickson quadrangle) to facilitate identification of geomorphic features on the ground

A field survey of the study area was conducted by Historical Research Associates, Inc., in late January and early February of 1993. This survey included walking through the power plant site and its associated pipeline and transmission line corridors using a 20-meter (65-foot) survey transect interval. Transect intervals were oriented along an east-west axis. An additional 60-meter (200-foot) buffer zone surrounding the proposed power plant was surveyed. A 25-meter (80-foot) corridor along both sides of the proposed pipeline and transmission line routes was also surveyed.

The site is characterized by a dense understory of vegetation (see Section 4.5, Vegetation and Wildlife, for a complete description). Consequently, visibility of the ground surface is reduced substantially. Because systematic clearing of vegetation in order to view the entire site surface was not practical, alternative survey techniques were utilized. These techniques included examining areas around the base of fallen trees and other surface exposures where encountered. In order to inspect the ground surface more closely, meter-square (roughly yard-square) plots of vegetation were cleared every 50 to 100 meters (165 to 330 feet) along the transect lines established for the survey.

APPENDIX G

AIR QUALITY/PUBLIC HEALTH AND SAFETY

NOTE TO READER

The air quality information contained in this appendix is excerpted from "Notice to Construct Application, Tenaska Washington II Generation Project, Frederickson, Washington," Tenaska Washington Partners II, L.P., December 1993. Complete air quality information can be found in the application. Also included is an excerpt of Tenaska's December 3, 1993, letter to PSAPCA revising emissions data for particulate matter and impact analyses.

Contents

- 6.0 Air Quality Impact Methodology
- 7.0 Air Quality Impacts
- 8.0 References
- 9.0 Supporting Data for Emission Calculations
- 10.0 MSDS for DCL 500
- 11.0 December 3, 1993, Letter to Mr. Fred L. Austin (PSAPCA) Request for Modification to DRAFT Notice of Construction Permit/Order of Approval for Tenaska Washington II Generation Project with Attachment I - Revised Emissions Calculations.

AIR QUALITY IMPACT METHODOLOGY

6.1 APPROACH

Air quality dispersion modeling analyses were performed to demonstrate that the proposed project will not cause or contribute to the violation of ambient air quality standards for attainment pollutants (NO_2 , SO_2 , TSP/PM_{10}), and not cause a significant impact for non-attainment pollutants (CO and ozone). Further, although the proposed source is not a major source, the analysis includes an assessment of potential PSD increment consumption (Class I and II increments) from the proposed source. The following is a description of the dispersion models used, meteorological data used, treatment of building wake effects (where applicable), input databases for the models, and available existing background air quality. A Level-2 visibility analysis (USEPA 1988) was performed using the VISCREEN model to evaluate the visual impact a plume might have at Mt. Rainier National Park (the closest PSD Class I area).

6.1.1 Description of Air Quality Dispersion Models

Maximum project impacts are expected to occur very near the facility. The air quality modeling analysis to assess the maximum impacts utilized the USEPA's Industrial Source Complex model (ISCST2), Version 92062. The ISC model (USEPA 1992) is recommended as a guideline model for assessing the impact of aerodynamic downwash. The results from the use of this model were used to estimate maximum impacts for assessing compliance with the ambient standards, PSD Class II increments, and potential maximum toxic impacts near the facility.

The ISC model consists of two programs: a short-term model (ISCST2) and a long-term model (ISCLT2). The ISCST2 program utilizes an hourly meteorological data base, while ISCLT2 is a sector-averaged program using a frequency of occurrence based on categories of wind speed, wind direction, and atmospheric stability. Major features of the ISC model are as follows:

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- Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs 1971 and 1975);
- The influence of building wakes on plume transport and dispersion is evaluated by the Huber and Snyder method (1976, 1977) for physical stack heights that are greater than $h_b + 0.5L_b$, where h_b is the building height and L_b is the lesser of the building height or width, and by the Schulman and Scire method (1980a, 1980b, 1985, 1986) for stack heights that are less than $h_b + 0.5L_b$;
- Terrain truncation algorithm;
- Regulatory default option;
- Calm wind treatment of NWS meteorological data;
- Buoyancy-induced plume rise algorithm;
- Procedures suggested by Briggs (1973) for evaluating stack-tip downwash;
- Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations;
- Capability of simulating line, volume, and areas sources;
- Concentration estimates for 1-hour to annual average; and
- Adjustment procedures for complex terrain.

Version 92062 retained much of the features of the earlier versions, corrected "bugs," as well as extending the direction-specific treatment of building downwash influences from the Schulman-Scire algorithm for shorter stacks to the Huber-Snyder algorithm for stacks up to the GEP stack height. Also, the regulatory default option was selected such that the USEPA

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guideline requirements were met. Details of the modeling algorithms employed by ISC may be found in the User's Guide for ISC (USEPA 1987).

To assess potential impacts at Mt. Rainier, the EPA-approved COMPLEX-I model was used. COMPLEX-I allows for estimation of ambient concentrations in terrain with elevations higher than stack top. Regulatory default options were selected such that USEPA guideline requirements were met in the use of this model.

Because Mt. Rainier is located some distance away, and for simplicity, a single point located on the park boundary closest to the project site was evaluated. Ambient concentrations are expected to be lower at all other points within the park area. Impacts predicted at this point will represent the maximum concentrations expected for the entire park area.

6.1.2 GEP Stack Height and Treatment of Building Wake Effects (ISCST only)

The stack height regulation promulgated by USEPA on July 8, 1985 (50 FR 27892) established a stack height limitation to assure that stack height increases and other plume dispersion techniques would not be used in lieu of constant emission controls. This regulation applies to facilities that commenced construction after December 31, 1970, and to dispersion techniques implemented after that date. The regulation specifies that Good Engineering Practice (GEP) stack height is the maximum creditable stack height which a source may use in establishing its applicable State Implementation Plan (SIP) emission limitation. For stacks uninfluenced by terrain features, the determination of a GEP stack height for a source is based on the following empirical equation:

$$H_g = H + 1.5L_b$$

where: H_g = GEP stack height;

H = Height of the structure on which the source is located, or nearby structure; and

L_b = Lesser dimension (height or width) of the structure on which the source is located, or nearby structure.

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Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the direction of the wind. The area in which a nearby structure can have a significant influence on the source is limited to five times the lesser dimension (height or width) of that structure, or within 0.5 mile (0.8 km) of the proposed stack, whichever is less. The methods for determining GEP stack height for various building configurations have been described in USEPA's technical support document (USEPA 1985a).

The computation of projected building dimensions was performed using the Bowman Environmental Engineering (BEE) GEP preprocessing program. The BEE GEP program builds a mathematical representation of each building to determine projected building dimensions and the potential zone of influence of each building. These calculations were performed for 36 different wind directions.

The input to the BEE GEP preprocessing program consisted of all emission sources and structures along with corresponding building dimensions. Figure 6-1 illustrates those building structures that would have an influence on the proposed stacks at the Tenaska project site. Input and output for the BEE GEP program are contained in Appendix C.

6.1.3 Source Input Data

The proposed source will consist of a single gas turbine and HRSG (as described in Section 2.0), with a single 100-foot stack. Table 6-1 presents the source parameters of the stack used in the air quality dispersion analysis. While the actual exit velocity is expected to vary with ambient conditions and load requirements (see Appendix B for details), the value presented in Table 6-1 represents expected annual average conditions.

6.1.4 Meteorological Data

The meteorological data base used in the dispersion model consisted of 5 years (1980-1984) of surface and coincident upper air observations at the NWS station McChord AFB and Quillayute, Washington, respectively, obtained from the National Climatic Data Center. Surface observations consist of hourly measurements of wind direction, wind speed, and temperature, and estimates of ceiling height and cloud cover. The upper air station provides

a daily morning and afternoon mixing height value as determined from the twice-daily radiosonde measurements. These surface and upper air data were processed into a format suitable for dispersion modeling by USEPA's RAMMET program (Turner and Novak 1978). RAMMET utilizes the Turner Classification Scheme (Turner 1970) to estimate the dispersive capacity of the atmosphere. Using the surface observations of wind speed and cloud cover combined with an estimate of insolation based on solar altitude, a stability class category is assigned for each hour of meteorological surface data. The twice-daily mixing height values are interpolated by a USEPA scheme (USEPA 1974) to obtain hourly mixing height values. The USEPA developed a rural and urban interpolation method to account for the effects of the surrounding area on development of the mixing layer boundary.

For the visual impact modeling, the five years processed data were evaluated and a joint frequency distribution (JFD) of wind direction and wind speed was compiled for each stability class (A-F) and each of four periods of the day (hours 1-6, 7-12, 13-18, and 19-24) pursuant to USEPA guidelines on Plume Visual Impact analysis (USEPA 1988). This JFD is contained in Appendix E.

6.1.5 Receptor Grid

A receptor grid of variable density for the ISC dispersion model was designed to identify the maximum air quality impacts due to the proposed project. The total receptor grid, illustrated in Figure 6-2, consisted of 991 receptors extending to 5 kilometers from the facility. The coarse receptor grid portion consisted of 500 m spacing from 1 km out to 5 km. The refined receptor grid portion consisted of two groups. The first group used a 50-meter spacing from the source stack out to 250 m, excluding locations within the project boundary. The second group utilized a 100 meter spacing out to 1000 m. Figure 6-3 shows facility boundary and the refined grid receptors.

All locations within Mt. Rainier National Park are at elevations above the project stack height. For the COMPLEX-I model run, the location of the closest point on the Mt. Rainier Park boundary to the project was used. This is expected to conservatively represent impacts within the Mt. Rainier Park area.

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6.1.6 Background Air Quality Data

There is currently no air quality monitoring being conducted near the project area. To represent background concentrations of NO₂, SO₂, TSP/PM₁₀, and CO, the Washington Department of Ecology and PSAPCA provided air quality data from around the project area. It is believed that the data collected at these sites are representative of regional background ambient concentrations in the area of the proposed Tenaska facility. These background data are presented in Table 6-2. These background concentrations were added to the maximum predicted concentrations for comparison to the Washington ambient air quality standards (WAAQS), as appropriate.

6.2 TOXIC IMPACTS

Analysis of toxic impacts from the proposed project include those pollutants as described in Section 3 that are on PSAPCA's list of toxic compounds in Regulation III, Appendix A.

For natural gas firing, toxic compounds are estimated as a fraction of the VOC emissions. Maximum potential toxic impacts are estimated as the applicable fraction of maximum VOC impacts. The predicted impacts are compared to the appropriate acceptable source impact level (ASIL).

For No. 2 fuel oil firing, both toxic VOC species and other trace elements are evaluated. VOC species are, as for gas firing, a fraction of total VOC emissions. Trace metals emissions/impacts are based on fuel consumption. Impacts are pro-rated for annual periods to account for the infrequency of oil firing. Estimated impacts are compared to the appropriate ASILs.

6.3 VISIBILITY

Due to the proximity of the Mt. Rainier Class I area, the potential impacts to visibility were evaluated.

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To assess the impact of the proposed project on visibility, a Level-2 analysis was made using the JFD described in Section 6.1.3 and following methods described in Workbook for Plume Visual Impact Screening and Analysis (EPA 450/4-88-015).

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Table 6-1

**SOURCE PARAMETERS AND COORDINATES
TENASKA WASHINGTON II GENERATION PLANT
GE FRAME 7FA**

Stack Height (m)	30.48
Stack Diameter (m)	5.49
Exit Temperature (K)	360.2
Exit Velocity (m/s)	20.14
Stack Coordinates:	
UTM East (km)	548.225
UTM North (km)	5214.706
Base Elevation (ft)	410

TABLE 6-2

REPRESENTATIVE BACKGROUND AIR QUALITY DATA

Pollutant	Background Concentration ($\mu\text{g}/\text{m}^3$)
NO ₂ ^a	
Annual	30
SO ₂ ^b	
Annual	27
24-hour	106
3-hour	319
1-hour	426
PM ₁₀ ^c	
Annual	29
24-hour	85
TSP ^d	
Annual	41
24-hour	121

Notes:

- ^a Value reported by Dept. of Ecology (1992)
- ^b As measured in Tacoma area (Ecology, 1991)
- ^c Data from PSAPCA (Knectel, 1992) from measurements taken in Puyallup, WA
- ^d Estimated from PM₁₀ data assuming PM₁₀ = 0.70 TSP (Knectel, 1992)

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LEGEND

1. COOLING TOWER (120' X 40' X 45')
2. TURBINE BUILDING (180' X 110' X 70')
3. CONTROL & SWITCHGEAR BUILDING (70' X 40' X 30')
4. AMMONIA TANK (8' X 35')
5. HEAT RECOVERY STEAM GENERATOR (150' X 25' X 75')
6. RAW WATER STORAGE TANK (44' X 54')
7. NEUTRALIZATION TANK (18' X 27')
8. DEMINERALIZED WATER STORAGE TANK (40' X 48')
9. WATER TREATMENT BUILDING (40' X 40' X 30')
10. LAB (35' X 22' X 14')
11. MAINTENANCE/OFFICE BUILDING (90' X 40' X 30')
12. OIL STORAGE TANK (35,000 bbls.) (70' X 59')
13. PUMP BUILDING (35' X 28' X 22')
14. H.R.S.G. STACK (18' X 100')

ALL DIMENSIONS ARE LISTED
AS LENGTH X WIDTH X HEIGHT
OR DIAMETER X HEIGHT

PRELIMINARY
NOT FOR
CONSTRUCTION

THIS DRAWING IS FOR INFORMATION
AND ILLUSTRATION ONLY AND SHALL
NOT BE USED FOR DESIGN
OR CONSTRUCTION.

TENASKA WASHINGTON II
GENERATION PLANT

BONNEVILLE POWER ADMINISTRATION
MAJOR EQUIPMENT AND
BUILDING DIMENSIONS

NO.	DATE	BY	CHKD.	REVISED	REVISION
1	10/14/84	J.L.			REVISED
2	10/14/84	J.L.			REVISED
3	10/14/84	J.L.			REVISED
4	10/14/84	J.L.			REVISED
5	10/14/84	J.L.			REVISED
6	10/14/84	J.L.			REVISED
7	10/14/84	J.L.			REVISED
8	10/14/84	J.L.			REVISED
9	10/14/84	J.L.			REVISED
10	10/14/84	J.L.			REVISED
11	10/14/84	J.L.			REVISED
12	10/14/84	J.L.			REVISED
13	10/14/84	J.L.			REVISED
14	10/14/84	J.L.			REVISED

BY: JAMES L. LARSEN, JR.
Engineer - Architecture/Structural

Project No. 92C0548A	Tenaska Washington II Generation Project	BUILDING STRUCTURES ANALYZED FOR GEP	Figure 6-1
Woodward-Clyde Consultants

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Project No. 92C0548A	Tenaska Washington II Generation Project	RECEPTOR GRID USED IN AIR QUALITY ANALYSIS	Figure 6-2
Woodward-Clyde Consultants

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Project No. 92C0548A	Tenaska Washington II Generation Project	FACILITY PROPERTY BOUNDARY AND NEARBY FINE GRID RECEPTORS	Figure 6-3
Woodward-Clyde Consultants			

7.1 SUMMARY

This section presents modeled air quality impacts of emissions and visual impacts from the proposed Tenaska facility project. The results of the ISCST and COMPLEX-I models show that NO₂, TSP/PM₁₀, CO, and SO₂ impacts near the project site, as well as at Mt. Rainier National Park, will be below EPA and PSAPCA significance levels (see Table 4-1), and further, will not result in a violation of the ambient air quality standards. Results from the Level-2 visual impact analysis indicate that potential impacts to visibility in Mt. Rainier National Park will be below conservative significance criteria for plume perceptibility and contrast.

7.2 COMPLIANCE WITH NONATTAINMENT AREA REQUIREMENTS

The proposed project must demonstrate that expected impacts from nonattainment pollutant emissions will not significantly contribute to violation of the federal and/or state ambient standard for that pollutant; this must be done through the use of very stringent control technology and offsets, if necessary. Both VOC (as a precursor to ozone) and CO are nonattainment pollutants in the project area. Determining whether the project has a significant impact on the nonattainment status for VOC and CO was performed pursuant to PSAPCA Regulation I, Article 6, Section 6.08.

This project is being designed to utilize very stringent emission control technology. Table 7-1 shows that expected emissions for both CO and VOC are below the thresholds for which a significant impact is defined. Additionally, the predicted ambient concentration increase for CO is well below the significant impact concentration threshold. Consequently, the proposed project is not expected to have a significant impact on the nonattainment areas for CO or ozone, and will not be subject to the requirements to obtain offsets or further control requirements.

elements were based on fuel consumption, and emission rates were used directly to obtain predicted impacts from modeling results (Chi/Q).

