
Final Environmental Impact Statement

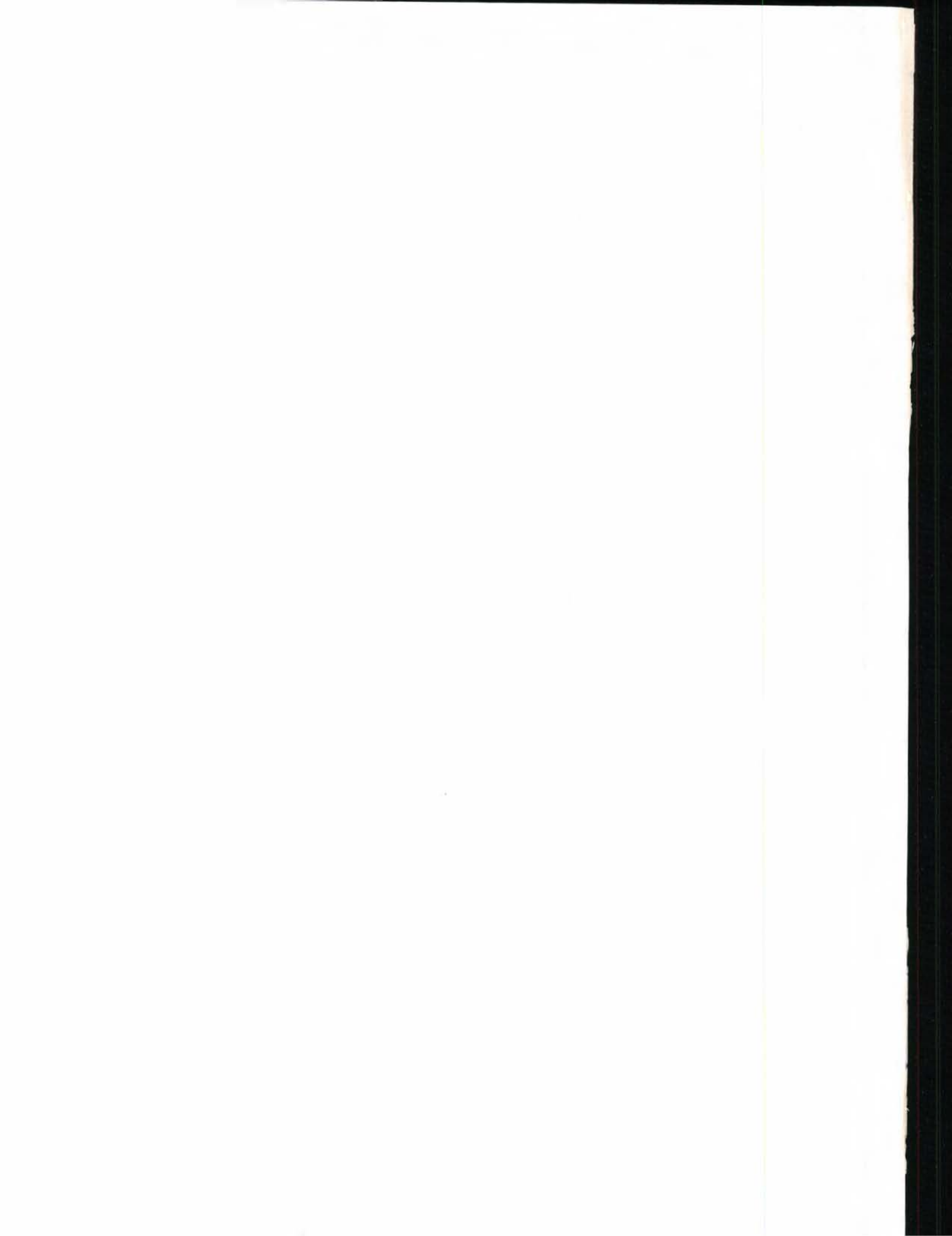
BONNEVILLE POWER
ADMINISTRATION

DIRECT SERVICE INDUSTRY OPTIONS

U.S. Department of Energy



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COVER SHEET

Responsible Agency: U.S. Department of Energy, Bonneville Power Administration (BPA).

Title of Document: Direct Service Industry Options Final Environmental Impact Statement (EIS).

States Involved: Idaho, Montana, Oregon, and Washington.

Abstract: BPA proposes to implement one or more options to reduce load fluctuations and revenue uncertainty resulting from its electrical service to 10 aluminum smelters and its other direct service industrial customers. BPA believes these options will give BPA greater ability to plan for power needs and help to maintain its relatively strong financial position during the current period of power surplus. They also are expected to enhance BPA's ability to repay the U.S. Treasury. In turn, BPA rates to other customers would stabilize.

The final EIS evaluates the effects of four options and their alternatives: No Action; the Variable Rate; the aluminum smelter Conservation/Modernization Program; and the IP-PF Rate Link. The EIS also evaluates the cumulative effect of implementing more than one option. The major effects examined include aluminum smelter operations, resource operations and development, and socioeconomic impacts.

Potential environmental impacts (generally benefits) and potentially major, localized adverse socioeconomic impacts are likely under the no action alternative, a result of closures of or reduced operations at certain Northwest aluminum smelters. The options have a varying effect on the operation and continued viability of Northwest aluminum smelters with consequent environmental and socioeconomic impacts.

No decision on any of the four options will be made until 18 days after the Environmental Protection Agency has published the Notice of Filing of this final EIS in the FEDERAL REGISTER.

For Additional Information Contact:

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208
(503) 230-5136



SUMMARY

EXECUTIVE SUMMARY

A. Introduction

The purpose of this environmental impact statement (EIS) is to identify and evaluate the potential environmental effects of implementing one or more of the options described herein for stabilizing the load on the Bonneville Power Administration (BPA) of BPA's direct-service industrial customers (DSIs).

The EIS and its Appendices describe in detail the physical and socioeconomic environment of each of the DSI aluminum smelters, including each plant's environmental impact at various levels of production. (Appendices A, B, and H have not been reprinted with the final EIS since the information presented therein did not change.) The EIS then evaluates the potential environmental effects that could result from implementing each one of the options and certain combinations of the options. The analyses in the EIS are performed primarily by using BPA's Decision Analysis Model (model). The conclusions in the EIS are based on the model results and interpretations of those results using studies performed in the Variable rate design process, knowledge of the DSIs themselves gained through BPA's dealings with them over the years, the DSI Options Study, external consultants, and other sources.

B. Purpose and Need

The purpose of implementing one or more of the DSI options is to maintain and stabilize the DSIs' power load on BPA. BPA desires to stabilize the DSI load in order to facilitate resource operational planning and to protect BPA's revenues. Achieving these objectives would enhance BPA's ability to make the necessary payments to the U.S. Treasury and would stabilize rates to BPA's customers.

The need for measures designed to stabilize the DSI load arises from dramatic fluctuations in the loads of the DSIs, particularly the loads of the aluminum smelters, in recent years. Load swings have resulted from the unstable and declining world price of aluminum and the production costs of Northwest smelters relative to others. BPA's rates to the DSIs for electric power have risen dramatically during the last 6 years and are now higher than for many aluminum smelters worldwide. Electricity is necessary for aluminum smelting and represents a significant portion of the smelters' production (variable) costs.

Aluminum smelter loads represent about 90 percent of DSI loads; DSI loads represent over 25 percent of BPA power sales. The stability of DSI loads is thus important to BPA for resource planning, which determines the levels of future costs and rates. The level and stability of DSI loads also influence the health of the economy of the Pacific Northwest as a whole. DSI loads are desirable loads from a utility perspective because of their high load factors and interruptibility which provide system operating reserves and planning reserves. Reduction in this load could affect the operations of BPA's generation resources.