Tables 7-5 and 7-6 show that the predicted maximum air toxic impacts from both natural gas and oil firing are well below the acceptable source impact levels (ASILs). These tables indicate whether the compound is either a carcinogen or a non-carcinogen. The only compound that is expected from both gas and oil firing is benzene, and combining the predicted impacts from each fuel scenario still indicates that impacts are well within acceptable levels.

Consequently, the proposed project is not expected to pose a risk with respect to toxic air contaminants from the turbine/HRSG.

7.5 VISIBILITY IMPACTS

An analysis of impacts from the proposed project on visibility in Mt. Rainier National Park was performed at the request of the Washington Department of Ecology. This analysis followed guidelines given in the "Workbook for Plume Visual Impact Screening and Analysis" (USEPA 1988) for a Level-2 analysis. The study was performed using both the 50th percentile value for background visual range (BVR) for the Mt. Rainier area currently accepted by Ecology (160 km), and the 90th percentile BVR value recommended for the area by the National Park Service (242 km). The meteorological database utilized for this analysis was described in Section 6.0.

The project site is located approximately 35 km to the northwest of Mt. Rainier. Using an appropriate USGS map, it was determined that wind directions from 279 through 320 degrees, inclusive, would potentially bring the plume into Mt. Rainier. Conservatively, all of the West, West-Northwest, and Northwest sectors (from 258.75 degrees to 331.25 degrees azimuth) were used in the analysis to represent the worst-case wind direction that would bring the plume to Mt. Rainier. Following guidance from the workbook cited above, using the three wind direction sectors (W, WNW, and NW), the dispersion condition related to the cumulative frequency of occurrence greater than 1 percent was D stability and a wind speed of 3 m/s. Table 7-7 shows the analysis of worst-case meteorological conditions for plume visual impact calculations that led to the choice of this dispersion condition. This

Table 7-1

**ESTIMATED EMISSIONS AND IMPACTS OF NONATTAINMENT POLLUTANTS
TO DETERMINE SIGNIFICANT IMPACT**

Pollutant	Averaging Time	Emissions (tons/yr)	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)	PSAPCA Significant Emissions (tons/yr)	PSAPCA Concentration Impact Thresholds ($\mu\text{g}/\text{m}^3$)
CO	Annual	91.2		100	
	8-hr		3.0		500
	1-hr		15.0		2000
VOC	--	37.0	--	40	--

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Table 7-2
RESULTS FROM ISC-2 MODEL
MAXIMUM IMPACT FOR ATTAINMENT POLLUTANTS

Pollutant	Averaging Time	Maximum Emissions GT/HRSG (g/s)	Maximum Modeled X/Q GT/HRSG	Maximum Project Impact GT/HRSG ($\mu\text{g}/\text{m}^3$)	Significant Impact Thresholds ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	2.8	0.011	0.0	1
TSP	24-hr, highest	2.7	0.377	1.0	5
	24-hr, highest, second high	2.7	0.175	0.5	--
	Annual	1.5	0.011	0.0	1
PM ₁₀	24-hr, highest	2.6	0.377	1.0	5
	24-hr highest, second high	2.6	0.175	0.5	--
	Annual	1.4	0.11	0.0	1
SO ₂	1-hr	11.7	5.018	58.5	--
	3-hr, highest	11.7	1.737	20.3	25
	3-hr, highest, second high	11.7	1.111	13.0	--
	24-hr, highest	11.7	0.377	4.4	5
	24-hr, highest, second high	11.7	0.175	2.0	--
	Annual	1.6	0.11	0.0	1

Notes: Maximum emissions based on: continuous fuel oil firing for 1-, 3-, 8-, and 24-hour periods; weighted annual average fuel oil and gas use for annual emissions (oil = 120 hours, gas = 8,400 hours).

CO and ozone are nonattainment, VOC is considered for ozone nonattainment.
Table 7-1 gives information for nonattainment impacts.

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Table 7-3

**COMPARISON OF MODELED PROJECT IMPACTS WITH PSD INCREMENTS
AND AMBIENT AIR QUALITY STANDARDS**

Pollutant	Averaging Time	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)	PSD Class II Increments ^a ($\mu\text{g}/\text{m}^3$)	Background Concentration ^b ($\mu\text{g}/\text{m}^3$)	Total Project Impact ($\mu\text{g}/\text{m}^3$)	Washington State Standards ($\mu\text{g}/\text{m}^3$)	National Standards ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	0.0	25	30	30	100	100
TSP	24-hr	0.5 ^c	37 ^d	121	121	150 ^d	--
	Annual	0.0	19	41	41	60	--
PM ₁₀	24-hr	0.5 ^c	-- ^e	85	85	150 ^d	150 ^d
	Annual	0.0	-- ^e	29	29	50	50
SO ₂	1-hr	58.5	--	426	485	1045	--
	3-hr	13.0 ^c	512 ^d	319	332	--	1300 ^{d,f}
	24-hr	2.0 ^c	91 ^d	106	108	260 ^d	365 ^{d,g}
	Annual	0.0	20	27	27	50	80

^a 40 CFR 52.21^b Based on data available from PSAPCA and Ecology for Frederickson area^c highest, second-high concentration^d concentration not to be exceeded more than once a year^e PSD increments for PM₁₀ not promulgated^f Secondary standard^g Primary standard

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Table 7-4

**MAXIMUM PROJECT IMPACTS AT
MT. RAINIER NATIONAL PARK BOUNDARY (CARBON RIVER ENTRANCE)**

Pollutant	Averaging Time	Maximum Emissions GT/HRSG (g/s)	Maximum Modeled X/Q GT/HRSG	Maximum Project Impact GT/HRSG ($\mu\text{g}/\text{m}^3$)	Class I PSD Increment ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	2.8	0.001	0.0	2.5
TSP	24-hr	2.7	0.011	0.0 ^a	10 ^b
	Annual	1.5	0.001	0.0	5
PM ₁₀	24-hr	2.6	0.011	0.0	--
	Annual	1.4	0.001	0.0	--
SO ₂	3-hr	11.7	0.036	0.4 ^a	25 ^b
	24-hr	11.7	0.011	0.1 ^a	5 ^b
	Annual	1.6	0.001	0.0	2

Notes: Maximum emissions based on: continuous fuel oil firing for 1-, 3-, 8-, and 24-hour periods; weighted average fuel oil and gas use for annual emissions (oil = 120 hours, gas = 8,400 hours per year).

Based on COMPLEX-I model results at 35 km (distance to closest point in Mt. Rainier National Park).

^a Highest, second-high concentration.

^b Concentration not to be exceeded more than once a year.

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Table 7-5

**PREDICTED MAXIMUM AIR TOXIC IMPACTS FROM TURBINE/HRSG
(NATURAL GAS-FIRING)**

	Type	Toxic Impacts ($\mu\text{g}/\text{m}^3$)	WA DOE ASIL ($\mu\text{g}/\text{m}^3$)	Exceedence (Y/N)
Isomers of Hexane	B	0.00120	5994	N
N-Butane	B	0.05978	6327	N
N-Pentane	B	0.00777	5994	N
Hexane	B	0.00120	599.4	N
Heptane	B	0.00120	5328	N
Octane	B	0.00120	4825.5	N
Nonane	B	0.00060	3496.5	N
Cyclopentane	B	0.00120	5727.6	N
Cyclohexane	B	0.00060	3496.5	N
Methylcyclohexane	B	0.00120	5328	N
Formaldehyde	A	0.00101	0.077	N
Acetaldehyde	A	0.00004	0.45	N
Isomers of Xylene	B	0.00120	1448.5	N
Benzene	A	0.00014	0.12	N
Toluene	B	0.00239	1248.8	N
Ethylbenzene	B	0.00060	1448.6	N
O-Xylene	B	0.00060	1448.6	N
M-Xylene	B	0.00060	1448.6	N
1,3,5-Trimethylbenzene	B	0.00120	416.3	N
1,2,4-Trimethylbenzene	B	0.00060	416.3	N
1,2,3-Trimethylbenzene	B	0.00060	416.3	N

Type A carcinogen, annual average
 Type B non carcinogen, 24-hour average
 Type C carcinogen, 24-hour average
 Type D fed. CAA listing, but not in WAC 173-460

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TABLE 7-6
PREDICTED MAXIMUM TOXIC IMPACTS FROM TURBINE/HRSG
(OIL-FIRING)

Organics	Type	Toxic Impacts ($\mu\text{g}/\text{m}^3$)	WA DOE ASIL ($\mu\text{g}/\text{m}^3$)	Exceedence (Y/N)
1,3-Butadine	C	0.08521	73.3	N
Benzene	A	2.24E-05	0.12	N

Trace Elements

	Type	Toxic Impacts ($\mu\text{g}/\text{m}^3$)	WA DOE ASIL ($\mu\text{g}/\text{m}^3$)	Exceedence (Y/N)
Aluminum	B	0.016994	33.3	N
Antimony	B	0.002496	1.7	N
Arsenic	A	1.56E-07	0.00023	N
Barium	B	0.00223	1.7	N
Beryllium	A	1.04E-08	0.00042	N
Boron	B	0.007435	3.3	N
Bromine	B	0.000478	33.3	N
Cadmium	A	1.34E-07	0.00056	N
Calcium	B	0.087626	6.7	N
Chromium	B	0.005311	1.7	N
****	A	1.49E-08	0.000083	N
Cobalt	B	0.001036	33.3	N
Copper	B	0.153479	3.3	N
Magnesium	B	0.026553	33.3	N
Manganese	B	0.038503	16.7	N
Mercury	B	0.000104	0.3	N
Molybdenum	B	0.000956	16.7	N
Nickel	C	0.139671	3.3	N
Selenium	B	0.000611	0.7	N
Tin	B	0.009294	6.7	N
Vanadium	B	0.000505	0.2	N
Zinc	B	0.078067	16.7	N
PAH (as Benzo[a]pyrene)	A	3.73E-09	0.0006	N

**** Emissions of Chromium(vi) assumed to be .01 * Chromium(iii)

Type A carcinogen, annual average

Type B non carcinogen, 24-hour average

Type C carcinogen, 24-hour average

Type D fed. CAA listing, but not in WAC 173-460

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Table 7-7

**ANALYSIS OF WORST-CASE METEOROLOGICAL CONDITIONS
FOR PLUME VISUAL IMPACT CALCULATIONS**

Dispersion Condition (stability, wind speed [m/s])	Sigma z · u (m ² /s)	Transport Time (hours)	Frequency of Occurrence of Worst-Case Wind Direction (percent)				Frequency # and Cumulative Frequency (percent)	
			1 - 6	7 - 12	12 - 18	18 - 24	freq.	cum. freq.
F, 1	72	19 **	0.659	0.025	0.002	0.868	0.000	0.000
E, 1	135	19 **	0.148	0.031	0.021	0.274	0.000	0.000
F, 2	144	6	0.086	0.005	0.000	0.254	0.254	0.254
F, 3	215	4	0.009	0.000	0.000	0.046	0.046	0.300
E, 2	270	6	0.030	0.009	0.005	0.176	0.176	0.476
D, 1	272	19 **	0.392	0.318	0.251	0.518	0.000	0.476
F, 4	287	3	0.002	0.000	0.000	0.009	0.009	0.485
F, 5	359	2	0.000	0.000	0.000	0.000	0.000	0.485
E, 3	405	4	0.028	0.004	0.011	0.181	0.181	0.666
E, 4	540	3	0.002	0.000	0.002	0.054	0.054	0.720
D, 2	544	6	0.084	0.224	0.169	0.217	0.224	0.944
E, 5	675	2	0.000	0.002	0.000	0.002	0.002	0.946
D, 3	815	4	0.030	0.239	0.534	0.255	0.534	1.480

Notes: Analysis performed pursuant to guidance in USEPA 1988
 Distance to Class I area is approximately 35 kilometers
 ** Dispersion conditions with transport times greater than 12 hours not included in analysis
 # Frequency chosen is maximum of the four different time periods

CORRECTED
12/23/92

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Table 7-8

SUMMARY OF PLUME VISUAL IMPACT SCREENING RESULTS FOR
AREAS INSIDE MT. RAINIER NATIONAL PARK

Background Visual Range (km)	<u>Maximum Predicted Plume Perceptibility Parameters</u>				<u>Plume Parameter Screening Thresholds</u>	
	<u>Delta-E</u>		<u>Contrast</u>		Delta-E	Contrast
	Gas Firing	Oil Firing	Gas Firing	Oil Firing		
160	0.222	0.347	0.002	0.004	2.0	0.5
242	0.533	0.831	0.005	0.008	2.0	0.5

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-
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SUPPORTING DATA FOR EMISSION CALCULATIONS

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Storage Tank
Emission Report
Wednesday, December 16 1992
3:39 PM

=====

Identification

Identification No.: 92C0548A
City: Olympia
State: Washington
Company: Tenaska Washington Partners II

Input Parameters

Type of Tank: Vertical Fixed Roof

Tank Dimensions

Shell Height (ft): 48
Diameter (ft): 73
Liquid Height (ft): 47
Volume(gallons): 1471670
Turnovers: 1
Net Throughput (gal/yr): 1471670

Roof Characteristics

Roof Type: Dome
Slope (ft/ft): 0.00000

Paint Characteristics

Shell Color/Shade: White/White
Shell Condition: Good
Roof Color/Shade: White/White
Roof Condition: Good

Breather Vent Settings

Vacuum Setting(psig): 0.00
Pressure Setting(psig): 0.00

=====

Liquid Contents of Storage Tank

Mixture Name: Distillate Fuel Oil No. 2

Report Time Period: 1 Year

=====

Emission Summary

Mixture Name	Standing Losses (lb)	Working Losses(lb)	Total
Distillate Fuel Oil No. 2	32.23	21.80	54.03

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YIMC FOR INDIAN

TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 20°F Compressor Inlet, 300 MMBtu/hr Annual Average Duct Firing

Date: December 8, 1992

Fuel Type: Natural Gas

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(gr/dscf)	(lbs/hr)	(gr/dscf)	(lbs/hr)
Gas Turbine (W/O SCR)	8400					42.0	285.0	1.4	10.4	25.1	81.0	0.8	1.5	0.0014	9.0	0.0014	9.0
HRSG (W/O SCR)	8400					3.0	24.0	0.2	1.7	9.3	30.0	5.9	10.8	0.0005	3.0	0.0004	2.4
GT/HRSG (W/SCR)	8400	100	18.0	189	1,076,100	3.0	23.8	1.6	12.0	6.9	22.2	4.7	8.6	0.0019	12.0	0.0018	11.4

Notes:

1. GT/HRSG combination exhausts through one common stack
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency)
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency)
4. Gas Turbine and HRSG NO_x emissions are reduced to 7.7% of uncontrolled emissions by SCR (92.3% catalyst efficiency)
5. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
6. All ppm reported by volume on a dry basis.
7. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
8. Natural gas is assumed to contain 2 grains sulfur per 100 scf. Actual sulfur content is expected to be under 1 grain per 100 scf.
9. Calculations assume operating 8,520 total hours per year with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

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TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 20°F Compressor Inlet, 300 MMBtu/hr Annual Average Duct Firing

Date: December 8, 1992

Fuel Type: Number 2 Distillate Oil

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(gr/dscf)	lbs/hr	(gr/dscf)	lbs/hr
Gas Turbine (W/O SCR)	120					65.0	461.0	12.2	90.9	25.1	82.0	4.0	7.5	0.0027	17.0	0.0027	17.0
HRSG (W/O SCR)	120					2.9	24.0	0.2	1.7	9.2	30.0	5.8	10.8	0.0005	3.0	0.0004	2.4
GT/HRSG (W/SCR)	120	100	18.0	189	1,071,100	8.0	65.5	12.5	92.5	6.9	22.4	6.9	12.8	0.0032	20.0	0.0031	19.4

Notes:

1. GT/HRSG combination exhausts through one common stack.
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency).
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency).
4. Gas turbine and HRSG NO_x emissions are reduced to 13.5% of uncontrolled emissions by SCR (86.5% catalyst efficiency).
5. SO₂ data based on the use of 0.05% weight sulfur distillate oil.
6. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
7. HRSGs are not capable of firing fuel oil. They are fired with natural gas only.
8. All ppm reported by volume on a dry basis.
9. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
10. Calculations assume operating 8,520 total hours per year, with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

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TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 50°F Compressor Inlet, 300 MMBtu/hr Annual Average Duct Firing
Date: December 8, 1992

Fuel Type: Natural Gas

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(gr/dscf)	lbs/hr	(gr/dscf)	lbs/hr
Gas Turbine (W/O SCR)	8400					42.0	270.0	1.4	9.9	25.1	77.0	0.9	1.5	0.0015	9.0	0.0015	9.0
HRSG (W/O SCR)	8400					3.2	24.0	0.2	1.7	9.9	30.0	6.2	10.8	0.0005	3.0	0.0004	2.4
GT/HRSG (W/SCR)	8400	100	18.0	189	1,024,700	3.0	22.6	1.7	11.6	7.0	21.4	4.9	8.6	0.0020	12.0	0.0019	11.4

Notes:

1. GT/HRSG combination exhausts through one common stack
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency)
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency)
4. Gas Turbine and HRSG NO_x emissions are reduced to 7.7% of uncontrolled emissions by SCR (92.3% catalyst efficiency)
5. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
6. All ppm reported by volume on a dry basis.
7. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
8. Natural gas is assumed to contain 2 grains sulfur per 100 scf. Actual sulfur content is expected to be under 1 grain per 100 scf.
9. Calculations assume operating 8,520 total hours per year with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

OFFICIAL USE ONLY

TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 50°F Compressor Inlet, 300 MMBtu/hr Annual Average Duct Firing

Date: December 8, 1992

Fuel Type: Number 2 Distillate Oil

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(gr/dscf)	lbs/hr	(gr/dscf)	lbs/hr
Gas Turbine (W/O SCR)	120					65.1	433.0	12.1	85.3	25.0	77.0	4.0	7.0	0.0029	17.0	0.0029	17.0
HRSG (W/O SCR)	120					3.1	24.0	0.2	1.7	9.8	30.0	6.2	10.8	0.0005	3.0	0.0004	2.4
GT/HRSG (W/SCR)	120	100	18.0	189	1,011,500	8.0	62.2	12.5	87.0	7.0	21.4	7.1	12.5	0.0034	20.0	0.0033	19.4

Notes:

1. GT/HRSG combination exhausts through one common stack
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency)
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency)
4. Gas Turbine and HRSG NO_x emissions are reduced to 13.6% of uncontrolled emissions by SCR (86.4% catalyst efficiency)
5. SO₂ data based on the use of 0.05% weight sulfur distillate oil.
6. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
7. HRSGs are not capable of firing fuel oil. They are fired with natural gas only.
8. All ppm reported by volume on a dry basis.
9. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
10. Calculations assume operating 8,520 total hours per year, with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

OFFICIAL USE ONLY

TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 80°F Compressor Inlet, 430 MMBtu/hr Maximum Duct Firing

Date: December 8, 1992

Fuel Type: Natural Gas

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(gr/dscf)	(lbs/hr)	(gr/dscf)	(lbs/hr)
Gas Turbine (W/O SCR)	8400					42.1	251.0	1.4	9.1	24.9	71.0	0.8	1.3	0.0016	9.0	0.0016	9.0
HRSG (W/O SCR)	8400					4.6	34.4	0.4	2.4	15.2	43.0	9.6	15.5	0.0008	4.3	0.0006	3.4
GT/HRSG (W/SCR)	8400	100	18.0	189	966,300	3.0	22.5	1.8	11.5	8.1	22.8	7.3	11.7	0.0024	13.3	0.0023	12.4

Notes:

1. GT/HRSG combination exhausts through one common stack
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency)
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency)
4. Gas Turbine and HRSG NO_x emissions are reduced to 7.9% of uncontrolled emissions by SCR (92.1% catalyst efficiency)
5. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
6. All ppm reported by volume on a dry basis.
7. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
8. Natural gas is assumed to contain 2 grains sulfur per 100 scf. Actual sulfur content is expected to be under 1 grain per 100 scf.
9. Calculations assume operating 8,520 total hours per year with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

OFFICIAL USE ONLY

TENASKA - FREDERICKSON GENERATION PROJECT

Operating Scenario: Base Load, 80°F Compressor Inlet, 430 MMBtu/hr Maximum Duct Firing
Date: December 8, 1992

Fuel Type: Number 2 Distillate Oil

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(ppm)	(lbs/hr)	(gr/dscf)	(lbs/hr)	(gr/dscf)	(lbs/hr)
Gas Turbine (W/O SCR)	120					65.1	404.0	12.1	79.6	24.9	72.0	3.9	6.5	0.0030	17.0	0.0030	17.0
HRSG (W/O SCR)	120					4.4	34.4	0.4	2.4	15.1	43.0	9.5	15.5	0.0008	4.3	0.0006	3.4
GT/HRSG (W/SCR)	120	100	18.0	189	958,200	8.0	62.3	12.5	82.0	8.1	23.0	9.4	15.4	0.0039	21.3	0.0037	20.4

Notes:

1. GT/HRSG combination exhausts through one common stack
2. Gas turbine and HRSG CO emissions are reduced to 20% of uncontrolled emissions by catalyst (80% catalyst efficiency)
3. Gas turbine and HRSG VOC emissions are reduced to 70% of uncontrolled emissions by catalyst (30% catalyst efficiency)
4. Gas Turbine and HRSG NO_x emissions are reduced to 14.2% of uncontrolled emissions by SCR (85.8% catalyst efficiency)
5. SO₂ data based on the use of 0.05% weight sulfur distillate oil.
6. SCR ammonia slip is about 10 ppm from gas turbines and HRSGs.
7. HRSGs are not capable of firing fuel oil. They are fired with natural gas only.
8. All ppm reported by volume on a dry basis.
9. PPM NO_x from GT and HRSG are corrected to 15% oxygen.
10. Calculations assume operating 8,520 total hours per year, with up to 8,520 hours per year operating on natural gas and up to 120 hours per year operating on fuel oil.

OFFICIAL USE ONLY

EMISSION CALCULATIONS FIRING NATURAL GAS

These sample calculations are organized according to the Index shown on Attachment 1 and are based on a temperature of 50°F. firing natural gas with the composition shown in Attachment 2. References are shown in parenthesis (). References directly to manufacturer data are made whenever appropriate.

Gas Turbine - Natural Gas

(Refer to GE Performance Data, Attachment 3, and GT/HRSG mass balance and calculated exhaust gas composition, Attachment 5.)

1. Gas Turbine NO_x

(NO_x emission with steam injection but without SCR.)

GT emission of NO_x as NO₂ = 270 lb/hr NO_x (Attach. 3)

GT Exhaust = 109,317 mol/hr - dry basis (Attach. 5)

NO_x, ppm by Volume on a dry basis:

$$\frac{270 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb}} \times \frac{\text{hr}}{109,317 \text{ mol dry G.T. Exhaust}} \times 10^6 = 53.7 \text{ ppmVd NO}_x$$

NO_x ppm Vol dry corrected to 15% O₂:

O₂ content of GT exhaust = 13.36 mol % - dry basis (Attach. 5)

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9 - \%O_2 \text{Vd}} = 53.7 \times \frac{5.9}{20.9 - 13.36} = 42.0 \text{ ppmVd NO}_x \text{ @ 15\% O}_2$$

2. Gas Turbine SO₂

(Firing pipeline natural gas)

Fuel consumption = 1603.0 MMBtu/hr LHV (Attach. 3)

Natural gas LHV/HHV ratio = 0.901 (Attach. 2)

SO₂ Emission Rate Firing Natural Gas = .00554 lb SO₂/MMBtu HHV (Attach. 6)

G.T. Emission of SO₂:

$$\frac{1603.0 \text{ MMBtu LHV}}{\text{hr}} \times \frac{\text{HHV}}{.901 \text{ LHV}} \times \frac{.00554 \text{ lb SO}_2}{\text{MMBtu HHV}} = 9.9 \frac{\text{lb SO}_2}{\text{hr}}$$

SO₂, ppm by Volume on a dry basis:

$$\frac{9.9 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb}} \times \frac{\text{hr}}{109,317 \text{ mol dry G.T. exhaust}} \times 10^6 = 1.4 \text{ ppmVd SO}_2$$

3. Gas Turbine CO

GT emission of CO = 77 lb/hr (Attach. 3)

CO, ppm by Volume on a dry basis:

$$\frac{77 \text{ lb}}{\text{hr}} \times \frac{\text{mol CO}}{28.01 \text{ lb}} \times \frac{\text{hr}}{109,317 \text{ mol dry G.T. exhaust}} \times 10^6 = 25.1 \text{ ppmVd CO}$$

4. Gas Turbine VOC non-methane, non-ethane (Reported as methane)

GT emission at UHC = 15 lb/hr (Attach. 3)

VOC's represent 10% of UHC (Attach. 4)

G.T. emission of VOC:

$$\frac{15 \text{ lb UHC}}{\text{hr}} \times \frac{.1 \text{ lb VOC}}{\text{lb UHC}} = 1.5 \frac{\text{lb VOC}}{\text{hr}}$$

VOC, ppm by Volume on a dry basis:

$$\frac{1.5 \text{ lb VOC}}{\text{hr}} \times \frac{\text{mol VOC (as CH}_4\text{)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{109,317 \text{ mol dry G.T. Exhaust}} \times 10^6 = 0.9 \text{ ppmVd VOC}$$

5. Gas Turbine Particulate

According to vendor, all G.T. particulate emissions are PM-10. (Attach. 4)

G.T. emission of Particulate = PM-10 = 9.0 lb/hr (Attach. 3)

Particulate = PM-10 Concentration, gr/dSCF

$$\frac{9.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{109,317 \text{ mol dry G.T. exhaust}} \times \frac{\text{mol}}{379.5 \text{ dSCF}} = .0015 \text{ gr/dSCF Particulate or PM-10}$$

NOTE: Standard conditions 60°F, 14.7 psia.

HRSG Duct Burner

The HRSG duct burners will fire an annual average of 300 MMBtu/hr (HHV) of natural gas. Note that the duct burners are not capable of firing fuel oil.

6. HRSG NO_x (NO_x emissions without SCR)

Duct burner emission of NO_x as NO₂ = 0.08 NO_x/MMBtu (Attach. 7)

Exhaust gas after duct burner = 108,547 mol/hr-dry basis (Attach. 5)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.08 \text{ lb NO}_x}{\text{MMBtu}} = 24 \text{ lb/hr NO}_x$$

NO_x ppm by Volume on a dry basis:

$$\frac{24 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry G.T./HRSG exhaust}} \times 10^6 = 4.8 \text{ ppmVd NO}_x$$

NO_x ppm by Volume dry corrected to 15% O₂:

O₂ content of exhaust gas = 12.01 mol % - dry basis (Attach. 5)

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9\% \text{ O}_2 \text{ Vd}} = 4.8 \times \frac{5.9}{20.9 - 12.01} = 3.2 \text{ ppmVd NO}_x \text{ @ 15\% O}_2$$

7. SO₂ Calculations for HRSG Duct Burner (Natural Gas Operation)

Basis: HRSG's fired at design rates with pipeline natural gas

HRSG Duct Burner 300 MMBtu/hr HHV

SO₂ emission firing natural gas = 0.00554 lb/SO₂/MMBtu HHV (Attach. 6)

Duct Burner emission of SO₂:

$$\frac{(300 \text{ MMBtu} \times .00554 \text{ lb SO}_2)}{\text{hr}} = 1.66 \text{ lb/hr/SO}_2$$

Duct Burner SO₂, ppm by Volume on a dry basis:

$$\frac{1.66 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry G.T./HRSG Exhaust}} \times 10^6 = 0.24 \text{ ppmVd SO}_2$$

8. HRSG CO

Duct burner emission of CO = 0.08 lb CO/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.10 \text{ lb CO}}{\text{MMBtu}} = 30 \text{ lb/hr CO}$$

CO, ppm by Volume on a day basis:

$$\frac{30 \text{ lb.}}{\text{hr}} \times \frac{\text{mol CO}}{28.01 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry G.T./HRSG Exhaust}} \times 10^6 = 9.9 \text{ ppmVd CO}$$

9. HRS VOC non methane, non ethane (reported as methane)

Duct burner emission of VOC = 0.036 lb VOC/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.036 \text{ lb}}{\text{MMBtu}} = 10.8 \text{ lb/hr VOC}$$

VOC, ppm by Volume on a dry basis:

$$\frac{10.8 \text{ lb}}{\text{hr}} \times \frac{\text{Mol VOC (as C}_1\text{)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry G.T./HRSG Exhaust}} \times 10^9 = 6.2 \text{ ppmVd VOC}$$

10. HRSG particulate

Duct burner emission of particulate (TSP)= 0.01 lb TSP/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.01 \text{ lb}}{\text{MMBtu}} = 3.0 \text{ lb/hr TSP}$$

Particulate (TSP) concentration, gr/dSCF:

$$\frac{3.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry G.T./HRSG Exhaust}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .00051 \text{ gr/dSCF TSP}$$

11. HRSG PM-10

According to burner manufacturer, expect about 80% of the TSP to be PM-10 (Attach. 7). Therefore, based on previous calculation:

$$\frac{3.0 \text{ lb}}{\text{hr}} \times .80 = 2.4 \text{ lb/hr PM-10}$$

$$\frac{.00051 \text{ gr}}{\text{dSCF}} \times .80 = .00041 \text{ gr/dSCF PM-10}$$

Note: Standard Conditions 60°F, 14.7 psia.

Gas Turbine/HRSG Stack Emissions

12. GT/HRSG Stack Volumetric flow (Wet basis) @ 189°F.

Exhaust flow to stack = 127,879 mol/hr - wet basis (Attach. 5)

$$\frac{127,879 \text{ mol}}{\text{hr}} \times \frac{379.5 \text{ SCF}}{\text{mol}} \times \frac{(459.67 + 189)^{\circ}\text{R actual}}{(459.67 + 60)^{\circ}\text{R std.}} \times \frac{14.696 \text{ psia std}}{14.479 \text{ psia actual}} \times \frac{\text{hr}}{60 \text{ min}} = 1,024,714 \text{ ACFM}$$

- Temperature Correction = Ratio of actual absolute temperature (189°F) to standard absolute (60°F)

Pressure Correction = Ratio of standard atmospheric pressure (14.696 psia at sea level) to actual atmospheric pressure (14.479 psia at 410 ft. elevation)

13. GT/HRSG Stack NO_x

Combined GT/HRSG NO_x with Selective Catalytic Reduction (SCR) removing 92.3% of the NO_x as NO₂ prior to stack discharge. (Attach. 8)

$$\frac{(270 + 24) \text{ lb NO}_x}{\text{hr}} \times (1-.923) = 22.64 \text{ lb/hr NO}_x$$

NO_x ppm by Volume on a dry basis:

$$\frac{22.64 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb.}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times 10^6 = 4.5 \text{ ppmVd NO}_x$$

O₂ content of gas to stack = 12.01 mol % - dry basis (Attach. 5)

NO_x ppm Vol. dry corrected to 15% O₂:

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9 - \% \text{O}_2 \text{Vd}} = 4.5 \times \frac{5.9}{20.9 - 12.0} = 3.0 \text{ ppmVd NO}_x @ 15\% \text{ O}_2$$

14. GT/HRSG Stack SO₂

$$9.9 \text{ lb/hr (GT)} + 1.7 \text{ lb/hr (HRSG)} = 11.6 \text{ lb/hr SO}_2$$

SO₂ ppm by Volume on a dry basis:

$$\frac{11.6 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb.}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times 10^6 = 1.7 \text{ ppmVd SO}_2$$

15. GT/HRSG Stack CO

Combined GT/HRSG CO with catalyst removing 80% of CO prior to stack discharge. (Attach. 9)

$$(77 + 30) \text{ lb/hr CO} \times (1-.80) = 21.4 \text{ lb/hr CO}$$

CO, ppm by Volume on a dry basis:

$$\frac{21.4 \text{ lb}}{\text{hr}} \times \frac{\text{mol CO}}{28.01 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times 10^6 = 7.0 \text{ ppmVd}$$

16. GT/HRSG Stack VOC non-methane, non-ethane (reported as methane)

Combined GT/HRSG VOC with catalyst removing 30% of VOC prior to stack discharge (Attach.9)

$$(1.5 + 10.8) \text{ lb/hr VOC} \times (1-.30) = 8.6 \text{ lb/hr VOC after catalyst}$$

VOC, ppm by Volume on a dry basis:

$$\frac{8.6 \text{ lb}}{\text{hr}} \times \frac{\text{mol VOC (as C1)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times 10^6 = 4.9 \text{ ppmVd VOC}$$

17. GT/HRSG Particulate (TSP)

$$9.0 \text{ lb/hr (G.T.)} + 3.0 \text{ lb/hr (HRSG)} = 12.0 \text{ lb/hr TSP}$$

Particulate concentration, gr/dSCF:

$$\frac{12.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .0020 \text{ gr/dSCF TSP}$$

18. GT/HRSG PM-10

$$9.0 \text{ lb/hr (G.T.)} + 2.4 \text{ lb/hr (HRSG)} = 11.4 \text{ lb/hr PM-10}$$

PM-10 concentration, gr/dSCF:

$$\frac{11.4 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{108,547 \text{ mol dry stack gas}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .0019 \text{ gr/dSCF PM-10}$$

EMISSION CALCULATIONS
FIRING NO. 2 FUEL OIL

These calculations are based on 50°F temperature firing No. 2 fuel oil in the gas turbine. As a backup fuel, fuel oil will only be fired when natural gas is not available. Fuel oil firing on major equipment will be limited to 120 hours/yr. The fuel oil analysis is shown on Attachment 11. The HRSG duct burners will fire natural gas since they are not capable of firing fuel oil.