BPA is required to repay, using revenue from power (and transmission service) sales, the U.S. Treasury for the Federal investment in the Pacific Northwest's power generation and transmission systems. Unstable revenues can jeopardize these payments. Stable revenue levels are also necessary to maintain the stability of BPA's rates to all its customers.

C. Alternatives and Their Impacts

Potential environmental impacts (generally benefits), and major adverse socioeconomic impacts are likely under the no action alternative, a result of projected closures of certain Northwest aluminum smelters. The options have a varying effect on the likelihood of aluminum smelter closures with consequent effect on the expected impacts.

1. No Action Alternative

The no action alternative is not undertaking any of the Variable rate or Conservation/Modernization (Con/Mod) alternatives or implementing the IP-PF rate link (a relationship between the rate charged the DSIs and the rate paid by BPA's preference customers). It assumes current DSI rate design, including the availability of short-term Incentive rate offers, and asserts nothing about DSI power sales contracts renewals. Other variables not under BPA's control could change the future, however. Future aluminum prices, BPA's future load growth, the costs of the resources needed to meet this load growth, and streamflow conditions are such variables.

The no action alternative was modeled as the base case for the EIS. The other options were compared with the base case to determine the potential environmental impacts of implementing the alternatives.

The identified environmental impacts of the no action alternative itself result principally from the probable closure of one or more aluminum smelters. The physical environmental effects of a plant closure would generally be positive. All the smelters operate within approved pollution limits, however, and are not seen as major contributors to environmental problems. The socioeconomic effects are likely to be negative. Socioeconomic impacts are substantial if viewed in the context of some of the smaller smelter communities, but are less significant in the context of the larger communities or the region as a whole. Several of the plants have already curtailed production or closed, so their environments have already felt much of the effects. BPA's generation resource operation could change if the level of loads changed significantly. Most likely, much of the firm power freed as a result of smelter closures could be exported under firm contracts. Nonfirm sales may decrease, and spill increase, with both positive and negative potential effects on fish through effects on migration and level of nitrogen supersaturation. The overall effect on fish would be expected to be positive though. As BPA's loads grow and BPA's power surplus diminishes, closure of aluminum

plants could avert the construction of thermal generation resources with their attendant environmental impacts.

2. The Variable Rate

The proposed Variable rate would establish a long-term tie between input price (electricity) and output price (aluminum) for the aluminum smelters in order to encourage higher aluminum production levels than would be economic under a fixed power rate. The proposed Variable rate is designed to discourage plant closures in the short run, 1 to 3 years.

The proposal and two alternative rate designs were analyzed. The two alternatives were designed largely to bracket an expected range of potential environmental impacts. The three rate designs are BPA's actual proposed Variable rate, an alternative designed primarily to protect BPA's revenue, and an alternative designed primarily to maintain DSI load.

The analysis concluded that the revenue protection alternative would most likely result in reduced Northwest aluminum smelter operation compared to the no action alternative. The proposal and load maintenance alternative would maintain more smelter load and production than the no action alternative. Environmental conditions would generally improve with smelter closures or reduced operation, but not substantially since the smelters are regulated to limit their impacts. Minor environmental improvements would be traded for a degree of localized adverse socioeconomic impact.

3. Aluminum Smelter Conservation/Modernization Program

Conservation/Modernization (Con/Mod) would consist of onsite modifications and retrofits to improve the production efficiency of aluminum smelters. BPA would pay incentives based on the energy saved to encourage participation. Incentives offered would be limited to levels which would not adversely affect other regional consumers.

Con/Mod incentive levels of 3, 5 and 10 mills/kWh were analyzed. Low levels of incentive produce limited efficiency improvements at the low cost smelters. A 10 mills/kWh incentive appears to be sufficient to induce some higher cost smelters to modernize, potentially averting plant closures, and maintaining production and load. Loads would be higher on average because smelter economics would be improved and they would tend to produce more aluminum over time. Peak loads of the smelters would be reduced though, and the contract limitations on load growth to be imposed under the program on participating smelters could preclude need for new resources sometime in the future. Impacts on rates are expected to be negligible with all three incentive levels, although somewhat greater with the 10 mills incentive than with the lower incentive levels.

4. IP-PF Rate Link

A long-term link between BPA's firm power rate to the DSIs, the Industrial Firm Power (IP) rate, and BPA's rate to its preference customers, currently the Priority Firm Power (PF) rate, was proposed by the DSIs in BPA's 1985 general rate adjustment proceeding. The IP-PF rate link would apply to all DSIs, not just the aluminum smelters.

Alternative forms of an IP-PF rate link considered for the EIS include limiting the duration of the link to 5 years or extending the link for the duration of the DSI power sales contracts, i.e., through June 30, 2001. The EIS also examines the impact if the link were implemented as a DSI power sales contract modification or as a policy.

The effects of an IP-PF rate link are virtually impossible to quantify by BPA, since they would result from the perception of the DSIs about the degree of additional certainty provided by implementing a long-term rate link. The EIS thus discusses the potential impacts of the link qualitatively rather than quantitatively. The link could be expected to be generally supportive of aluminum smelter loads, and may provide some reinforcement of positive investment or operating decisions by smelter managers.

5. Variable Rate - Con/Mod Combinations

Implementing combinations of the IP-PF rate link, the Variable rate, and the Con/Mod options is also discussed in the EIS. Combinations including the revenue protection Variable rate alternative have essentially the same impacts as the revenue protection alternative alone; that is, aluminum smelter loads would be reduced. Other combinations of Variable rate and Con/Mod alternatives result in a reinforcement of the impacts of the part which alone has the greatest effect: there is an effect greater than that of any part of the combination, but the effects are not additive. Including the IP-PF rate link with these combinations may slightly enhance the effects.

D. Areas of Controversy

Throughout the DSI Options Study and the scoping of the EIS, the principal physical environmental concerns have focused on the changes in operations of the aluminum plants, potential effects on the need for additional energy resources to serve electric power needs, and potential effects of a changed DSI load on the operation of the Federal Columbia River Power System. The types of environmental changes that may result from implementation of the proposed actions are fairly well understood and have not created substantial controversy. However, the socioeconomic effects of the proposals are a significant concern that has been raised by aluminum company employees, unions, representatives of communities where smelters are located, and others throughout the region concerned with electricity rates.

E. Issues to be Resolved

There are three basic issues to be resolved related to the DSI options described in this EIS.

First, which, if any, of the DSI options should be implemented? Second, if implemented, in what form (design) and for what term would the options be most economic for the DSIs and the rest of BPA's service region? And third, would the implementation of any (or any combination) of the alternatives significantly affect the environment?

The issues related to rate design and incentive levels are myriad and complex. The Variable rate proposal has been released and, as required by section 7(i) of the Pacific Northwest Power Act, a rate hearing process is nearing completion. The Con/Mod program, released as a draft proposal, is being refined in a public process. The IP-PF rate link is still under consideration. Prior to implementation, a proposed link will be evaluated in a section 7(i) process.

This final EIS presents BPA's analyses of the potential environmental effects. Information gathered through the 7(i) processes, public meetings, and the National Environmental Policy Act process will contribute to resolution of the issues.