The sample calculations for "fuel oil operation" are organized according to the index shown on Attachment 10. Calculation references are shown in parenthesis (). References directly to manufacturer data are made whenever appropriate.

Gas Turbine - No. 2 fuel oil

(Refer to GE Performance data, Attachment 3, and GT/HRSG Mass balance and calculated exhaust gas composition, Attachment 12).

19. Gas turbine NO_x (NO_x emissions with steam injection but without SCR).

G.T. emission of NO_x as NO₂ = 433 lb/hr NO_x (Attach. 3)

G.T. exhaust = 109,844 mol/hr - dry basis (Attach. 12)

NO_x ppm by Volume on a dry basis:

$$\frac{433 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb}} \times \frac{\text{hr}}{109,844 \text{ mol dry G.T. Exhaust}} \times 10^6 = 85.7 \text{ ppmVd NO}_x$$

NO_x ppmVd dry corrected to 15% O₂:

O₂ content of G.T. exhaust = 13.13 mole % - dry basis (Attach. 12)

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9 - \% \text{O}_2 \text{Vol}} = 85.7 \times \frac{5.9}{20.9 - 13.13} = 65.1 \text{ ppmVd}$$

20. Gas turbine SO₂ (firing No. 2 oil)

Fuel consumption = 1,584.5 MMBtu/hr LHV (Attach. 3)

Fuel oil LHV/HHV ratio = 0.945 (Attach. 11)

SO₂ emission rate firing .05 wt %S No. 2 oil = .05089 lb SO₂/MMBtu HHV
(Attach. 6)

G.T. emission of SO₂:

$$\frac{1584.5 \text{ MMBtu LHV}}{\text{hr}} \times \frac{\text{HHV}}{0.945 \text{ LHV MMBtu HHV}} \times .05089 \text{ lb SO}_2 = 85.3 \frac{\text{lb SO}_2}{\text{hr}}$$

SO₂, ppm by Volume on a dry basis:

$$\frac{85.3 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb}} \times \frac{\text{hr}}{109,844 \text{ mol dry G.T. Exhaust}} \times 10^6 = 12.1 \text{ ppmVd SO}_2$$

21. Gas turbine CO

GT emission of CO = 77.0 lb/hr (Attach. 3)

CO, ppm by Volume on a dry basis:

$$\frac{77.0 \text{ lb}}{\text{hr}} \times \frac{\text{mol CO}}{28.01 \text{ lb.}} \times \frac{\text{hr}}{109,844 \text{ mol dry G.T. Exhaust}} \times 10^6 = 25.0 \text{ ppmVd CO}$$

22. Gas turbine VOC non-methane, non-ethane (reported as methane)

VOC's represent 50% of UHC G.T. emission of VOC (Attach. 4)

G.T. UHC emission = 14 lb/hr (Attach. 3)

$$\frac{14 \text{ lb UHC}}{\text{hr}} \times \frac{.5 \text{ lb VOC}}{\text{lb UHC}} = 7.0 \frac{\text{lb VOC}}{\text{hr}}$$

VOC, ppm by Volume on a dry basis:

$$\frac{7.0 \text{ lb}}{\text{hr}} \times \frac{\text{mol VOC (as C}_1\text{)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{109,844 \text{ mol dry G.T. Exhaust}} \times 10^6 = 4.0 \text{ ppmVd VOC}$$

23. Gas Turbine Particulate

According to vendor, all G.T. particulate emissions are under 10 micron, PM-10. (Attach. 4)

G.T. emission of Particulate TSP = PM-10 = 17.0 lb/hr (Attach. 3)

Particulate Concentration (TSP = PM-10), gr/dSCF

$$\frac{17.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{109,844 \text{ mol dry G.T. exhaust}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .0029 \text{ gr/dSCF TSP or PM-10}$$

NOTE: Standard conditions 60°F, 14.7 psia.

HRSG Duct Burner

Since the duct burners are not capable of burning fuel oil, they will be fired with natural gas while the gas turbine is fired with fuel oil. The G.T./HRSG mass balance and calculated exhaust gas composition firing oil in the gas turbine and gas in the HRSG is presented in Attachment 12.

24. HRSG NO_x (NO_x emissions without SCR)

Duct burner emission of NO_x as NO₂ = 0.10 lb NO_x/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.08 \text{ lb NO}_x}{\text{MMBtu}} = 24 \text{ lb/hr NO}_x$$

Exhaust gas after duct burner = 109,073 mol/hr - dry basis (Attach. 12)

NO_x ppm by Volume on a dry basis:

$$\frac{24 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry G.T./HRSG exhaust}} \times 10^6 = 4.8 \text{ ppmVd NO}_x$$

NO_x ppm by Volume dry corrected to 15% O₂

O₂ content of exhaust gas = 11.8 mol % (Attach. 12)

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9 - \% \text{O}_2 \text{Vd}} = 4.8 \times \frac{5.9}{20.9 - 11.8} = 3.1 \text{ ppmVd NO}_x \text{ @ 15\% O}_2$$

25. SO₂ Calculations for HRSG Duct Burner
(No. 2 distillate Oil Operation)

Basis: Since HRSG's cannot fire oil, duct burner will be fired with natural gas.

HRSG Duct Burners = 300 MMBtu/hr HHV

Natural gas required = 300 MMBtu/hr HHV

SO₂ emission firing natural gas = 0.00554 lb SO₂/MMBtu HHV (Attach. 6)

SO₂ from HRSG burner:

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{.00554 \text{ lb SO}_2}{\text{MMBtu Nat. Gas}} = 1.66 \text{ lb/hr SO}_2$$

SO₂, ppm by Volume on a dry basis:

$$\frac{1.66 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry G.T./HRSG Exhaust}} \times 10^8 = 0.24 \text{ ppmVd SO}_2$$

26. HRSG CO

Duct burner emission of CO = 0.08 lb CO/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.10 \text{ lb CO}}{\text{MMBtu}} = 30 \text{ lb/hr}$$

CO, ppm by Volume on a day basis:

$$\frac{30 \text{ lb.}}{\text{hr}} \times \frac{\text{mol CO}}{28.01} \times \frac{\text{hr}}{109,073 \text{ mol dry G.T./HRSG Exhaust}} \times 10^8 = 9.8 \text{ ppmVd CO}$$

27. HRSG VOC non-methane, non-ethane (reported as methane)

Duct burner emission of VOC = 0.036 lb VOC/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.036 \text{ lb}}{\text{MMBtu}} = 10.8 \text{ lb/hr VOC}$$

VOC, ppm by Volume on a dry basis:

$$\frac{10.8 \text{ lb}}{\text{hr}} \times \frac{\text{Mol VOC (as C1)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry G.T./HRSG Exhaust}} \times 10^6 = 6.2 \text{ ppmVd}$$

28. HRSG particulate

Duct burner emission of particulate (TSP) = 0.01 lb TSP/MMBtu (Attach. 7)

$$\frac{300 \text{ MMBtu}}{\text{hr}} \times \frac{0.01 \text{ lb}}{\text{MMBtu}} = 3.0 \text{ lb/hr TSP}$$

Particulate concentration (TSP), gr/dSCF:

$$\frac{3.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry G.T./HRSG Exhaust}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .00051 \text{ gr/dSCF TSP}$$

29. HRSG PM-10

According to burner manufacturer, expect about 80% of the TSP to be PM-10 (Attach. 7). Therefore, based on previous calculation:

$$\frac{3.0 \text{ lb}}{\text{hr}} \times .80 = 2.4 \text{ lb/hr PM-10}$$

$$\frac{.00051 \text{ gr}}{\text{dSCF}} \times .80 = .00041 \text{ gr/dSCF PM-10}$$

Note: Standard Conditions 60°F, 14.7 psia.

Gas Turbine/HRSG Stack Emissions

(No. 2 distillate oil to G.T., Gas to HRSG)

30. GT/HRSG Stack Volumetric flow (Wet basis) @ 189°F.

Exhaust flow to stack = 126,231 mol/hr - wet basis (Attach. 12)

$$\frac{126,231 \text{ mol}}{\text{hr}} \times \frac{379.5 \text{ SCF}}{\text{mol}} \times \frac{(459.67 + 189)^{\circ}\text{R actual}}{(459.67 + 60)^{\circ}\text{R std.}} \times \frac{14.696 \text{ psia std}}{14.479 \text{ psia actual}} \times \frac{\text{hr}}{60 \text{ min}} = 1,011,506 \text{ ACFM}$$

Temperature Correction = Ratio of actual absolute temperature (189°F) to standard absolute temperature (60°F)

Pressure Correction = Ratio of standard atmospheric pressure (14.696 psia at sea level) to actual atmospheric pressure (14.479 psia at 410 ft. elevation)

31. GT/HRSG Stack NO_x

Combined GT/HRSG NO_x with Selective Catalytic Reduction (SCR) removing 86.4% of the NO_x as NO₂ prior to stack discharge. (Attach. 8)

$$\frac{(433+24)\text{lb NO}_x}{\text{hr}} \times (1-.864) = 62.15 \text{ lb/hr NO}_x$$

NO_x ppm by Volume on a dry basis:

$$\frac{62.15 \text{ lb}}{\text{hr}} \times \frac{\text{mol NO}_x}{46.01 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times 10^6 = 12.4 \text{ ppmVd NO}_x$$

NO_x ppm Vol. dry corrected to 15% O₂:

O₂ content of gas to stack = 11.8 mol % (Attach. 12)

$$\text{NO}_x \text{ ppmVd} \times \frac{5.9}{20.9-\%O_2\text{Vd}} = 12.4 \times \frac{5.9}{20.9-11.8} = 8.0 \text{ ppmVd NO}_x @15\% O_2$$

32. GT/HRSG Stack SO₂

$$85.3 \text{ lb/hr (GT)} + 1.7 \text{ lb/hr (HRSG)} = 87.0 \text{ lb/hr SO}_2$$

SO₂ ppm by Volume on a dry basis:

$$\frac{87.0 \text{ lb}}{\text{hr}} \times \frac{\text{mol SO}_2}{64.06 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times 10^6 = 12.5 \text{ ppmVd SO}_2$$

33. GT/HRSG Stack CO

Combined GT/HRSG CO with catalyst removing 80% of CO prior to stack discharge. (Attach. 9)

$$(77 + 30) \text{ lb/hr CO} \times (1 - .80) = 21.4 \text{ lb/hr CO}$$

CO, ppm by Volume on a dry basis:

$$\frac{21.4 \text{ lb}}{\text{hr}} \times \frac{\text{mol CO}}{28.01 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times 10^6 = 7.0 \text{ ppmVd CO}$$

34. GT/HRSG Stack VOC non-methane, non-ethane (reported as methane)

Combined GT/HRSG VOC with catalyst removing 30% of VOC prior to stack discharge. (Attach.9)

$$(7.0 + 10.8) \text{ lb/hr CO} \times (1 - .30) = 12.5 \text{ lb/hr CO}$$

VOC, ppm by Volume on a dry basis:

$$\frac{12.5 \text{ lb}}{\text{hr}} \times \frac{\text{mol VOC(as C1)}}{16.04 \text{ lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times 10^6 = 7.1 \text{ ppmVd VOC}$$

35. GT/HRSG Particulate (TSP)

$$17.0 \text{ lb/hr (G.T.)} + 3.0 \text{ lb/hr (HRSG)} = 20.0 \text{ lb/hr TSP}$$

Particulate concentration, gr/dSCF:

$$\frac{20.0 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .00338 \text{ gr/dSCF TSP}$$

36. GT/HRSG PM-10

$$17.0 \text{ lb/hr (G.T.)} + 2.4 \text{ lb/hr (HRSG)} = 19.4 \text{ lb/hr PM-10}$$

PM-10 concentration, gr/dSCF:

$$\frac{19.4 \text{ lb}}{\text{hr}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{hr}}{109,073 \text{ mol dry stack gas}} \times \frac{\text{mol}}{379.5 \text{ SCF}} = .00328 \text{ gr/dSCF PM-10}$$

ATTACHMENTS TO EMISSION CALCULATIONS

1. Emission Calculation Cross Reference - Natural Gas
2. Natural Gas Composition and Heating Value
3. General Electric Performance Data
4. General Electric Letter on VOC and PM-10
5. Mass Balance and Exhaust Gas Compositions - Natural Gas
6. SO₂ Calculations for Natural Gas and Fuel Oil
7. Coen Letter on Duct Burner Emissions
8. Mitsubishi Specification for SCR Catalyst
9. Engelhard Letter on CO and VOC Catalyst
10. Emission Calculation Cross Reference - Fuel Oil
11. Fuel Oil Characteristics and Heating Value
12. Mass Balance and Exhaust Gas Composition - Fuel Oil

ATTACHMENT 1

TENASKA - FREDERICKSON GENERATION PROJECT

EMISSION CALCULATION CROSS REFERENCE - NATURAL GAS

Operating Scenario: Base Load, 50°F Compressor Inlet

Date: November 4, 1992

Fuel Type: Natural Gas

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(gr/dscf)	lbs/hr	(gr/dscf)	lbs/hr
Gas Turbine (W/O SCR)						1	1	2	2	3	3	4	4	5	5	5	5
HRSG (W/O SCR)						6	6	7	7	8	8	9	9	10	10	11	11
GT/HRSG (W/SCR)					12	13	13	14	14	15	15	16	16	17	17	18	18

ATTACHMENT 2

NATURAL GAS COMPOSITION AND HEATING VALUE

BASIS: DRY GAS, 14.696 PSIA, 60°F

1990 ANNUAL COMPOSITE
Northwest Pipeline Company District 61

COMPONENT	LHV BTU/SCF	HHV BTU/SCF	GAS COMPOSITION MOL %	LHV PRODUCT BTU/SCF	HHV PRODUCT BTU/SCF	COMPONENT MOL WT LB/MOL	GAS MOL WT PRODUCT LB/MOL
CO ₂	0.0	0.0	0.15	0.00	0.00	44.010	0.067
N ₂	0.0	0.0	0.58	0.00	0.00	28.013	0.162
H ₂	273.9	324.2	0.00	0.00	0.00	2.016	0.000
C ₁	909.1	1009.7	96.13	873.85	970.54	16.043	15.421
C ₂	1617.8	1768.7	2.69	43.52	47.58	30.070	0.809
C ₃	2315.9	2517.2	0.32	7.48	8.13	44.097	0.142
IC ₄	3001.0	3252.6	0.09	2.70	2.93	58.124	0.006
NC ₄	3010.5	3262.0	0.01	0.30	0.33	58.124	0.051
IC ₅	3697.9	3999.7	0.01	0.41	0.44	72.151	0.008
NC ₅	3706.8	4008.7	0.01	0.37	0.40	72.151	0.007
C ₆ 'S	4403.9	4756.1	0.01	0.40	0.43	86.178	0.008
C ₇ +	5100.3	5502.8	0.00	0.00	0.00	103.000	≈0.000
TOTAL			100.00	929.03	1030.79		16.682

CALCULATION SUMMARY

LOWER HEATING VALUE = 929.03 BTU/SCF
21,135 BTU/LB*

HIGHER HEATING VALUE = 1030.79 BTU/SCF
23,450 BTU/LB*

LHV/HHV RATIO = $\frac{21,135 \text{ BTU/LB}}{23,450 \text{ BTU/LB}}$ = 0.901

MOLECULAR WEIGHT = 16.682 LB/MOL

* At 379.5 SCF/LB MOL

NGHTGVALC
11/10/92

OFFICIAL USE ONLY

1.1 ESTIMATED PERFORMANCE – PG7221(FA)

LOAD CONDITION		BASE	BASE	BASE	BASE	BASE
AMBIENT TEMP.	– Deg F.	10	20	30	40	50
AMBIENT RELATIVE HUMID	– %	60	60	60	60	60
OUTPUT	– kW	185200.	186300.	183900.	179800.	175000.
HEAT RATE (LHV)	– Btu/kWh	9140.	9070.	9080.	9100.	9160.
HEAT CONS. (LHV) X10–6	– Btu/h	1692.7	1689.7	1669.8	1636.2	1603.0
EXHAUST FLOW X10–3	– lb/h	3700.0	3713.0	3668.0	3600.0	3529.0
EXHAUST TEMP	– Deg F.	1060.	1058.	1063.	1071.	1080.
EXHAUST HEAT X10–6	– Btu/h	1029.2	1022.3	1010.5	990.9	974.0
STEAM FLOW	– lb/h	148500.	148130.	146310.	143470.	139700.
NOX	– ppmvd @ 15% O2	42.	42.	42.	42.	42.
NOX AS NO2	– lb/h	285.	285.	281.	276.	270.
CO	– ppmvd	25.	25.	25.	25.	25.
CO	– lb/h	80.	81.	80.	78.	77.
UHC	– ppmvw	7.	7.	7.	7.	7.
UHC	– lb/h	15.	15.	15.	15.	15.
PART	– lb/h	9.0	9.0	9.0	9.0	9.0
EXHAUST ANALYSIS % VOL.						
ARGON		0.84	0.85	0.85	0.83	0.84
NITROGEN		70.30	70.29	70.21	70.11	69.98
OXYGEN		11.51	11.54	11.53	11.51	11.49
CARBON DIOXIDE		3.74	3.72	3.72	3.72	3.71
WATER		13.61	13.60	13.70	13.83	13.99
SITE CONDITIONS						
ELEVATION	– ft.	410				
SITE PRESSURE	– psia	14.49				
INLET LOSS	– in. Water	3.5				
EXHAUST LOSS	– in. Water	17				
RELATIVE HUMIDITY	– %	60				
FUEL TYPE	–	CUST GAS				
FUEL LHV	– Btu/lb	21145				
APPLICATION	–	317S HYDROGEN COOLED GENERATOR				
COMBUSTION SYSTEM	–	STANDARD				

EMISSION INFORMATION BASED ON GE RECOMMENDED MEASUREMENT METHODS.
NO_x EMISSIONS ARE CORRECTED TO 15% O₂ WITHOUT HEAT RATE CORRECTION AND ARE NOT CORRECTED TO ISO REFERENCE CONDITIONS PER 40CFR 60.335(a)(1)(i).
NO_x LEVELS SHOWN WILL BE CONTROLLED BY ALGORITHMS WITHIN THE SPEEDTRONIC CONTROL SYSTEM.
FUEL SUPPLY TEMP 300 F
IPS–8683
JAH 7–15–92

OFFICIAL USE ONLY

1.2 ESTIMATED PERFORMANCE – PG7221(FA)

LOAD CONDITION		BASE	BASE	BASE	BASE
AMBIENT TEMP.	– Deg F.	60	70	80	90
AMBIENT RELATIVE HUMID	– %	60	60	60	60
OUTPUT	– kW	170900.	164600.	157900.	150600.
HEAT RATE (LHV)	– Btu/kWh	9180.	9290.	9410.	9570.
HEAT CONS. (LHV) X10–6	– Btu/h	1568.9	1529.1	1485.8	1441.2
EXHAUST FLOW X10–3	– lb/h	3471.0	3390.0	3307.0	3218.0
EXHAUST TEMP	– Deg F.	1087.	1097.	1107.	1118.
EXHAUST HEAT X10–6	– Btu/h	953.7	935.2	914.6	894.4
STEAM FLOW	– lb/h	135380.	129240.	121950.	112620.
NOX	– ppmvd @ 15% O2	42.	42.	42.	42.
NOX AS NO2	– lb/h	265.	257.	251.	243.
CO	– ppmvd	25.	25.	25.	25.
CO	– lb/h	75.	73.	71.	69.
UHC	– ppmvw	7.	7.	7.	7.
UHC	– lb/h	14.	14.	13.	13.
PART	– lb/h	9.0	9.0	9.0	9.0
EXHAUST ANALYSIS % VOL.					
ARGON		0.84	0.84	0.83	0.83
NITROGEN		69.84	69.64	69.38	69.05
OXYGEN		11.49	11.46	11.42	11.37
CARBON DIOXIDE		3.69	3.67	3.66	3.64
WATER		14.15	14.39	14.71	15.11
SITE CONDITIONS					
ELEVATION	– ft.	410			
SITE PRESSURE	– psia	14.49			
INLET LOSS	– in. Water	3.5			
EXHAUST LOSS	– in. Water	17			
RELATIVE HUMIDITY	– %	60			
FUEL TYPE	–	CUST GAS			
FUEL LHV	– Btu/lb	21145			
APPLICATION	–	317S HYDROGEN COOLED GENERATOR			
COMBUSTION SYSTEM	–	STANDARD			

EMISSION INFORMATION BASED ON GE RECOMMENDED MEASUREMENT METHODS.
NO_x EMISSIONS ARE CORRECTED TO 15% O₂ WITHOUT HEAT RATE CORRECTION AND ARE NOT CORRECTED TO ISO REFERENCE CONDITIONS PER 40CFR 60.335(a)(1)(i).
NO_x LEVELS SHOWN WILL BE CONTROLLED BY ALGORITHMS WITHIN THE SPEEDTRONIC CONTROL SYSTEM.
FUEL SUPPLY TEMP 300 F
IPS-8683
JAH 7-15-92

OFFICIAL USE ONLY

1.3 ESTIMATED PERFORMANCE – PG7221(FA)

LOAD CONDITION		BASE	BASE	BASE	BASE	BASE
AMBIENT TEMP.	– Deg F.	10	20	30	40	50
AMBIENT RELATIVE HUMID	– %	60	60	60	60	60
OUTPUT	– kW	183700.	184800.	181000.	176500.	171300.
HEAT RATE (LHV)	– Btu/kWh	9200.	9130.	9150.	9190.	9250.
HEAT CONS. (LHV) X10–6	– Btu/h	1690.0	1687.2	1656.2	1622.0	1584.5
EXHAUST FLOW X10–3	– lb/h	3726.0	3738.0	3670.0	3599.0	3525.0
EXHAUST TEMP	– Deg F.	1059.	1058.	1066.	1074.	1083.
EXHAUST HEAT X10–6	– Btu/h	1034.4	1027.5	1009.1	990.1	970.0
STEAM FLOW	– lb/h	163030.	161860.	158200.	153730.	148230.
NOX	– ppmvd @ 15% O2	65.	65.	65.	65.	65.
NOX AS NO2	– lb/h	462.	461.	453.	443.	433.
CO	– ppmvd	25.	25.	25.	25.	25.
CO	– lb/h	81.	82.	80.	79.	77.
UHC	– ppmvw	7.	7.	7.	7.	7.
UHC	– lb/h	15.	15.	15.	14.	14.
SO2	– ppmvw	10.	10.	10.	10.	10.
SO2	– lb/h	87.	86.	85.	83.	81.
SO3	– ppmvw	1.	1.	1.	1.	1.
SO3	– lb/h	5.	6.	5.	6.	6.
SULFUR MIST	– lb/h	9.	9.	9.	9.	9.
PART	– lb/h	17.0	17.0	17.0	17.0	17.0
EXHAUST ANALYSIS % VOL.						
ARGON		0.85	0.84	0.85	0.84	0.84
NITROGEN		70.60	70.61	70.55	70.48	70.40
OXYGEN		11.47	11.51	11.50	11.50	11.50
CARBON DIOXIDE		4.87	4.85	4.84	4.84	4.82
WATER		12.21	12.19	12.26	12.34	12.44
SITE CONDITIONS						
ELEVATION	– ft.	410				
SITE PRESSURE	– psia	14.49				
INLET LOSS	– in. Water	3.5				
EXHAUST LOSS	– in. Water	17				
RELATIVE HUMIDITY	– %	60				
FUEL TYPE	–	DISTILLATE				
FUEL LHV	– Btu/lb	18550				
APPLICATION	–	317S HYDROGEN COOLED GENERATOR				
COMBUSTION SYSTEM	–	STANDARD				

EMISSION INFORMATION BASED ON GE RECOMMENDED MEASUREMENT METHODS.
 NO_x EMISSIONS ARE CORRECTED TO 15% O₂ WITHOUT HEAT RATE CORRECTION AND ARE NOT CORRECTED TO ISO REFERENCE CONDITIONS PER 40CFR 60.335(a)(1)(i).
 NO_x LEVELS SHOWN WILL BE CONTROLLED BY ALGORITHMS WITHIN THE SPEEDTRONIC CONTROL SYSTEM.
 DISTILLATE FUEL IS ASSUMED TO HAVE .015% FUEL BOUND NITROGEN, OR LESS.
 FBN AMOUNTS GREATER THAN .015% WILL ADD TO THE REPORTED NO_x VALUE.
 SULFUR EMISSIONS BASED ON .05 WT% SULFUR CONTENT IN THE FUEL.
 IPS-8683 JAH 7-15-92

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1.4 ESTIMATED PERFORMANCE – PG7221(FA)

LOAD CONDITION		BASE	BASE	BASE	BASE
AMBIENT TEMP.	– Deg F.	60	70	80	90
AMBIENT RELATIVE HUMID	– %	60	60	60	60
OUTPUT	– kW	168700.	162300.	155400.	148000.
HEAT RATE (LHV)	– Btu/kWh	9260.	9370.	9510.	9680.
HEAT CONS. (LHV) X10–6	– Btu/h	1562.2	1520.8	1477.9	1432.6
EXHAUST FLOW X10–3	– lb/h	3489.0	3407.0	3321.0	3230.0
EXHAUST TEMP	– Deg F.	1087.	1097.	1108.	1119.
EXHAUST HEAT X10–6	– Btu/h	956.0	936.0	916.1	895.4
STEAM FLOW	– lb/h	143280.	135480.	126180.	115100.
NOX	– ppmvd @ 15% O2	65.	65.	65.	65.
NOX AS NO2	– lb/h	427.	416.	404.	391.
CO	– ppmvd	25.	25.	25.	25.
CO	– lb/h	76.	74.	72.	70.
UHC	– ppmvw	7.	7.	7.	7.
UHC	– lb/h	14.	14.	13.	13.
SO2	– ppmvw	10.	10.	10.	10.
SO2	– lb/h	80.	78.	76.	73.
SO3	– ppmvw	1.	1.	1.	1.
SO3	– lb/h	5.	5.	5.	5.
SULFUR MIST	– lb/h	8.	8.	8.	8.
PART	– lb/h	17.0	17.0	17.0	17.0
EXHAUST ANALYSIS % VOL.					
ARGON		0.85	0.85	0.84	0.84
NITROGEN		70.30	70.15	69.95	69.67
OXYGEN		11.50	11.49	11.47	11.43
CARBON DIOXIDE		4.80	4.78	4.76	4.74
WATER		12.55	12.73	12.98	13.32
SITE CONDITIONS					
ELEVATION	– ft.	410			
SITE PRESSURE	– psia	14.49			
INLET LOSS	– in. Water	3.5			
EXHAUST LOSS	– in. Water	17			
RELATIVE HUMIDITY	– %	60			
FUEL TYPE	–	DISTILLATE			
FUEL LHV	– Btu/lb	18550			
APPLICATION	–	317S HYDROGEN COOLED GENERATOR			
COMBUSTION SYSTEM	–	STANDARD			

EMISSION INFORMATION BASED ON GE RECOMMENDED MEASUREMENT METHODS.
 NO_x EMISSIONS ARE CORRECTED TO 15% O₂ WITHOUT HEAT RATE CORRECTION AND ARE
 NOT CORRECTED TO ISO REFERENCE CONDITIONS PER 40CFR 60.335(a)(1)(i).
 NO_x LEVELS SHOWN WILL BE CONTROLLED BY ALGORITHMS WITHIN THE
 SPEEDTRONIC CONTROL SYSTEM.
 DISTILLATE FUEL IS ASSUMED TO HAVE .015% FUEL BOUND NITROGEN, OR LESS.
 FBN AMOUNTS GREATER THAN .015% WILL ADD TO THE REPORTED NO_x VALUE.
 SULFUR EMISSIONS BASED ON .05 WT% SULFUR CONTENT IN THE FUEL.

IPS-8683

JAH 7-15-92

OFFICIAL USE ONLY

November 25, 1992

Chuck Eliason
Tenaska Inc.
407 North 117 Street
Omaha, NE 68154

Subject: BPA/Fredrickson Project
7FA Combustion Turbine
Performance & Emissions Data

Dear Chuck:

In response to your November 19th request, attached are "JAH 7/15/92" performance runs on GE letter head.

Regarding VOC emission data for the specified natural gas fuel and distillate oil #2, twenty percent (20%) of the UHC's represent VOC's when operating on natural gas and fifty percent (50%) on distillate #2. Approximately ten percent (10%) of the total UHC's on natural gas fuel operation are Non-Methane and Non-Ethane. For operation on distillate oil, all of the VOC's are Non-Methane and Non-Ethane (i.e., 50% of the UHC's are Non-Methane and Non-Ethane). Data providing a further break down of these constituents is not available.

Please note that the foregoing data is based upon GE's definition of VOC (All non-methane organic compounds in the exhaust).

Please contact Peter Pritchard should you have any questions or comments regarding this information.

Best Regards,

Jose R. Dumenigo
Sales Manager

cc: Peter Pritchard (GE)
Mike Lebens (Tenaska)
Phil Black (Tenaska)

OFFICIAL USE ONLY

ATTACHMENT 5

MASS BALANCE AND EXHAUST GAS COMPOSITION - GAS TURBINE FIRING NATURAL GAS

	Mole Wt	Exhaust Gas From Gas Turbine - Wet Basis				Natural Gas To Duct Burner - Wet Basis				Exhaust Gas To Stack - Wet Basis			
		Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr
C1	16.043					96.13	92.45	11,827	737				
C2	30.07					2.69	4.85	620	21				
C3	44.097					0.32	0.85	108	2				
nC4	58.124					0.01	0.03	4	0				
iC4	58.124					0.09	0.31	40	1				
nC5	72.151					0.01	0.04	6	0				
iC5	72.151					0.01	0.04	6	0				
C6	86.178					0.01	0.05	7	0				
N2	28.013	69.97	70.59	2,491,206	88,930	0.58	0.97	125	4	69.55	70.34	2,491,330	88,935
CO2	44.01	3.71	5.88	207,522	4,715	0.15	0.40	51	1	4.31	6.84	242,346	5,507
Ar	39.948	0.84	1.21	42,649	1,068					0.83	1.20	42,649	1,068
O2	31.999	11.49	13.24	467,299	14,604					10.20	11.78	417,193	13,038
H2O	18.015	13.99	9.08	320,324	17,781					15.12	9.83	348,274	19,332
TOTAL WET BASIS:		100.00	100.00	3,529,000	127,098	100.00	100.00	12,793	767	100.00	100.00	3,541,793	127,879

MOLECULAR WEIGHT:

27.766

16.682

27.696

	Mole Wt	Exhaust Gas From Gas Turbine - Dry Basis				Natural Gas To Duct Burner - Dry Basis				Exhaust Gas To Stack - Dry Basis			
		Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr
C1	16.043					96.13	92.45	11,827	737				
C2	30.07					2.69	4.85	620	21				
C3	44.097					0.32	0.85	108	2				
nC4	58.124					0.01	0.03	4	0				
iC4	58.124					0.09	0.31	40	1				
nC5	72.151					0.01	0.04	6	0				
iC5	72.151					0.01	0.04	6	0				
C6	86.178					0.01	0.05	7	0				
N2	28.013	81.35	77.64	2,491,206	88,930	0.58	0.97	125	4	81.93	78.01	2,491,330	88,935
CO2	44.01	4.31	6.47	207,522	4,715	0.15	0.40	51	1	5.07	7.59	242,346	5,507
Ar	39.948	0.98	1.33	42,649	1,068					0.98	1.34	42,649	1,068
O2	31.999	13.36	14.56	467,299	14,604					12.01	13.06	417,193	13,038
TOTAL DRY BASIS:		100.00	100.00	3,208,676	109,317	100.00	100.00	12,793	767	100.00	100.00	3,193,519	108,547

MOLECULAR WEIGHT:

29.352

16.682

29.421

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ATTACHMENT 6

SO₂ CALCULATIONS FOR FUEL OIL AND NATURAL GAS

FUEL OIL at .05 wt % S and 19,630 Btu/lb HHV (18,550 Btu/lb LHV, LHV/HHV - .945)

$$\frac{.05 \text{ lb S}}{100 \text{ lb}} \times \frac{64.06 \text{ lb SO}_2}{32.06 \text{ lb S}} \times \frac{\text{lb}}{19,630 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} = .05089 \text{ lb SO}_2/\text{MMBtu}$$

NATURAL GAS at 2 grain S/100 SCF and 1,031 Btu/SCF HHV (929 Btu/SCF LHV, LHV/HHV - .901)

$$\frac{2 \text{ Grain S}}{100 \text{ SCF}} \times \frac{\text{lb S}}{7000 \text{ grain S}} \times \frac{64.06 \text{ lb SO}_2}{32.06 \text{ lb S}} \times \frac{\text{SCF}}{1,031 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} = .00554 \text{ lb SO}_2/\text{MMBtu HHV}$$

COEN Company, Inc.