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Appendices

(Appendices A, B, and H have not been reprinted for the final EIS. Appendix A is a report prepared for BPA by Battelle Pacific Northwest Laboratories entitled An Environmental and Socioeconomic Analysis of Northwestern Aluminum Smelters. Appendix B consists of a description of the Decision Analysis Model, and Appendix H is BPA's 1986 Variable Rate Proposal: Variable Industrial Power Rate Design Study, December 1985. Refer to the draft EIS Appendices volume for these, or if you do not have this volume, contact the person identified on the Cover Sheet to secure copies.)

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PURPOSE OF AND NEED FOR ACTION

Chapter 1

PURPOSE OF AND NEED FOR ACTION

In recent years, the amount of direct service industrial customer (DSI) power purchases from the Bonneville Power Administration (BPA), particularly those of the aluminum plants, has fluctuated dramatically from year to year. The changing power demand has resulted in uncertainty about BPA's future resource planning, financial strength, and rate stability. Changes in the operation of Northwest aluminum smelters also have contributed to weakness and instability in the region's economy as a whole. Short-term attempts to alleviate these problems have been only partially successful.

BPA desires to stabilize the DSI load in order to facilitate resource operational planning and to stabilize BPA's revenues. Stable revenues would enhance BPA's ability to make the necessary payments to the U.S. Treasury and would stabilize rates to BPA's customers.

1.1 PROBLEMS BPA IS ATTEMPTING TO SOLVE

1.1.1 Aluminum DSI Load

Once a steady, major consumer of BPA power, the Northwest aluminum industry has become a highly unstable power purchaser in the last 5 years. During that time, the 10 aluminum smelting plants have operated at levels ranging from 58 to almost 100 percent of production capacity. Production level changes have followed variations in the price of aluminum ingot.

Currently, almost no Northwest smelters produce at full capacity. Many of the smelters operate as "swing" plants--they reduce production when aluminum prices fall. One plant, the Martin Marietta plant at The Dalles, Oregon, has closed. Others are at risk of closure.

Uncertainty about the viability of Northwest aluminum smelters leads to questions about the future size of the DSIs' electric power load.

1.1.2 Resource Planning and Operation

Load uncertainty hampers BPA's ability to plan for resources to meet future power demand. Errors in load projections could result in acquiring unnecessary costly resources. Or acquisition could be postponed only to find that loads exceed the supply of power necessitating expensive short-term power purchases.

Due to the size and the uniform daily and monthly consumption of energy by DSI customers, DSI load changes could affect BPA's resource operation.

1.1.3 Rates

Power rates to all of BPA's customers have increased dramatically during the last 5 years. For the DSIs, average rates increased from 2.9 mills per kilowatthour (mills/kWh) in 1979 to 22.8 mills in 1985. Power costs now account for about one-third of the total production costs of aluminum in the Northwest. Even small changes in power costs can have significant effects on the competitiveness of the Northwest plants in the world aluminum market. Because aluminum operations are sensitive to the price of electricity, BPA has offered temporary rate discounts when aluminum prices were low. These discounts, or "Incentive rates," resulted in higher DSI operating levels and increased BPA revenues even after consideration of the possibility of marketing this increment of power elsewhere, such as to California utilities.

In 1983 BPA sold low cost, nonfirm energy to the DSIs for increases in production between March 21 and October 31. Twice (from September 1984 through February 1985, and between March and June 1985), BPA provided short-term Incentive rates to the DSIs because aluminum markets were severely depressed and the discounts increased BPA's total revenues. Discounts were again offered September 1, 1985 to last through June 30, 1986. Incentive rates have enabled Northwest smelters to compete and maintain higher production levels. Consequently, power purchases have been higher than they otherwise might have been. The Incentive rates are made available through special provisions in the BPA Industrial Firm Power (IP) rate schedule.

While Incentive rates have been mutually beneficial to BPA and the Northwest aluminum smelters, they have been cumbersome to implement procedurally, and do not provide long-term assurance of rates that the aluminum companies would need to influence long-term business decisions.

1.1.4 Cost Recovery

BPA is required to make scheduled payments to the U.S. Treasury to repay the Federal investment in hydroelectric and transmission facilities in the Northwest. On September 30, 1984, BPA became current on all scheduled interest payments owed the U.S. Treasury. Continued revenue instability resulting from severe DSI load fluctuations would create uncertainty about BPA's ability to meet its scheduled repayment obligations in the future.

1.1.5 Rate Setting

Section 7(c) of the Pacific Northwest Electric Power Planning and Conservation Act (Pacific Northwest Power Act) prescribes a post-July 1, 1985, rate relationship between the IP rate, which is the rate charged the DSIs, and BPA's applicable wholesale rate to its public agency and cooperative customers. In general terms, the post-1985 DSI rate is based upon the applicable wholesale rates to public utilities, plus a margin based upon the typical margins (above power and transmission costs) that public utilities charge their industrial customers, less a credit for BPA system reserves provided by the DSIs through certain interruptibility provisions in the DSI

contracts. Fixing the relationship between the DSI rate and the rate paid by its public agency and cooperative customers on a long-term basis would reduce the rate uncertainty facing the DSIs. It could also reduce contention of some issues related to the DSI rate in future rate hearings conducted under section 7(i) of the Pacific Northwest Power Act.

1.2 THE DIRECT SERVICE INDUSTRIES

The DSIs are 15 corporations that purchase electric power directly from BPA for use in 20 plants in the Pacific Northwest. Table 1 provides the names, locations, products, and other information for all the DSIs.

Nearly all the DSI plants use electrolytic or electrothermal processes. Therefore, substituting other forms of energy for a large portion of their electricity usage is either impossible or impractical.

All the DSIs have contracts with BPA for purchase of power. The contracts were offered in accordance with the Pacific Northwest Power Act; they expire on June 30, 2001. The power sold under terms of these contracts is called Industrial Firm Power.

Industrial Firm Power is subject to certain restriction rights which do not apply to utility customers. Much of the DSI power may be interrupted to ensure a continuous flow of power to other BPA firm power customers whenever conditions require it. BPA's right to restrict is based on "quartiles." Quartiles divide the DSIs' load into 25 percent blocks.

BPA does not plan or acquire resources to serve the first quartile of the DSI load. Rather, BPA uses the flexibility of the hydrosystem to meet this portion of the DSI load. The first quartile is served with a combination of nonfirm energy when available, and "borrowing" energy (advance energy) from the future. Service to the first quartile is not guaranteed. The DSIs' first quartile is the first power load served when BPA has nonfirm energy available. Sometimes, when power supply conditions are not good enough for BPA to serve the first quartile with nonfirm energy, one or more DSIs will ask for "advance" power from BPA and take the chance that streamflow conditions will improve later in the year. Currently, the U.S. Corps of Engineers is reviewing their policy of provisional drafting of reservoirs for serving advance energy. Possible revisions to this policy may have an impact on the amount of service provided the first quartile with nonfirm and advance energy. If advance energy is taken, and is later needed to serve other firm loads, the DSIs have to repay it, either through purchasing energy from another source, or by curtailing their own firm loads. Furthermore, the first quartile may be restricted at any time and for any reason to protect regional firm load.