 1510 Rollins Road
 Burlingame, California 94010
 Telephone: (415) 697-0440
 Facsimile: (415) 579-3255

November 30, 1992

 Tenaska
 407 North 117 Street
 Omaha, NE 68154

Attention: Mr. Chuck Eliason

 Subject: Coen Duct Burner Emissions
 Fredrickson, Washington Project

Dear Chuck:

In response to your FAX request of November 19, I calculated the combustion products for the four (4) design operating cases and this information is listed below. The emission values listed from the duct burner system are guarantee levels, and can be used in your permit applications. Please note that as the duct burner manufacturer, we can only guarantee emissions on a mass basis, such as in units of LBS/HR or LB per Million BTU (HHV) of fuel fired. We can calculate total volumetric concentrations, such as Parts Per Million on a dry or corrected basis; but we cannot guarantee these values. The turbine load rate, fuel firing rate, ambient conditions, etc. all affect the total exhaust mass flow rate, water vapor levels, and oxygen content. As these values change, so also will the volumetric concentrations of these emissions change. -

General Electric Frame Seven "FA" Turbine, 100% Load.				
Case	A	B	C	D
Ambient, Degrees F	50°	50°	50°	50°
Turbine Fuel	Gas	Gas	Oil	Oil
TEG Flow x 1000 (LBS/HR)	3,527	3,527	3,525	3,525
Burner Inlet Degrees F	1060°	1030°	1060°	1030°
O ₂ , Volume. %	11.49	11.49	11.50	11.50
N ₂ , Volume. %	69.98	69.98	70.40	70.40
CO ₂ , Volume. %	3.71	3.71	4.82	4.82

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November 30, 1992

Tenaska

Page 2 of 3

General Electric Frame Seven "FA" Turbine, 100% Load.				
Case	A	B	C	D
H ₂ O, Volume. %	13.99	13.99	12.44	12.44
Ar, Volume. %	0.84	0.84	0.84	0.84

General Electric Frame Seven "FA" Turbine, 100% Load.					
Case		A	B	C	D
Emission Products Added by the Coen Duct Burner, Firing Natural Gas.					
Heat Release	Million BTU/HR (Gross HHV)	430.0	300.0	430.0	300.0
NO _x	LB/MM BTU (HHV)	0.080	0.080	0.080	0.080
	LBS/HR, Max.	34.4	24.0	34.4	24.0
CO	LB/MM BTU (HHV)	0.100	0.100	0.100	0.100
	LBS/HR, Max.	43.0	30.0	43.0	30.0
Total UHC	LB/MM BTU (HHV)	0.060	0.060	0.060	0.060
	LBS/HR, Max.	25.8	18.0	25.8	18.0
VOC	LB/MM BTU (HHV)	0.036	0.036	0.036	0.036
	LBS/HR, Max.	15.5	10.8	15.5	10.8
TSP	LB/MM BTU (HHV)	0.010	0.010	0.010	0.010
	LBS/HR, Max.	4.3	3.0	4.3	3.0
PM-10	LB/MM BTU (HHV)	0.008	0.008	0.008	0.008
	LBS/HR, Max.	3.4	2.4	3.4	2.4

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November 30, 1992
Tenaska
Page 3 of 3

I hope that the above information is helpful to you, and if you have any questions, please contact me at your earliest convenience.

Sincerely,

COEN COMPANY, INCORPORATED

A handwritten signature in dark ink, appearing to read 'RAB', with a long horizontal flourish extending to the right.

Richard A. Brown, Sales Application Engineer
Cogeneration Systems

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92年03月26日14時48分 宛先:MIC HOU

FM:NAGATSUUSHIN2 -5800 (MAR26 0106E W02291/MAR26 0052E N01153)
発信:MHI NAGASAKI 通信

ATTACHMENT 8

Sht. 1

MESSRS. TENESKA

TECHNICAL SPECIFICATION
OF
DRY SELECTIVE CATALYTIC NOx REMOVAL SYSTEM
FOR
REFERENCE DESIGN

SPEC. NO. 92N04600

MAR. 92

MITSUBISHI HEAVY INDUSTRIES, LTD.

DRAWN J. Fujimoto
CHECKED A. Hattori
APPROVED SN

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ATTACHMENT 8

Sht. 2

S 1. GENERAL DESCRIPTION

This specification covers the design specification and scope of supply for MITSUBISHI Dry Selective NOx Removal system(s).

1. NOx Removal Performance

Offered SCR system is designed to achieve the performance described in section 2 " TECHNICAL SPECIFICATION " and/or performance requirements of Buyer's data sheets as attached except where stated otherwise in this specification.

2. Scope of Supply

Any item which is not shown in this specification means Mitsubishi's Out of Scope.

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ATTACHMENT 8

Sht. 3

§ 2. TECHNICAL SPECIFICATION

1. SCR System Specification

- Type of Catalyst : Homogeneous Honeycomb Type
- Nos. of SCR System : 1
- Flue Gas Source : G/T
- Primary Fuel Considered for SCR Design : Nat. Gas, Propane, Butane, Kerosene, #2 Oil, #1 Diesel, Refinery Gas (), Others ()
- Secondary Fuel (if applicable) : NG, (#2OIL)

2. Reactor Inlet Flue Gas Condition

- Performance Case : NG 30°F #2OIL 30°F
- Flue Gas Flow Rate (lb/h) : 3654000 3697000
- Flue Gas Temperature (°F) : 680* 680*
- Flue Gas Main Component (Vol. or Wgt. %)
- N₂ : 70.72 70.57
- O₂ : 11.62 11.52
- H₂O : 13.11 13.23
- CO₂ : 3.71 4.84
- Ar : 0.84 0.84
- Other Flue Gas Component
- Particulate (lb/h) : 0* 15*
- SO₂ (ppmvd, @15% O₂) : 0* 25*
- SO₃ (ppmvd, @15% O₂) : 0* 1*
- NO_x (ppmvd, @15% O₂) : 42 65

3. SCR Performance Data (Items marked ☒ show warranted values)

- NO_x Removal Performance
- Catalyst Life (years) : ☒ 3 ☒ 8 ☐
- SCR Outlet NO_x (ppmvd, @15% O₂) : ☒ 3 ☒ 87.7 ☐
- NO_x Removal Efficiency (%) : ☐ 92.8 ☐ 10* ☐
- Slip NH₃ (ppmvd, @15% O₂) : ☒ 10* ☒ 10* ☐
- Gas Side Pressure Drop (in. W.G.) : ☐ 3.0 ☐ 3.0 ☐

4. Predicted Other Data

- Ammonia Consumption (lb/H) : 123 152
- ☒ Anhydrous Ammonia
- ☐ Aqueous Ammonia (% Solution)

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ATTACHMENT 8

Sht. 4

5. Limitation on Operation

- Heat Resistance Temperature of Catalyst (°F) : 750
- Minimum Temperature to Inject Ammonia (°F) : 520

6. Overall Housing Dimension

- Interface Dimensions at Reactor Inlet and/or Outlet
(Housing or Duct Internal Dimensions)

$$W \times H = \underline{29'-8"} \times \underline{62'-0"}^*$$

- Gas Pass Dimensions of Boiler Side at Upstream of Reactor

$$W \times H = \underline{29'-8"} \times \underline{62'-0"}^*$$

- Reactor Internal Dimensions

$$W \times H \times D = \underline{29'-8"} \times \underline{62'-0"} \times \underline{9'-9"}$$

Note 1. Item(s) marked * show(s) MHI's assumption value(s). Please let us know these data immediately to design properly.

- There shall be no warranties owing to any causes or circumstances beyond control of this system, including either improper plant operation over this specification, or fly of abnormal flammable, fragmental insulation or rust from upstream equipment.

- Initial loading of catalyst modules shall be conducted after complete starting-up adjustment of plant.

- Minimum temperature to inject ammonia is defined by SO₂ concentration which is shown above.

5. Materials

- Catalyst Module Frame Carbon Steel
- SCR Housing
 - Casing & Structure Carbon Steel
 - Inner Liner ☒ Carbon Steel ☐ Stainless
 - Internal Insulation ☒ Mineral Wool ☐ Ceramic Fiber
- ATG ☒ Carbon Steel ☐ Stainless
- Ammonia Injection System Carbon Steel

6. Shipping Condition

Module size for SCR Housing should be decided the largest one under following transportation limit. Maximum Legal Load with permits not Regarding Escorts;
12'-0" wide × 15'-0" over all height.

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ENGELHARD CORPORATION
101 WOOD AVENUE
ISELIN, NEW JERSEY 08830-0770
908-205-5000

December 2, 1992

Mr. Chuck Eliason
Tenaska
407 North 117 Street
Omaha, NE 68154

Subject: Tenaska Frederickson Washington Project

Dear Mr. Eliason:

Confirming our conversation, Engelhard can provide an oxidation catalyst which would simultaneously reduce CO and non methane-non ethane hydrocarbons (NM-NEHC) from the exhaust of a GE Frame 7FA gas turbine. As discussed, the catalyst would primarily have to reduce the NM-NEHC emissions when duct firing is utilized.

We can provide performance guarantees of 80% CO reduction and 30% NM-NEHC reduction. The CO reduction is relatively easy to achieve; however, in order to achieve the required NM-NEHC reduction, catalyst location is to be considered. Therefore, it is our recommendation to locate the catalyst in a high temperature zone of 1000-1100°F. This will insure 30% NM-NEHC reduction and will not affect the integrity of the catalyst. The catalyst has a ceramic substrate which can withstand temperatures of 1300°F+.

Thank you for your interest in our company. Please advise us if we can be of further assistance.

Very truly yours,

ENGELHARD CORPORATION
ENVIRONMENTAL CATALYSTS GROUP

Abe Rosenstein
Executive Sales Engineer

ABR/new
92-097

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ATTACHMENT 10

TENASKA - FREDERICKSON GENERATION PROJECT

EMISSION CALCULATION CROSS REFERENCE - FUEL OIL

Operating Scenario: Base Load, 50°F Compressor Inlet
Date: November 4, 1992

Fuel Type: Number 2 Distillate Oil

Unit	Operating Hrs/Year	Stack Height (ft)	Stack Diam. (ft)	Stack Temp. (Deg.F)	Volume Flow (acfm)	Emissions											
						NO _x		SO ₂		CO		VOC		Part.		PM10	
						(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(ppm)	lbs/hr	(gr/dscf)	lbs/hr	(gr/dscf)	lbs/hr
Gas Turbine (W/O SCR)						19	19	20	20	21	21	22	22	23	23	23	23
HRSG (W/O SCR)						24	24	25	25	26	26	27	27	28	28	29	29
GT/HRSG (W/SCR)					30	31	31	32	32	33	33	34	34	35	35	36	36

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ATTACHMENT 11

FUEL OIL CHARACTERISTICS AND HEATING VALUE

<u>Component</u>	<u>Formula</u>	<u>% by Weight</u>
Carbon	C	84.50
Hydrogen	H	15.43
Sulfur	S	.05
Nitrogen	N	.02
Oxygen	O	<u>Nil</u>
TOTAL		100.00
Higher Heating Value, Btu/lb 19630		
Lower Heating Value, Btu/lb 18550		
LHV/HHV Ratio = $\frac{18,550 \text{ Btu/lb}}{19,630 \text{ Btu/lb}} = 0.945$		
Density, lb/gal	7.21	

ATTACHMENT 12
MASS BALANCE AND EXHAUST GAS COMPOSITION - GAS TURBINE FIRING FUEL OIL

	Mole Wt	Exhaust Gas From Gas Turbine - Wet Basis				Natural Gas To Duct Burner - Wet Basis				Exhaust Gas To Stack - Wet Basis			
		Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr
C1	16.043					96.13	92.45	11,827	737				
C2	30.07					2.69	4.85	620	21				
C3	44.097					0.32	0.85	108	2				
nC4	58.124					0.01	0.03	4	0				
iC4	58.124					0.09	0.31	40	1				
nC5	72.151					0.01	0.04	6	0				
iC5	72.151					0.01	0.04	6	0				
C6	86.178					0.01	0.05	7	0				
N2	28.013	70.40	70.18	2,474,009	88,316	0.58	0.97	125	4	70.40	70.18	2,474,134	88,321
CO2	44.01	4.82	7.55	266,114	6,047	0.15	0.40	51	1	4.82	7.55	300,939	6,838
Ar	39.948	0.84	1.19	42,096	1,054					0.84	1.19	42,096	1,054
O2	31.999	11.50	13.10	461,640	14,427					11.50	13.10	411,534	12,861
H2O	18.015	12.44	7.98	281,141	15,606					12.44	7.98	309,090	17,157
TOTAL WET BASIS:		100.00	100.00	3,525,000	125,450	100.00	100.00	12,793	767	100.00	100.00	3,537,793	126,231

MOLECULAR WEIGHT:

28.099

16.682

28.026

	Mole Wt	Exhaust Gas From Gas Turbine - Dry Basis				Natural Gas To Duct Burner - Dry Basis				Exhaust Gas To Stack - Dry Basis			
		Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr	Mole %	Wt %	Lb/hr	Mole/hr
C1	16.043					96.13	92.45	11,827	737				
C2	30.07					2.69	4.85	620	21				
C3	44.097					0.32	0.85	108	2				
nC4	58.124					0.01	0.03	4	0				
iC4	58.124					0.09	0.31	40	1				
nC5	72.151					0.01	0.04	6	0				
iC5	72.151					0.01	0.04	6	0				
C6	86.178					0.01	0.05	7	0				
N2	28.013	80.40	76.27	2,474,009	88,316	0.58	0.97	125	4	80.97	76.63	2,474,134	88,321
CO2	44.01	5.50	8.20	266,114	6,047	0.15	0.40	51	1	6.27	9.32	300,939	6,838
Ar	39.948	0.96	1.30	42,096	1,054					0.97	1.30	42,096	1,054
O2	31.999	13.13	14.23	461,640	14,427					11.79	12.75	411,534	12,861
TOTAL DRY BASIS:		100.00	100.00	3,243,859	109,844	100.00	100.00	12,793	767	100.00	100.00	3,228,703	109,073

MOLECULAR WEIGHT:

29.532

16.682

29.601

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DCL 500 PIPE FILLING LIQUID

Rev. Date
March 1985

DUSSEK CAMPBELL LIMITED
30 DUSSEK STREET
BELLEVILLE, ONTARIO
CANADA K8N 5A5

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product

General

Trade Name	DCL 500	Telephone Number
Synonyms	SYNTHETIC INSULATING LIQUID	611 - 966-8881
Chemical Family	HYDROCARBON	DOT Hazardous Materials Proper Shipping Name NOT DEFINED AS A "HAZARDOUS MATERIAL"
Chemical Name	ALKYL BENZENE/POLYISOBUTYLENE/BUTENE BLEND	DOT Hazard Class NOT REGULATED
AS No.	68648-86-2	

Summary of Hazards

DCL 500 IS A STABLE, INERT MATERIAL UNDER NORMAL STORAGE
CONDITIONS AND PRESENTS NO SIGNIFICANT HEALTH HAZARD

Fire and Explosion

Flash Point (Method)	Autoignition Temperature (Method)	Flammable Limits (% Vol. in Air)
ASTM D92	HEATING ABOVE 200°C PRODUCES DEPOLYMERIZATION AND THERMAL DECOMPOSITION	NO OSHA LIMITS HAVE BEEN ESTABLISHED FOR THIS MATERIAL

Usual fire and explosion hazards: WHEN HEATED ABOVE ITS FLASH POINT, THIS MATERIAL WILL RELEASE FLAMMABLE VAPOURS WHICH CAN BURN OR BE EXPLOSIVE IN CONFINED SPACES, IF EXPOSED TO A SOURCE OF IGNITION

Extinguishing media: DRY CHEMICAL, CARBON DIOXIDE, FOAM

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Special firefighting procedures:

FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER ANY ENCLOSED OR CONFINED FIRE SPACE WITHOUT PROPER PROTECTIVE EQUIPMENT. THIS INCLUDES SELF-CONTAINED BREATHING APPARATUS TO PROTECT AGAINST THE HAZARDOUS EFFECTS OF COMBUSTION PRODUCTS AND OXYGEN DEFICIENCIES. COOL TANKS AND CONTAINERS EXPOSED TO FIRE WITH WATER.