Table 1

BPA'S DIRECT SERVICE INDUSTRIES

Company	Plants	Product	Contract Demand (MW)	Actual Loads Jan 1985 Avg. MW
Alcoa	Vancouver, WA Wenatchee, WA Addy, WA <u>1/</u>	Primary Aluminum Primary Aluminum Magnesium & Silicon	600.0	470.5
Columbia Falls Aluminum Co.	Columbia Falls, MT	Primary Aluminum	427.5	333.6
Commonwealth	Goldendale, WA	Primary Aluminum	296.1	288.7
Intalco	Ferndale, WA	Primary Aluminum	456.8	443.2
Kaiser	Mead, WA Tacoma, WA Trentwood, WA	Primary Aluminum Primary Aluminum Aluminum Rolling	737.5	421.0
Martin Marietta	The Dalles, OR	Primary Aluminum	159.5	3.0 <u>2/</u>
Reynolds	Longview, WA Troutdale, OR	Primary Aluminum Primary Aluminum	700.7	577.3
Carborundum	Vancouver, WA	Silicon Carbide	34.0	0.2 <u>3/</u>
Georgia Pacific	Bellingham, WA	Chlorine & Caustic Soda	34.4	26.0
Hanna <u>4/</u>	Riddle, OR	Ferronickel	120.0	72.4
Oremet	Albany, OR	Titanium	18.0	6.6
Pacific Carbide	Portland, OR	Calcium Carbide	9.3	9.3
Pennwalt	Portland, OR	Chlorine & Caustic Soda	84.0	49.7
Port Townsend	Port Townsend, WA	Pulp & Paper	16.6	14.5
Gilmore Steel	Portland, OR	Ferroalloys	30.0	0.2 <u>5/</u>

1/ Northwest Alloys, Inc., a subsidiary of Alcoa which receives BPA power through Alcoa's Power Sales Contract.

2/ Plant was closed in December 1984 and is currently for sale.

3/ Plant is closed.

4/ Plant receives power at the Special Industrial Power Rate, a rate lower than the rate for the other DSIs, which was established pursuant to section 7(d)(2) of the Pacific Northwest Power Act.

5/ Plant is closed. Gilmore Steel bought the former Elkem ferroalloy plant in 1983, but has not reopened the plant. Gilmore originally intended to use the power at its steel plant, but instead was able to negotiate a more favorable power contract with Portland General Electric.

The second quartile of DSI load provides both planning and emergency reserves. This portion of power can be cut off if the region is short of power because a new resource does not come on line when scheduled, or if a power project is out-of-service for emergency reasons.

BPA may interrupt all DSI loads for up to 15 minutes to alleviate a short-term power outage. To serve other customers, BPA also may restrict up to 50 percent for 2 hours each day during peak hours.

In most cases, advance notice of power curtailments can be given by BPA. If interruptions last no more than 2 hours, and if the entire power supply is not cut off, the aluminum plants switch available power back and forth between potlines to keep the aluminum molten. However, some interruptions can be costly. The pots cool and "freeze" unless the molten metal is removed in time. A long interruption may require one or more potlines to shut down, which damages the pots. To restart an idle potline can take up to 3 months and cost more than \$1 million.

Expensive interruptions occur infrequently however. Aluminum producers signed interruptible power contracts because the lower rates they receive in exchange for the risk offset the costs of interruptions.

Over the past 8 years, BPA has had to make long-term interruptions to the DSI first quartile four times (for a total of about 34 months), in order to continue full service to other customers. The DSIs sometimes purchase power from other sources in order to replace the BPA power interruptions.

Short-term interruptions also occur on an irregular basis. For example, when a series of events triggered a Northwest power grid outage on October 2, 1984, six aluminum plants were the first loads cut, helping to minimize the effect on utilities and their customers.

BPA's DSI customers have large, steady electrical loads. While large variations in the total DSI load have occurred with changes in economic conditions, mainly aluminum price, DSI loads vary little from hour-to-hour or day-to-day. This means their monthly load factors are high, differing from the loads of most utilities, which vary from night to day and from winter to summer. The DSIs have a load factor of 98 percent compared to a typical utility load factor of 55 percent.

Much of the region's generating capacity consists of large, multipurpose hydroelectric projects. Operating constraints require minimum flows to be maintained at these projects for fish migration, navigation, recreation, and other purposes. The DSI baseload often allows these minimum flows to be provided with water used for generation rather than being spilled, thereby producing revenue and energy from water which would otherwise have no direct economic value. The DSI baseload also enhances BPA's ability to accept return of peaking energy from other utilities at off-peak times, since BPA can use that returning energy to serve the DSI load and cut back hydro generation, saving water to meet other loads later.

1.3 OVERVIEW OF THE DSI OPTIONS STUDY

Recognizing a need for a more thorough analysis of these problems, in late 1984 BPA began a study of mid- to long-term policy, service, and rate options concerning its DSI customers.

The primary goal of the DSI Options Study was to screen options concepts to see which, if any, should be pursued. BPA focused on its aluminum smelting customers because they have by far the largest impact on BPA's DSI loads and revenues. DSI customers account for between one-quarter and one-third of all BPA electric power sales. About 90 percent of these sales are to 10 aluminum plants.

Five alternatives or options were analyzed in the DSI Options Study. The options were defined from available information and in consultation with interested parties. Several variations of each of the options were tested, as were some options built by combining features from the five options.

The following is a brief discussion of the options and explanation of why some were eliminated from further analysis.

1.3.1 No Action

This option is simply taking no action. Contractual relationships with the DSIs, the rate setting process, and the general form (but not necessarily the level) of rates would remain as they are. To study this option required dealing with future uncertainties, sometimes making certain assumptions about the future, and testing various scenarios.

The no action alternative was found in the DSI Options Study to have fewer benefits than some of the other options.

1.3.2 Increased Interruptibility

The increased interruptibility option analyzed in the study would increase the amount of power interruptible on very short notice from the current level of 25 percent of load to some higher level. In return for agreeing to a greater amount of service interruption, the participating DSI would be eligible for a discount on all of its power purchases from BPA.

The increased interruptibility option was dismissed from further consideration by the study for the time being. The region's current firm power surplus delays any potential benefits to BPA of increased interruptibility far into the future.

1.3.3 Conservation/Modernization

Under this option, BPA would offer incentives for DSI plants to initiate conservation/modernization actions. The greater the incentive, the greater participation expected from DSIs. It is estimated that roughly 300 MW of cost-effective conservation is possible by the aluminum smelters.

Modernization would increase the efficiency of power and labor use, lowering production costs. Lower production costs would enable the smelter to compete in the world aluminum market more effectively, thus maintaining and stabilizing the power load placed on BPA. The DSI Options Study concluded that establishment of a Con/Mod program should be explored further.

1.3.4 Variable Rate

As noted earlier, BPA has provided short-term rate discounts, called Incentive rates, to the DSIs when aluminum markets were severely depressed. The Variable rate option would have much the same purpose. It would provide a predetermined relationship between the price of BPA power and the aluminum ingot price and a mechanism to raise BPA's power price to the smelters when aluminum prices were high, as well as providing a discount when aluminum prices were low. The increase in BPA's revenues during prosperous aluminum markets is intended to offset the decrease in BPA's revenues when aluminum markets are depressed.

Through most of the DSI Options Study, a Variable rate design like that shown as Concept 1 on Figure 1 was considered. However, in this design, a participating smelter would pay a greater amount to BPA if aluminum prices were higher than projected on average; conversely, BPA could experience a revenue shortfall if aluminum prices were lower than expected. A rate design like Concept 2 on Figure 1, which evolved near the end of the Options Study, somewhat reduced these risks.

Constraints could also be imposed on the relationship between power rates and aluminum price. For example, a lower limit to the power rate could be established to recognize the fact that BPA power could have higher value in alternative markets (e.g., sales to California). The DSI Options Study concluded that further work on a "plateau-type" (i.e., a design like Concept 2 on Figure 1) Variable rate was warranted.