Emergency and First Aid

Should inhalation occur, immediately remove personnel from contaminated area to fresh air. Administer oxygen if there are signs of breathing difficulties. Obtain prompt medical attention.

Flush eyes with clean, low-pressure water for at least 15 minutes. If irritation persists, obtain medical attention.

Thoroughly wash affected area with soap and water. Ensure all contaminated clothing is thoroughly clean before re-use.

Do not induce vomiting since aspiration into lungs will cause lipid pneumonia. Obtain prompt medical attention.

Spill and Disposal

Eliminate all open flames in vicinity of spill. If possible, safely stop flow of spill. Contain liquid by diking to prevent material from entering sewage systems or water bodies. Absorb residual material with oil absorbent clays or diatomaceous earth. Contaminated area should be subsequently washed with mineral spirits or alternative solvents which conform to all applicable OSHA and EPA regulations. Treat affected area with a final oil absorbent clay cleanup to remove all residual solvent. Ensure adequate ventilation for all personnel when handling solvents.

Contaminated material may be dumped in approved landfill disposal area or incinerated by a licensed operator, ensuring compliance with local, state and federal regulations.

Components

Component Name	CAS No.	
XYLBENZENE	88515-28-6	75 PERCENT
OLYISOBUTYLENE/BUTENE COPOLYMER	9003-29-6	25 PERCENT

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MEALIN MAZAROS

THIS MATERIAL PRESENTS NO SIGNIFICANT HEALTH HAZARD UNDER NORMAL
CONDITIONS OF USE.

ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS
-------------------	--------------------

NO SIGNIFICANT ADVERSE HEALTH EFFECTS ARE EXPECTED TO OCCUR UPON
SHORT-TERM EXPOSURE TO ALKYL BENZENE/POLYBUTENE VAPOURS

ye
ontact

kin
absorption

NO SIGNIFICANT ADVERSE HEALTH EFFECTS ARE EXPECTED UNDER NORMAL CONDITIONS
OF USE

PROLONGED OR REPEATED SKIN CONTACT MAY PRODUCE MINOR IRRITATION

gestion

Effects Of
overexposure

PROLONGED EXPOSURE TO VAPOURS AT ELEVATED TEMPERATURES MAY CAUSE
DIZZINESS, HEADACHE, NAUSEA.
MINOR SKIN IRRITATION MAY BE NOTED FOLLOWING PROLONGED OR REPEATED SKIN CONTACT

Protective Equipment

Respiratory NOT REQUIRED WHEN MATERIAL USED AT AMBIENT TEMPERATURES

entilation IF-HANDLED HOT, USE ADEQUATE VENTILATION TO KEEP VAPOURS BELOW APPLICABLE STANDARDS. USE NIOSH/OSHA APPROVED RESPIRATOR

SAFETY GLASSES SHOULD PROVIDE ADEQUATE PROTECTION WHEN MATERIAL
HANDLED AT AMBIENT TEMPERATURES

WEAR NEOPRENE OR CHEMICAL RESISTANT GLOVES TO AVOID PROLONGED OR REPEATED SKIN CONTACT

*SUITABLE PROTECTIVE EQUIPMENT REQUIRED TO PREVENT BURNS, IF
PRODUCT HANDLED HOT

Occupational Exposure Limits

Substance:	ALKYLBENZENE/POLYBUTENE VAPOURS
------------	---------------------------------

Exposure Limit Value/Time	Notes

NO OSHA EXPOSURE STANDARD OR THRESHOLD LIMIT VALUE HAS BEEN
- ESTABLISHED FOR THIS MATERIAL

2.

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X. Physical and Chemical Data			
Boiling Point THERMAL DECOMPOSITION OCCURS ABOVE 200°C	Evaporation Rate 48 HRS/25°C - <0.5%		
Freezing Point NOT APPLICABLE	Vapor Pressure (MM HG) 40°C - <1.0		
Specific Gravity H ₂ O = 1 0.88/15°C	Vapor Sp. Gr. (Air = 1.0) 15°C >1.0	Solubility in Water <0.1%	Stability STABLE UNDER NORMAL CONDITIONS
Hazardous Polymerization WILL NOT OCCUR	Viscosity KINEMATIC/37.8°C RANGE 108-118.8 cSt TYPICAL 110 cSt	Fire Point 190°C	
Other Physical and Chemical Properties	Pour Point RANGE -15°C - -25°C ASTM D97 TYPICAL -20°C	Average Molecular Wt. 460	
Appearance and Odor	CLEAR, PALE YELLOW MOBILE LIQUID - BLAND ODOR		
Conditions to Avoid	EXTREME HEAT AND OPEN FLAME		
Materials to Avoid	MAY REACT WITH STRONG OXIDIZING MATERIALS		
Hazardous Decomposition Products	NORMAL COMBUSTION FORMS CARBON DIOXIDE AND WATER VAPOUR. INCOMPLETE COMBUSTION CAN PRODUCE CARBON MONOXIDE		
XI. Additional Precautions			

Handling and Storage	USE GOOD PERSONAL HYGIENE PRACTISES. WASH HANDS THOROUGHLY BEFORE EATING AND DRINKING. STORE DCL 500 AWAY FROM EXCESSIVE HEAT AND OPEN FLAMES. DO NOT STORE NEAR COMBUSTIBLE MATERIALS.
----------------------------	---

OFFICIAL USE ONLY

OFFICIAL USE ONLY

TENASKA WASHINGTON PARTNERS II, L.P.

407 North 117 Street
Omaha, NE 68154

Telephone: (402) 691-9500
Fax: (402) 691-9526

December 3, 1993
92C0548A

Fred L. Austin, Air Pollution Engineer
Puget Sound Air Pollution Control Agency
110 Union Street, Suite 500
Seattle, Washington 98101-2038

**Subject: Request for Modification to DRAFT Notice of Construction Permit/
Order of Approval for Tenaska Washington II Generation Project
(Reg. No. 10645, NC No. 4842)**

Dear Mr. Austin:

In this letter, Tenaska Washington Partners II, L.P. respectfully request a modification to the DRAFT Order of Approval for Notice of Construction No. 4842. All supporting information and attachments are included with this letter to facilitate your review of this request.

PURPOSE OF REQUEST

This modification request focuses on a revision to the estimated emissions of particulate matter in our proposed project located in Fredrickson, Washington. In the past few months, our engineering staff has realized the need to more accurately estimate particulate matter emissions from the gas turbine/HRSG with the proposed SCR and oxidation catalyst controls. More specifically, we propose to include the formation of particulate matter from secondary sulfate formation due to the presence of ammonia slip from the SCR control system.

This letter presents the revised emission information and provides revised air quality impact assessment information for TSP and PM₁₀. From our estimates, no other pollutants will be emitted in amounts higher than already provided in our original application submittal. Consequently, the analysis provided here is limited to emissions and air quality impacts associated with particulate matter. It is important to note that the results from this analysis do not indicate a significant increase in impacts compared to those presented in the original analysis.

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REVISED PARTICULATE MATTER EMISSIONS

Due to the potential for additional particulate matter emissions from secondary sulfate formation in the turbine exhaust, specifically the reaction of ammonia with SO_3 and SO_4 , estimated emission of TSP and PM_{10} are revised from estimates provided with our original NC application materials. Table 1 presents the revised estimated particulate matter emissions. Attachment 1 provides the background engineering calculations used to determine these estimates.

REVISED AIR QUALITY IMPACTS

Revised TSP/ PM_{10} Estimated Maximum Impacts. An analysis of air quality impacts for particulate matter was conducted following the same methods as described in our original NC Application. Maximum short-term and annual impacts were modeled with the EPA-approved ISC2 dispersion model using the meteorological data set from nearby McChord Air Force Base (1980 - 1984). Due to differing stack parameters, separate simulation were made for annual and short-term impacts. Simulations of short-term impacts were performed using unit emissions and subsequently pro-rated by the revised potential emission rates. Since earlier maximum short-term impacts occurred during oil-firing, it was assumed that the revised short-term impacts would also result from oil-firing, and the simulations incorporated the oil-firing stack parameters accordingly. Simulations for annual impacts were performed using revised potential emission rates (annualized), to account for the combined effect of different stack parameters between gas- and oil-firing.

Table 2 presents the revised impacts from particulate matter as compared to PSAPCA significant impact thresholds. Table 3 presents the revised impacts from particulate matter as compared to PSD Class II increments and ambient standards. The project's estimated maximum particulate matter impacts are well below all applicable thresholds, increments, and standards.

Revised TSP/ PM_{10} Estimated Impacts at Mt. Rainier. In a method similar to that described above, but using the EPA-approved dispersion model COMPLEX-1 as appropriate, a revised impact analysis was conducted for the point of maximum potential impact at the closest Federal Class I wilderness area, Mt. Rainier. Table 4 shows that the revised impacts from particulate matter are well below the PSD Class I increments.

As summary of the revised dispersion modeling results are presented in Attachment 2.

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Table 1

Revised Particulate Matter Emissions
From Tenaska Washington II Turbine/HRSG

Pollutant	Maximum Hourly (lb/hr)				Annual Average (tpy)	Annual Average (tpy)
	Gas [original]	Oil [original]	Gas [revised]	Oil [revised]	[original]	[revised]
TSP	13.3	21.3	18.4	82.6	51.6	82.4
PM-10	12.4	20.4	17.8	82.6	49.0	79.9

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Table 2

**REVISED RESULTS FROM ISC2 MODELING
MAXIMUM IMPACT FOR TSP AND PM-10
FROM TENASKA WASHINGTON II TURBINE/HRSG**

Pollutant	Averaging Time	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)		Significant Impact Thresholds ($\mu\text{g}/\text{m}^3$)
		[original]	[revised]	
TSP	24-hr, highest	1.0	2.1	5
	24-hr, highest 2nd high	0.5	1.0	--
	Annual	0.017	0.027	1
PM-10	24-hr, highest	1.0	2.1	5
	24-hr, highest 2nd high	0.5	1.0	--
	Annual	0.015	0.025	1

Notes:

Short-term impacts are based on oil-firing in turbine
Annual average impacts are based on weighted annual average fuel
use and associated emissions (oil = 120 hours, gas = 8400 hours)

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Table 3

REVISED COMPARISON OF MODELED PROJECT TSP/PM-10 IMPACTS
WITH PSD CLASS II INCREMENTS AND AMBIENT AIR QUALITY STANDARDS
FROM TENASKA WASHINGTON II TURBINE/HRSG

Pollutant	Averaging Time	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)		PSD Class II Increments ^a ($\mu\text{g}/\text{m}^3$)	Background Concentration ^b ($\mu\text{g}/\text{m}^3$)	Total Project Impact ($\mu\text{g}/\text{m}^3$)		Washington State Standards ($\mu\text{g}/\text{m}^3$)	National Standards ($\mu\text{g}/\text{m}^3$)
		[original]	[revised]			[original]	[revised]		
TSP	24-hr	0.5	1.04 ^c	37 ^d	121	121	122	150 ^d	--
	Annual	0.017	0.027	19	41	41	41	60	--
PM-10	24-hr	0.5	1.04 ^c	30 ^{d,e}	85	85	86	150 ^d	150
	Annual	0.015	0.025	17 ^e	29	29	29	50	50

Notes:

- ^a 40 CFR 52.21
- ^b based on data available from PSAPCA and Ecology for the Fredrickson area
- ^c highest, second high concentration
- ^d concentration not to be exceeded more than once a year
- ^e newly promulgated (58 FR 31622, June 3, 1993)

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Table 4

**REVISED MAXIMUM PROJECT TSP/PM-10 IMPACTS AT
MT. RAINIER NATIONAL PARK BOUNDARY (CARBON RIVER ENTRANCE)
FROM TENASKA WASHINGTON II TURBINE/HRSG**

Pollutant	Averaging Time	Maximum Project Impact ($\mu\text{g}/\text{m}^3$)		PSD Class I Increments ^a ($\mu\text{g}/\text{m}^3$)
		[original]	[revised]	
TSP	24-hr	0.030	0.091 ^b	10 ^c
	Annual	0.0015	0.0028	5
PM-10	24-hr	0.029	0.091 ^b	8 ^{c,d}
	Annual	0.0014	0.0027	4 ^d

Notes:

^a 40 CFR 52.21^b highest, second high concentration^c concentration not to be exceeded more than once a year^d newly promulgated (58 FR 31622, June 3, 1993)

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Air Toxics. There will be no increases in the potential emissions/impacts from the air toxics estimates presented in the original NC Application.

Revised Impacts to Visibility (impacts to Mt. Rainier). As particulate matter is integral to the analysis of impacts to visibility, the analysis performed in the original NC application was re-assessed. The original analysis estimated impact to visibility at Mt. Rainier using a background visual range (BVR) of 160 kilometers (recommended by PSAPCA), representing a 50th percentile (or average) value of the distance one could see distant objects in the region. Additionally, the original analysis estimated visibility impacts using a BVR of 242 km [90th percentile visual distance], as recommended by the Washington Department of Ecology as a value often used by the National Park Service in evaluating visibility impacts from major sources in the region. The original analysis was performed using a Level-2 analysis as described by the *Workbook for Plume Visual Impact Screening and Analysis* (EPA 1988) using the EPA-approved VISCREEN model, and default screening plume visual impact thresholds of plume perceptibility and contrast.

In the revised visibility impact analysis, the results from using the same methods as described above for the new PM emissions and BVR value of 160 km demonstrated that impacts will remain below the default screening plume visual impact thresholds. A printout of the VISCREEN simulation is provided in Attachment 3.

For the revised analysis using the BVR value of 242 km, a Level-3 visibility analysis was conducted using the EPA-approved PLUVUE II model. This more rigorous analysis estimates impacts accounting for more detailed information about intervening terrain, plume particle characteristics, magnitude of impact, and frequency of occurrence. A complete copy of the Level-3 impact analysis is provided in Attachment 4. The Level-3 analysis results show that plume visual impacts using a BVR value of 242 km would remain below the default screening thresholds.

These revised analyses demonstrate that the project will not cause a significant impact to visibility at Mt. Rainier.

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**REQUESTED CHANGES TO DRAFT ORDER OF APPROVAL NC #4842
CONDITIONS**

Based on the supporting information presented in this letter (including attachments), Tenaska Washington Partners II, L.P. request that the following changes be made to the indicated specific permit conditions:

Condition #7

Change from: PM10 ~~= 49.0 tons~~ to **PM10 = 79.9 tons**

Condition #8

	Natural Gas	Oil
Change from:	0.0023 gr/dscf	0.0037 gr/dscf
to:	0.0030 gr/dscf	0.0131 gr/dscf

Based on our review of the DRAFT Order of Approval, the items indicated above are the only things to change. If you feel that additional items in the existing DRAFT Order require changing or new items are required, as a result of the revisions to emissions/impacts described in this letter, please contact us as soon as possible.

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We look forward to your review of this material and further progress on our permit application. Please feel free to contact me at (402) 691-9515 or Mr. Dan Guido (WCC) at (510) 874-3172, if you have any questions.

Sincerely,

A handwritten signature in dark ink, appearing to read "Mike Lebens", with a long horizontal flourish extending to the right.

Michael C. Lebens
Vice President, Engineering

Attachments

cc: Tom Hendricks
Dave Schlotthauer
William E. Steiner (WCC)
Dan Guido (WCC)

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ATTACHMENT 1

REVISED EMISSION CALCULATIONS

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TENASKA WASHINGTON II GENERATION PROJECT
FREDERICKSON, WASHINGTON
SUPPLEMENTAL EMISSION CALCULATIONS

These calculations supplement the sample calculations included in the Notice to Construct Application dated December 22, 1992. These calculations include an increase of particulate emissions from the reaction of ammonia and sulfur in the flue gas to form ammonium sulfate or ammonium bisulfate. These calculations are based on the following assumptions, which are believed to be conservative:

- Natural gas is assumed to contain 1 grain of sulfur per 100 Scf for these calculations. Actual sulfur content is expected to average 1/4 grain of sulfur per 100 Scf of natural gas.
- Fuel oil is assumed to contain 0.05% sulfur by weight for these calculations. Actual sulfur content is expected to average 0.035% by weight.
- All SO₃ in the flue gas is assumed to convert to ammonium sulfate.
- Oxidation catalyst is assumed to convert 60% of SO₂ in the flue gas to SO₃ when the duct burners are fired, and 30% of SO₂ to SO₃ when the duct burners are unfired.
- SCR catalyst is assumed to convert 2% of SO₂ in the flue gas to SO₃.
- All ammonium sulfate is assumed to leave the HRSG in the flue gas as particulate. Some portion of ammonium sulfate produced is expected to remain within the boiler and be removed by water washing.
- The duct burner will not be fired when the gas turbine is firing fuel oil.

I. 50°F, Natural Gas Firing

IA. Gas Turbine Particulate Emissions

9 lb/hr particulate from gas turbine per G.E.

Assume the same SO₃/SO₂ ratio from gas turbine when firing natural gas as when firing fuel oil.

$$81 \frac{\text{lb/hr SO}_2}{\text{hr}} \times \frac{32.06 \text{ lb S}}{64.06 \text{ lb SO}_2} = 40.54 \frac{\text{lb S}}{\text{hr}}$$

$$6 \frac{\text{lb/hr SO}_3}{\text{hr}} \times \frac{32.06 \text{ lb S}}{80.06 \text{ lb SO}_3} = 2.40 \frac{\text{lb S}}{\text{hr}}$$

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$$\frac{40.54}{40.54 + 2.40} = 94.4\% \text{ S to SO}_2$$

$$\frac{2.40}{40.54 + 2.40} = 5.6\% \text{ S to SO}_3$$

Natural gas at 1 grain S/100 Scf and 1,031 Btu/Scf HHV
(929 Btu/Scf LHV, LHV/HHV = .901)

$$\frac{1 \text{ Grain S}}{100 \text{ Scf}} \times \frac{1 \text{ lb S}}{7000 \text{ grain S}} \times \frac{\text{Scf}}{1031 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} = .00139 \frac{\text{lb S}}{\text{MMBtu HHV}}$$

1603.0 MMBtu/hr LHV consumed by gas turbine per G.E.

$$1603 \times 10^6 \frac{\text{Btu LHV}}{\text{hr}} \times .00139 \frac{\text{lb S}}{\text{MMBtu HHV}} \times \frac{1}{.901} \frac{\text{HHV}}{\text{LHV}} = 2.47 \frac{\text{lb S}}{\text{hr}}$$

$$2.47 \frac{\text{lb S}}{\text{hr}} \times 5.6\% \text{ as SO}_3 \times \frac{80.06 \text{ lb SO}_3}{32.06 \text{ lb S}} = .34 \frac{\text{lb SO}_3}{\text{hr}} \text{ from gas turbine}$$

$$2.47 \frac{\text{lb S}}{\text{hr}} \times 94.4\% \text{ as SO}_2 \times \frac{64.06 \text{ lb SO}_2}{32.06 \text{ lb S}} = 4.66 \frac{\text{lb SO}_2}{\text{hr}} \text{ from gas turbine}$$

Assume 60% conversion of SO₂ to SO₃ by oxidation catalyst per Engelhard

$$4.66 \frac{\text{lb SO}_2}{\text{hr}} \times 60\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = 3.49 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted by oxidation catalyst}$$

Assume 2% conversion of SO₂ to SO₃ by SCR catalyst per Engelhard

$$4.66 \frac{\text{lb SO}_2}{\text{hr}} \times 40\% = 1.86 \frac{\text{lb SO}_2}{\text{hr}} \text{ entering SCR}$$

$$1.86 \frac{\text{lb SO}_2}{\text{hr}} \times 2\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = .05 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted by SCR catalyst}$$

$$\text{Total SO}_3 = .34 + 3.49 + .05 = 3.88 \frac{\text{lb SO}_3}{\text{hr}}$$

Assume 100% conversion of SO₃ to ammonium sulfate

$$3.88 \frac{\text{lb SO}_3}{\text{hr}} \times 100\% \times \frac{132.14 \text{ lb (NH}_4)_2\text{SO}_4}{80.06 \text{ lb SO}_3} = 6.40 \frac{\text{lb (NH}_4)_2\text{SO}_4}{\text{hr}}$$

$$\text{Total particulate emissions} = 9.0 + 6.4 = 15.4 \frac{\text{lb particulate}}{\text{hr}}$$

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Supplemental Emission Calculations
Page 3

Gas turbine exhaust = 109,317 mole/hr, dry basis

$$\frac{15.4 \text{ lb particulate}}{\text{hr}} \times \frac{7,000 \text{ grain}}{\text{lb}} = .0026 \frac{\text{grain particulate}}{\text{dry Scf}}$$

$$109,317 \frac{\text{mole}}{\text{hr}} \times 379.5 \frac{\text{Scf}}{\text{mole}}$$

IB. Duct Burner Particulate Emissions,
300 MMBtu/hr Annual Average Firing Rate

Duct burner produces 0.01 lb particulate per MMBtu, per Coen

$$221 \frac{\text{MMBtu}}{\text{hr}} \times .01 \frac{\text{lb}}{\text{MMBtu}} = 2.2 \frac{\text{lb particulate}}{\text{hr}}$$

Natural gas at 1 grain S/100 Scf and 1,031 Btu/Scf HHV
(929 Btu/Scf LHV, LHV/HHV = .901)

$$\frac{1 \text{ Grain S}}{100 \text{ Scf}} \times \frac{\text{lb S}}{7000 \text{ grain S}} \times \frac{\text{Scf}}{1031 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} = .00139 \frac{\text{lb S}}{\text{MMBtu HHV}}$$

$$221 \times 10^6 \frac{\text{Btu HHV}}{\text{hr}} \times .00139 \frac{\text{lb S}}{\text{MMBtu HHV}} = .307 \frac{\text{lb S}}{\text{hr}}$$

Assume the same SO₃/SO₂ ratio from duct burner as for gas turbine.

$$.307 \frac{\text{lb S}}{\text{hr}} \times 5.6\% \text{ as SO}_3 \times \frac{80.06 \text{ lb SO}_3}{32.06 \text{ lb S}} = .043 \frac{\text{lb SO}_3}{\text{hr}} \text{ from gas turbine}$$

$$.307 \frac{\text{lb S}}{\text{hr}} \times 94.4\% \text{ as SO}_2 \times \frac{64.06 \text{ lb SO}_2}{32.06 \text{ lb S}} = .579 \frac{\text{lb SO}_2}{\text{hr}} \text{ from gas turbine}$$

Assume 60% conversion of SO₂ to SO₃ by oxidation catalyst per Engelhard

$$.579 \frac{\text{lb SO}_2}{\text{hr}} \times 60\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = .434 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted by oxidation catalyst}$$

Assume 2% conversion of SO₂ to SO₃ by SCR catalyst per Engelhard

$$.579 \frac{\text{lb SO}_2}{\text{hr}} \times 40\% = .232 \frac{\text{lb SO}_2}{\text{hr}} \text{ entering SCR}$$

$$.232 \frac{\text{lb SO}_2}{\text{hr}} \times 2\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = .0058 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted by SCR catalyst}$$

$$\text{Total SO}_3 = .043 + .434 + .006 = .483 \frac{\text{lb SO}_3}{\text{hr}}$$

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Supplemental Emission Calculations
Page 4

Assume 100% conversion of SO_3 to ammonium sulfate

$$.483 \frac{\text{lb SO}_3}{\text{hr}} \times 100\% \times \frac{132.14 \text{ lb (NH}_4)_2\text{SO}_4}{80.06 \text{ lb SO}_3} = .80 \frac{\text{lb (NH}_4)_2\text{SO}_4}{\text{hr}}$$

$$\text{Total particulate emissions} = 2.2 + .8 = 3.0 \frac{\text{lb particulate}}{\text{hr}}$$

Combined gas turbine/duct burner exhaust = 108,547 mole/hr, dry basis

$$\frac{3.0 \frac{\text{lb}}{\text{hr}}}{108,547 \frac{\text{mole}}{\text{hr}}} \times \frac{7,000 \frac{\text{grain lb}}{\text{Scf}}}{379.5 \text{ mole}} = .00051 \frac{\text{grain particulate}}{\text{dry Scf}}$$

IC. Combined Gas Turbine and Duct Burner Particulate Emissions

$$\begin{array}{rcl} \text{Particulate from gas turbine} & = & 15.4 \text{ lb/hr} \\ \text{Particulate from duct burner} & = & 3.0 \text{ lb/hr} \\ \text{Total particulate} & = & 18.4 \text{ lb/hr} \end{array}$$

$$\frac{18.4 \frac{\text{lb}}{\text{hr}}}{108,547 \frac{\text{mole}}{\text{hr}}} \times \frac{7,000 \frac{\text{grain lb}}{\text{Scf}}}{379.5 \text{ mole}} = .0031 \frac{\text{grain}}{\text{dry Scf}}$$

ID. Gas Turbine PM-10 Emissions

G.E. says all gas turbine particulate emissions are PM-10.

Assume all ammonium sulfate emissions are PM-10.

Therefore, gas turbine PM-10 emissions are the same as calculated for particulate emissions:

15.4 lb/hr

.0026 grain/Scf dry

Supplemental Emission Calculations

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IE. Duct Burner PM-10 Emissions

Coen says PM-10 emissions will be about 80% of particulate emissions

Assume 80% of ammonium sulfate emissions are PM-10.

$$3.0 \frac{\text{lb}}{\text{hr}} \times 80\% = 2.4 \text{ lb/hr}$$

$$\frac{2.4 \frac{\text{lb}}{\text{hr}} \times 7,000 \frac{\text{grain}}{\text{lb}}}{108,547 \frac{\text{mole}}{\text{hr}} \times 379.5 \frac{\text{Scf}}{\text{mole}}} = .00041 \frac{\text{grain}}{\text{dry Scf}}$$

IF. Combined Gas Turbine and Duct Burner PM-10 Emissions

PM-10 from gas turbine	=	15.4 lb/hr
PM-10 from duct burner	=	2.4 lb/hr
Total PM-10	=	17.8 lb/hr

$$\frac{17.8 \frac{\text{lb}}{\text{hr}} \times 7,000 \frac{\text{grain}}{\text{lb}}}{108,547 \frac{\text{mole}}{\text{hr}} \times 379.5 \frac{\text{Scf}}{\text{mole}}} = .0030 \frac{\text{grain}}{\text{dry Scf}}$$

II. 20°F, Fuel Oil Firing

IIA. Gas Turbine Particulate Emissions

17 lb/hr particulate from gas turbine per G.E.
 86 lb/hr SO₂ from gas turbine per G.E.
 6 lb/hr SO₃ from gas turbine per G.E.

Assume 30% conversion of SO₂ to SO₃ by oxidation catalyst per Engelhard

$$86 \frac{\text{lb SO}_2}{\text{hr}} \times 30\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = 32.2 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted from SO}_2 \text{ by oxidation catalyst}$$

Assume 2% conversion of SO₂ to SO₃ by SCR catalyst by Engelhard

$$86 \frac{\text{lb SO}_2}{\text{hr}} \times 70\% = 60.2 \frac{\text{lb SO}_2}{\text{hr}} \text{ entering SCR catalyst}$$

Supplemental Emission Calculations
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$$60.2 \frac{\text{lb SO}_2}{\text{hr}} \times 2\% \times \frac{80.06 \text{ lb SO}_3}{64.06 \text{ lb SO}_2} = 1.50 \frac{\text{lb SO}_3}{\text{hr}} \text{ converted from SO}_2 \text{ by SCR catalyst}$$

$$\text{Total SO}_3 = 6 + 32.2 + 1.5 = 39.7 \frac{\text{lb SO}_3}{\text{hr}}$$

Assume 100% conversion of SO₃ to ammonium sulfate

$$39.7 \frac{\text{lb SO}_3}{\text{hr}} \times 100\% \times \frac{132.14 \text{ lb (NH}_4)_2\text{SO}_4}{80.06 \text{ lb SO}_3} = 65.6 \frac{\text{lb (NH}_4)_2\text{SO}_4}{\text{hr produced}}$$

$$\text{Total particulate emissions} = 17 + 65.6 = 82.6 \frac{\text{lb particulate}}{\text{hr}}$$

Gas Turbine Exhaust = 116,688 mole/hr, dry basis

$$\frac{82.6 \frac{\text{lb particulate}}{\text{hr}} \times 7,000 \frac{\text{grain}}{\text{lb}}}{116,688 \frac{\text{mole}}{\text{hr}} \times 379.5 \frac{\text{Scf}}{\text{mole}}} = .0131 \frac{\text{grain}}{\text{dry Scf}}$$

IIB. Duct Burner Emissions

The duct burner will not be fired when the gas turbine is firing fuel oil, so duct burner emission contribution will be zero.

IIC. Combined as Turbine and Duct Burner Particulate Emissions

Since the duct burner is not fired, gas turbine only emissions hold

$$82.6 \frac{\text{lb particulate}}{\text{hr}}$$

$$.0131 \frac{\text{grain particulate}}{\text{dry Scf}}$$

IID. Gas Turbine PM-10 Emissions

G.E. says all gas turbine particulate emissions are PM-10.

Assume all ammonium sulfate emissions are PM-10.

Therefore, gas turbine PM-10 emissions are the same as calculated for particulate emissions.

Supplemental Emission Calculations
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82.6 $\frac{\text{lb}}{\text{hr}}$

.0131 $\frac{\text{grain}}{\text{dry Scf}}$

IIE. Duct Burner PM-10 Emissions

The duct burners will not be fired when the gas turbine is firing fuel oil, so the duct burner emission contribution will be zero.

IIF. Combined Gas Turbine and Duct Burner PM-10 Emissions

Since the duct burner is not fired, gas turbine only emissions hold

82.6 $\frac{\text{lb PM-10}}{\text{hr}}$

.0131 $\frac{\text{grain PM-10}}{\text{dry Scf}}$

TENASKA WASHINGTON II GENERATION PROJECT
FREDERICKSON, WASHINGTON

Frederickson GE Frame 7FA	Particulate		PM10	
	Gr/dscf	lb/hr	gr/dscf	lb/hr
Natural Gas Firing at 20°F CIT				
Gas Turbine	0.0025	15.7	0.0025	15.7
HRSG	0.0005	3.0	0.0004	2.4
GT/HRSG combined	0.0030	18.7	0.0029	18.1
No. 2 Fuel Oil Firing at 20°F CIT				
Gas Turbine	0.0131	82.6	0.0131	82.6
HRSG	0.0000	0.0	0.0000	0.0
GT/HRSG combined	0.0131	82.6	0.0131	82.6
Natural Gas Firing at 50°F CIT				
Gas Turbine	0.0026	15.4	0.0026	15.4
HRSG	0.0005	3.0	0.0004	2.4
GT/HRSG combined	0.0031	18.4	0.0030	17.8
No. 2 Fuel Oil Firing at 50°F CIT				
Gas Turbine	0.0133	79.4	0.0133	79.4
HRSG	0.0000	0.0	0.0000	0.0
GT/HRSG combined	0.0133	79.4	0.0133	79.4
Natural Gas Firing at 80°F CIT				
Gas Turbine	0.0027	14.9	0.0027	14.9
HRSG	0.0009	4.8	0.0007	3.8
GT/HRSG combined	0.0036	19.7	0.0034	18.7
No. 2 Fuel Oil Firing at 80°F CIT				
Gas Turbine	0.0133	74.5	0.0133	74.5
HRSG	0.0000	0.0	0.0000	0.0
GT/HRSG combined	0.0133	74.5	0.0133	74.5

NOTES:

1. Natural gas is assumed to contain 1 grain sulfur/100 Scf natural gas. Actual sulfur level of natural gas is expected to average about 1/4 grain sulfur/100 Scf. Fuel oil is assumed to contain 0.05 weight % sulfur fuel oil. Actual sulfur level of fuel oil is expected to average about 0.035 weight % sulfur.
2. HRSG duct burners are fired with natural gas only. They will not be capable of firing with fuel oil. Calculations are based on heat input of 221 MMBtu/hr HHV at the 20°F CIT and 50°F CIT cases, and 350 MMBtu/hr HHV (maximum duct firing) at the 80°F CIT case.

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