1.3.5 Service from Other Power Suppliers

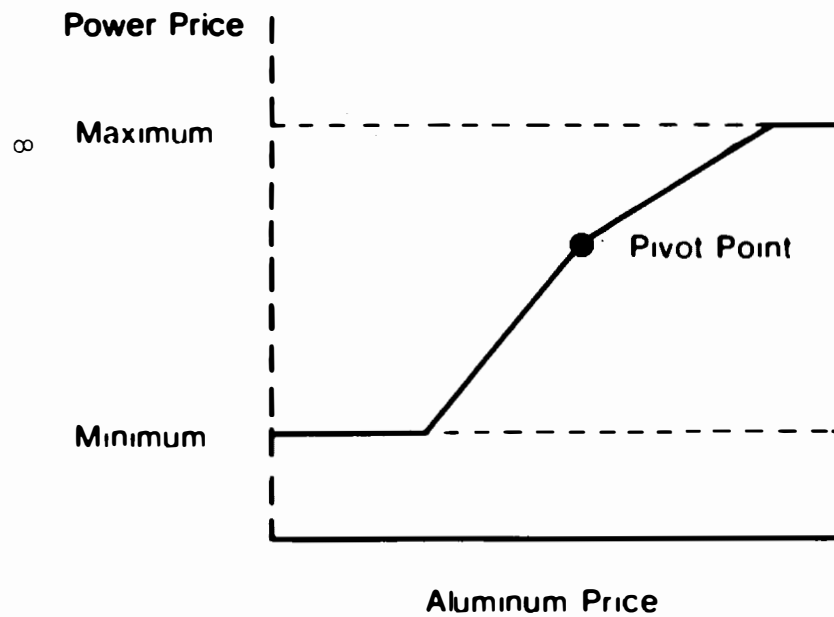
Currently, the Power Sales Contracts between BPA and the DSIs do not allow the DSIs to seek alternative power supplies without BPA's approval. Under the service from other power suppliers option, BPA would waive or agree to modify the current contractual provision to allow the DSIs to be served by other utilities.

This option was dismissed from further consideration because other utilities were unwilling or unable to commit enough power to the aluminum companies at favorable rates for a long enough term for any significant benefits to the DSIs to accrue.

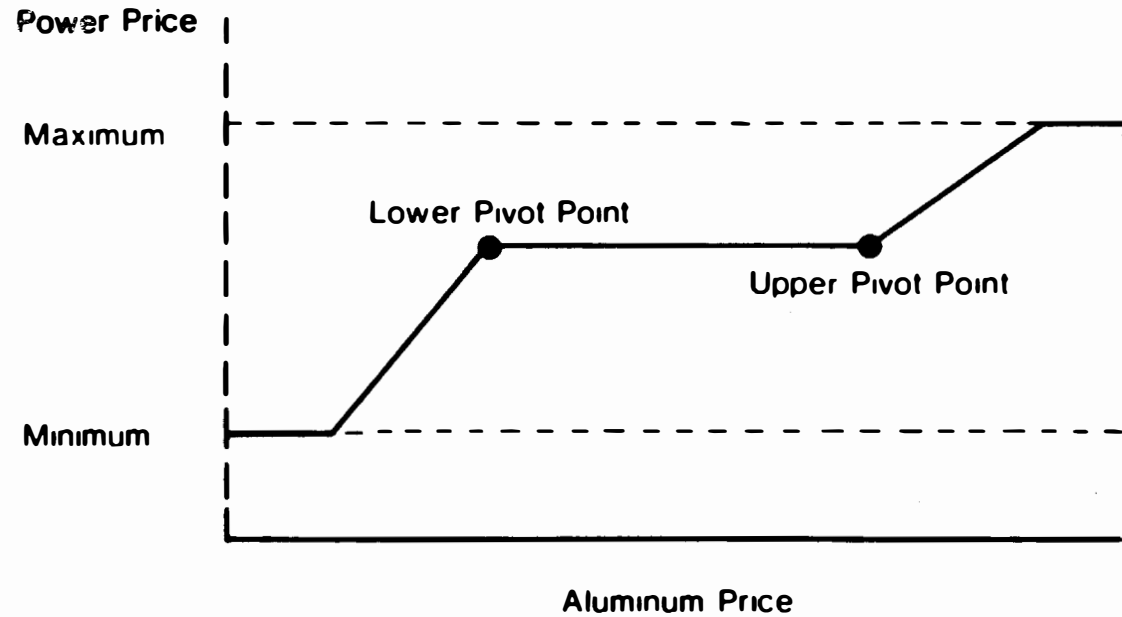
Figure 1

TWO VARIABLE RATE CONCEPTS

Concept 1 - Single Pivot Point



Concept 2 - Plateau Rate with Two Pivot Points



1.4 BPA'S DECISIONMAKING PROCESS FOR THE OPTIONS

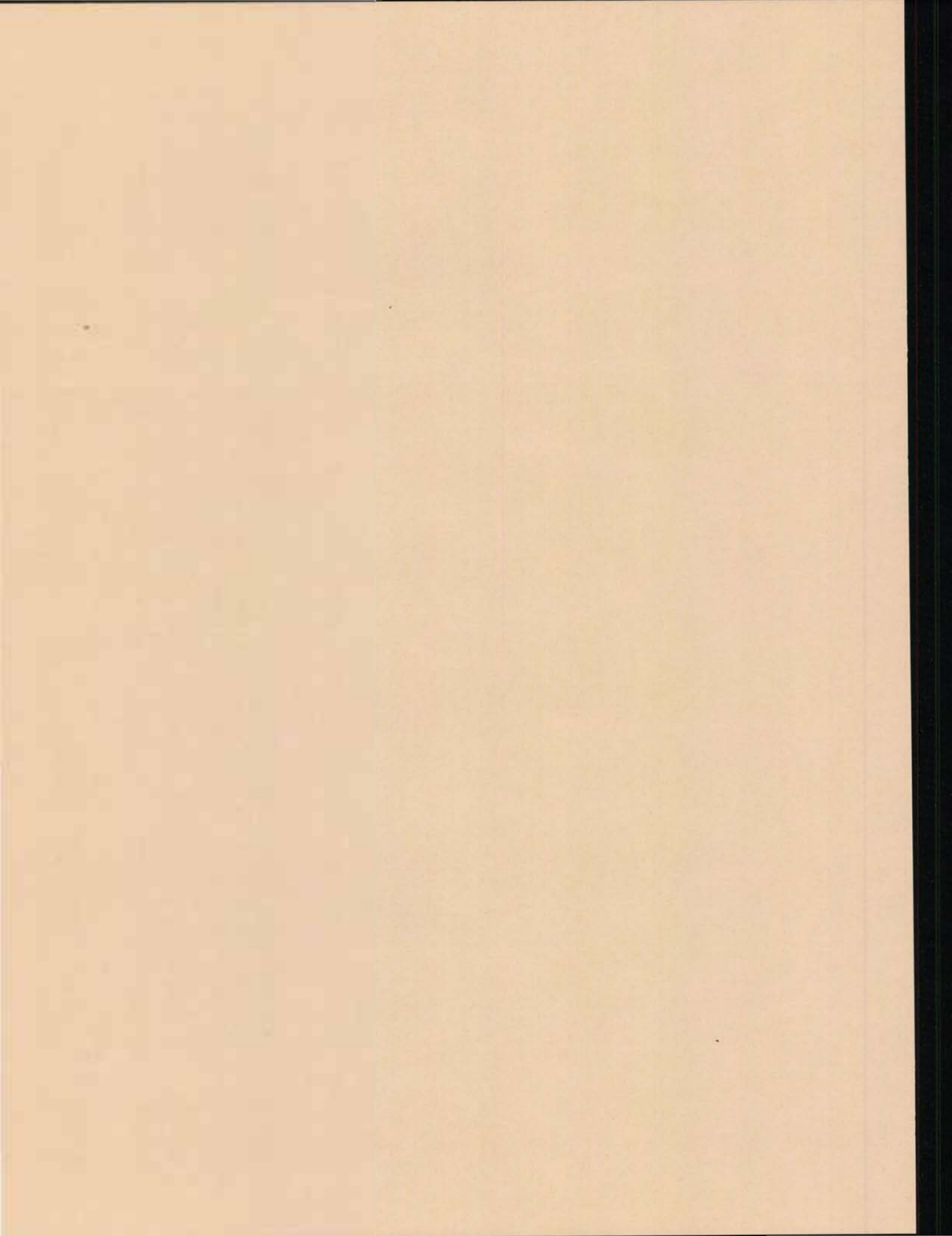
BPA's decisionmaking process consists of two separate processes, with possibly a third at some later time, to resolve issues related to the proposals studied in this EIS with respect to the DSI aluminum smelters and BPA's need to plan for power needs and maintain its financial position.

The Variable rate is undergoing a rates public involvement proceeding in accordance with section 7(i) of the Pacific Northwest Power Act. A similar proceeding is contemplated for the IP-PF rate link. The Con/Mod program was designed through a public process -- experts from outside BPA were invited to participate with BPA staff in formulating a design team to develop a draft program proposal.

The EIS analyzes the impacts of the various options and their alternatives, as well as impacts resulting from some possible combination of these options. Upon completion of this EIS, and following the no action period, and completion of the respective public involvement processes for the Variable rate and for the Con/Mod program, BPA's Administrator will prepare a separate Record of Decision (ROD) for each proposal. In reaching a final decision on each of the options, the Administrator will consider comments received from the public and customers during the respective public involvement process and the analysis contained in the final EIS.

Assuming the Administrator decides to proceed with a variable rate for the aluminum smelters, it would become effective upon final or interim approval by the Federal Energy Regulatory Commission. The Pacific Northwest Power Act specifies in section 7(a)(2) that the Commission must review the rate proposal to determine that (1) rates are sufficient to assure repayment of the Federal investment in the FCRPS over a reasonable number of years after first meeting BPA's other costs; and (2) rates are based on BPA's total system costs. Pursuant to section 7(i)(6) of the Pacific Northwest Power Act, the Commission has promulgated rules found at 18 C.F.R. Part 300 establishing procedures for the approval of BPA rates.

ALTERNATIVES INCLUDING THE PROPOSED ACTIONS



Chapter 2

ALTERNATIVES INCLUDING THE PROPOSED ACTIONS

The DSI Options Study process served as the principal process to select alternatives for the Environmental Impact Statement (EIS). The DSI Options Study identified two options that seemed to meet BPA's needs for revenue and load stability while offering both the DSIs and BPA's regional utility customers potential economic benefits. These were the Variable rate option with a plateau rate in effect over a range of aluminum prices, and a Con/Mod program. The two options were selected as the basis for development of alternatives to be analyzed in the EIS and other technical and economic studies. In addition, development of a detailed proposal and alternatives for establishing a long-term relationship between the IP and PF rates (IP-PF rate link) was also undertaken. A specific proposal made by the DSIs in the 1985 rate proceeding, and comments received during the DSI Options Study gave further support for BPA proceeding with the development of such a long-term link. The IP-PF rate link alternatives are topics of this EIS as well.

BPA believes these options in some form offers a good possibility of a more stable, predictable, and competitive DSI operation. For BPA, this could mean a higher and more stable DSI demand for power than has existed in recent years. This would give BPA greater ability to plan for power needs and help to maintain its relatively strong financial position during this current period of power surplus, enhancing BPA's ability to repay the U.S. Treasury. In turn, BPA rates to other customers would stabilize.

This EIS specifically addresses the three types of actions being considered, i.e., an IP-PF rate link, an aluminum smelter Con/Mod program, and a Variable rate for aluminum smelters. The three types of actions are not alternatives to each other since each could be implemented independently. Questions of cumulative effects of the alternatives, however, may be pertinent to the decision of which, if any, is implemented.

2.1 NO ACTION ALTERNATIVE

The no action alternative occurs if BPA chooses not to implement (1) an IP-PF rate link; (2) a Variable rate for the aluminum smelters; and (3) an aluminum smelter Con/Mod program. Selection of the no action alternative does not preclude BPA from reinvestigating options related to the DSIs and implementing some action or actions regarding them at some future time in a separate decisionmaking process.

In order to evaluate the no action alternative, it is necessary to project how the values of a number of variables may change in the future. Some of these variables are future aluminum prices, BPA's future load growth and costs of resources to meet it, and the availability of water to operate the Federal dams in the Northwest.

The DSI Options Study performed sensitivity analyses for the no action alternative to test different assumptions such as the continued availability

of short-term Incentive rates, the renewal of DSI contracts in the year 2001, and a customer charge (i.e., a fixed component of the DSI rate).

For purposes of analysis for this EIS, the design of the DSI (i.e., IP) rate maintains features in the IP-85 rate schedule over the course of the study period; only the level of the rate changes. Rate provisions which are not in the current IP-85 rate schedule, such as a customer charge or other take-or-pay provisions, are assumed not to be implemented in future rate cases.

Second, for the purpose of study, the DSI Incentive rate (discussed in section 1.1.3) is also assumed to continue to be offered on a short-term basis when aluminum prices are low. These assumptions are consistent with the concept of no action.

Third, no assumption is made with respect to renewal of the DSI contracts when the current contracts expire in 2001. It is premature to analyze the issue of DSI contract renewal; analysis of a decision to renew the DSI contracts is not within the scope of this EIS. While the model runs (see section 4.1) for the analyses were carried out for a period extending beyond 2001, the EIS reports impacts only through Fiscal Year (FY) 2000. The Variable rate and the aluminum smelter Con/Mod program are proposed to terminate prior to DSI contract expiration; the rate link would last no longer than the current contracts; and the payback period in which aluminum companies would plan on recovering investment costs in Con/Mod is less than the remaining term of the DSI contracts. Therefore, the aluminum companies' decisions with respect to any options ultimately offered would not be dependent on their Power Sales Contracts being renewed. The issue of DSI Power Sales Contract renewal is therefore not relevant to this EIS.

Finally, the no action alternative assumes that uncertainties perceived by the aluminum companies regarding future aluminum prices and electricity prices are too great to justify substantial investments in Con/Mod by the high cost Northwest smelters without some external incentives.

2.2 VARIABLE RATE

The Variable rate ties the price of BPA's power for aluminum smelter DSIs to the U.S. aluminum ingot price. Establishing a tie between input price (electricity) and output price (aluminum) will enhance the ability of aluminum producers to operate over the entire business cycle. When the price of aluminum decreases (increases) so will the price of power, within certain limits. When aluminum prices are low, decreasing the price of power should encourage higher production levels than if a higher fixed rate were in place. This in turn should serve to reduce the cyclical nature of smelter operations. The increased price of power during prosperous aluminum markets is intended to offset the decrease in BPA's revenues when the lower rate and lower smelter operations occur.

A variable rate is needed for aluminum smelters partially because the Incentive rate provisions currently available provide only a short-term

response to low and fluctuating aluminum smelter loads. Implementation of the Incentive rate contains a degree of uncertainty, which detracts from the long-term viability of PNW smelters. The Incentive rate procedures do not necessarily guarantee that a particular Incentive rate will be offered whenever aluminum prices are low, because an offer depends on streamflow conditions and BPA's expectations of the electricity prices that could be obtained in alternative markets, especially California. Furthermore, the Incentive rate implementation procedures require a lag between the onset of low aluminum prices and an Incentive rate offer. This lag increases the risks both to the DSIs and to BPA. A company's cash flow situation may require actions to reduce operating costs before an Incentive rate offer could be implemented. Also, BPA faces the risk that aluminum price expectations and/or other conditions can change significantly between initial consideration of an Incentive rate and final offer. The Incentive rate is designed to address short-term problems. Some of the problems facing the Northwest plants require longer term solutions. The Variable rate addresses the industry's problems over a longer period (i.e., 10 years). The Variable rate significantly reduces, but does not completely eliminate, power cost uncertainty because the Variable rate formula provides for an automatic change in monthly power rates based on market aluminum prices.

The DSIs have indicated that the uncertainty inherent in the Incentive rate inhibits long-term planning. The rate certainty provided by the Variable rate should reduce somewhat the risk associated with long-term investment decisions and facilitate long-term planning. Further, because the Variable rate formula provides for automatic adjustments to the rate, the lag associated with the Incentive rate will be eliminated.

As the proposed Variable rate is a function of the price of aluminum, this option would be available on a voluntary basis only to aluminum smelters. Other aluminum operations (e.g., aluminum fabrication) and all nonaluminum DSI customers would be ineligible to purchase power at the proposed Variable rate, and so would continue to purchase power at the IP-85 rate and its successor rate schedules. The Variable rate schedule is proposed to be available for 10 years beginning in summer 1986.

For this EIS, only Variable rate designs having a plateau (see Figure 1) are considered as alternatives. The single pivot point rate design was excluded because of the risk in selecting a long-range projected average aluminum price at which the pivot point would be set since BPA revenues could be harmed if this price were selected too high, and since the aluminum smelters could close or operate at low levels if the price is set too low.

The plateau rate design has a number of elements (see Figure 1) which could be varied to form alternatives. The elements are the positions of the upper and lower pivot points, the upper and lower slopes, the maximum and minimum rates, duration of the rate, and how the rate elements might vary as a function of time. The plateau rate is proposed to be equal to the IP Standard rate, now 22.8 mills/kWh. The IP Standard rate is set in rate proceedings independent of the Variable rate process, and is therefore not an issue for this EIS.

BPA has identified the following goals for the Variable rate. The proposed Variable rate design attempts to balance these goals. The goals are:

1. Discourage aluminum plant closures during the short run, 1 to 3 years. The Variable rate is not intended to forestall closure of plants that are not economic over the medium to long term at the IP Standard rate.
2. Encourage high aluminum plant operating rates and discourage aluminum smelter swing operations at times of low aluminum market prices during BPA's surplus power period.
3. Increase BPA's total revenues over the revenues anticipated if the IP Standard rate to the DSIs were to remain in effect. If possible, the average rate forecasted under the Variable rate option should equal the IP Standard rate.

Based on the above goals, three plateau-type Variable rates, including the proposal, were formulated and analyzed as alternatives. The actual rates formulated for the three alternatives and used for the analysis in this EIS are specified in Figure 2 and Table 2.

The design of the proposed Variable rate attempts to balance the three goals discussed earlier. These goals, although not mutually exclusive, do contain a degree of conflict. For example, the rate design that encourages high DSI operations and discourages plant closure may not yield the IP Standard rate on average. This EIS examines alternatives to the Variable rate proposal that highlight this conflict and emphasize one goal to the exclusion of the other goals in order to provide a range of impacts.

One alternative to the proposed Variable rate proposal emphasizes the goal of protecting BPA's revenues year by year and achieving the IP Standard rate on average over the entire period. The other focuses on the goals of encouraging high smelter operations and discouraging aluminum plant closures.

2.2.1 Proposed Variable Rate

2.2.1.1 Rate Plateau

The plateau rate is equal to the average IP-85 Standard rate of 22.8 mills/kWh. The initial plateau rate would not change when aluminum prices are between 61.0 cent per pound (¢/lb.) and 72.0 ¢/lb. The plateau rate would be adjusted concurrently with adjustments to BPA's other wholesale power rates.

Figure 2

DSI VARIABLE RATE
Alternative Proposals

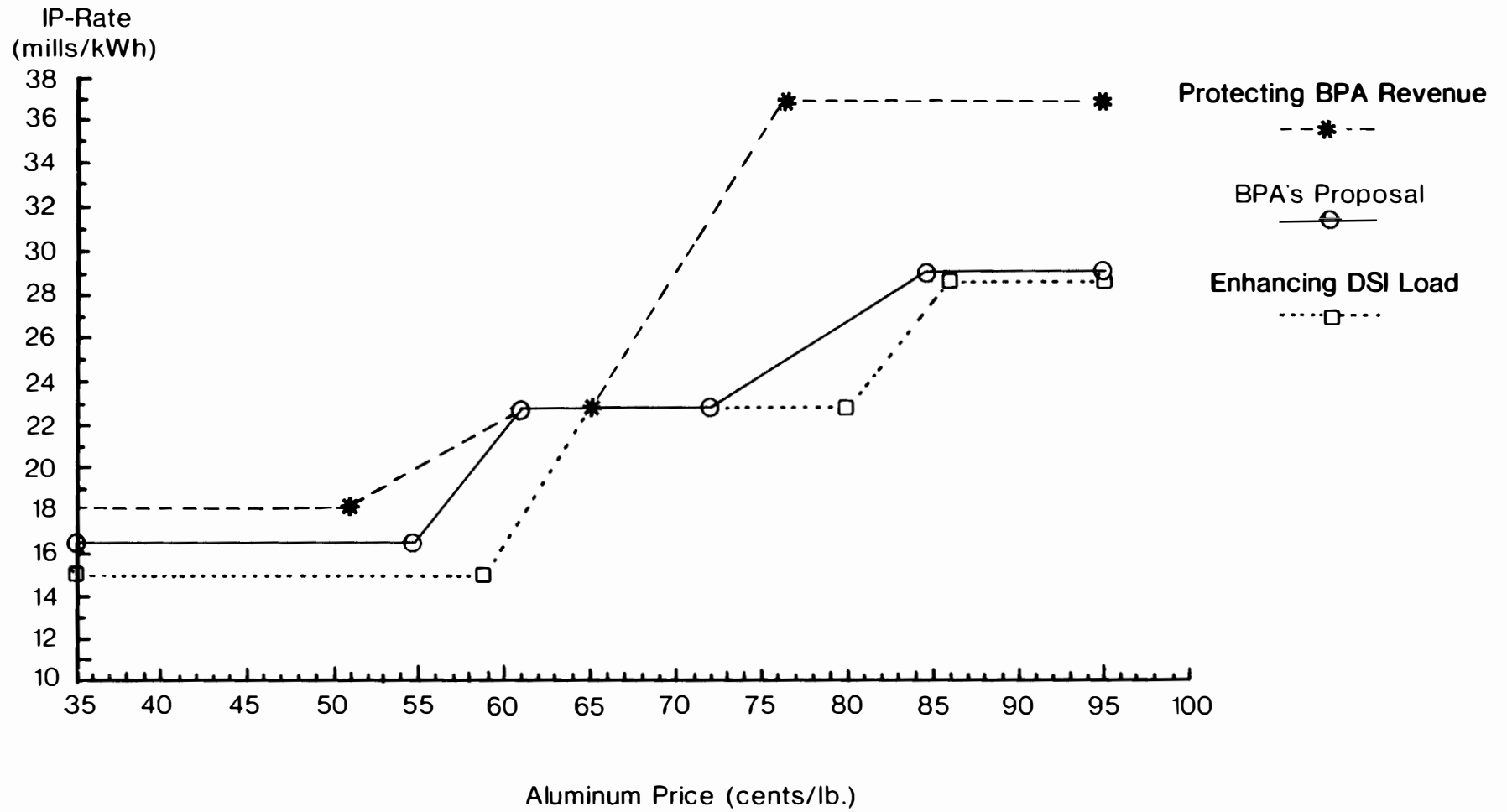


Table 2

VARIABLE RATE DESIGN ALTERNATIVES

	<u>Revenue Protection Alternative</u>	<u>BPA's Proposal</u>	<u>DSI Load Maintenance Alternative</u>
<u>Rate Components:</u>			
1. Lower Pivot Point	59 ¢/lb.	61 ¢/lb.	65 ¢/lb.
2. Lower Slope	0.5	1.00	1.00
3. Lower Rate Limit	18.1 mills/kWh <u>1/</u>	<u>2/</u>	15.0 mills/kWh
4. Upper Pivot Point	65 ¢/lb.	72 ¢/lb.	80 ¢/lb.
5. Upper Slope	1.25	0.5	1.00
6. Upper Rate Limit	37.0 mills/kWh	29.1 mills/kWh	28.7 mills/kWh

1/ NF-85 contract rate.

2/ 13.8 mills/kWh for March through July and 18.8 mills/kWh for August through February.

3/ Three times the difference between the average NF-85 contract rate and IP-85 standard rates.

4/ SP-85 contract rate.

2.2.1.2 Lower Rate Components

The lower pivot point, the lower slope, and the lower rate limit constitute the lower rate components. The lower rate components define the parameters for rate reductions from the plateau.

The lower pivot point is the point on the plateau below which a further decrease in the market price of aluminum would result in a decrease in the electricity rate. This point is initially defined so that when the market price of aluminum falls below the production costs (variable costs) at the region's highest-cost smelter the electricity rate decreases. BPA has estimated the current short-run variable cost at the highest cost smelter to be 61¢/lb. This estimate is based on the costs that a smelter can avoid if production is reduced or suspended. Short-run variable costs include all electricity costs and a portion of alumina, labor, transportation, and other raw materials.

The rate of change in the price of electricity due to a change in the market aluminum price below the lower pivot point is the lower slope, equal to 1. Thus, for every 1¢/lb. decrease in the market price of aluminum below the lower pivot point (61¢/lb.), the electricity rate would decrease 1 mill/kWh. The lower rate limit is seasonally differentiated to recognize that BPA's revenues in alternative markets vary by season, primarily because of streamflow conditions. In March through July, the lower rate limit is initially 13.8 mills/kWh. In August through February, the lower rate limit is initially 18.8 mills/kWh. The lower rate limits were established to balance recognition of BPA's alternative markets and enhancement of DSI loads.

2.2.1.3 Upper Rate Components

The upper rate components are the upper pivot point, the upper slope, and the upper rate limit. These components establish the increase in the rate from the plateau, enabling BPA to offset the revenue decrease on the lower portion of the rate.

The point above which a further increase in the aluminum market price results in an increase in the electricity price is the upper pivot point. This point is set at the long-run variable cost of the region's highest cost smelter. The long-run variable cost includes alumina, labor, electricity, and other costs; it does not include a return to equity, nor interest, depreciation, and amortization associated with plant investment in place at the time the rate is offered. BPA has estimated the current long-run variable cost of the highest cost smelter to be 72 ¢/lb.

The upper slope is set so that a 1¢/lb. increase in the market price of aluminum above 72¢/lb. causes the electricity rate to increase one-half mill/kWh. The upper rate limit is initially 29.1 mills/kWh, equal to the difference in mills/kWh between the plateau rate and the weighted average lower rate limit.

The upper portion of the rate is designed not only to collect the BPA revenues lost when the lower portion of the rate is in effect, but to allow the DSIs to retain some of the benefits of better aluminum markets.

2.2.1.4 Annual Adjustments

The upper and lower pivot aluminum prices are proposed to be adjusted annually on the anniversary date of the rate, July 1. During the first 5 years of the rate, the aluminum prices which define pivot points will be adjusted annually for inflation. The proposed inflation adjustment is based on a weighted average of changes in (1) U.S. producer costs for intermediate materials, excluding food and electricity, and (2) the regional cost of electricity to the DSIs. In the last 5 years of the rate, August 1, 1991 through July 30, 1996, the pivot point aluminum prices are adjusted annually to reflect both inflation and the average real aluminum prices that occurred during the previous 5 years the rate was in effect. As a result of this last adjustment, the size of the plateau may change. If low aluminum prices were to persist over the first 5 years, the plateau could collapse, creating a single point for both rate increases and decreases. In this case, the upper and lower pivot points would be the same. However, the single pivot point may not go below 55¢/lb. as adjusted for inflation.

2.2.2 Revenue Protection Alternative

To ensure that revenue from a Variable rate achieves on average the revenue expected from the IP Standard rate the responsiveness of the electricity rate to low aluminum prices may be constrained and/or the revenue recovery when aluminum markets begin to improve may be accelerated.

This alternative sets the lower pivot point at 59¢/lb. The price of electricity remains constant until the market price of aluminum is below the current short-run variable costs of the two highest-cost regional smelters. The lower pivot point equals the average variable cost of the five regional smelters with the highest short-run production costs. The lower pivot point recognizes the revenue tradeoff between the load reduction at the highest cost smelters and the revenue loss from the lower-cost smelters which would tend to operate without the discount. The lower pivot point also corresponds to the average intermediate-term variable cost of the regional smelters.

The electricity rate decreases gradually in response to low aluminum prices. For every 1¢/lb. decrease in the market price of aluminum below the lower pivot point, the electricity rate decreases 0.5 mills/kWh (i.e., the slope is equal to 0.5). The lower rate limit is set at 18.1 mills/kWh, which is equal to BPA's NF-85 Nonfirm Contract rate. The lower rate limit recognizes the average revenues BPA could obtain in alternative markets. This results in the lowest possible rate for the DSIs under the Variable rate being approximately equal to the rate projected on average in the nonfirm energy market. In addition, the lower rate limit of 18.1 mills/kWh is only slightly below the current Incentive rate offer, and as such the lower rate limit recognizes BPA's recent experience with the IP Incentive rate.

The upper pivot point for this alternative is set so the price of electricity increases when the market price of aluminum exceeds the intermediate-term variable cost at the region's highest cost smelter. The intermediate-term variable cost consists of the total alumina, labor, and electricity costs of production, but only a portion of other costs. BPA estimated the current intermediate variable cost at the highest cost smelter to be approximately 65¢/lb. This corresponds to the Resource Strategies, Incorporated, October 1985 (see Appendix H, Table 1, column C) average aluminum price projection for the 10-year period in which the Variable rate would be in effect, and to BPA's projection of average aluminum prices for the first 5 years of the rate published in its July 1985 Forecast of Loads and Resources. The probability of quickly recovering revenue losses increases when the upper pivot point is set equal to the expected average aluminum price during the period the rate is effective.

Every 1¢/lb. increase in the market price of aluminum above the upper pivot point increases the electricity rate 1.25 mills/kWh. Given the current average production efficiencies of the regional aluminum smelters, the rate of increase results in production costs on average following aluminum prices. That is, a penny increase in the price of aluminum leads to a penny increase in the average costs of production. Therefore, the smelters do not receive the benefits of higher aluminum prices until the upper rate limit is reached. The upper rate limit is 37.0 mills/kWh. The distance from the upper pivot point to the upper rate limit is not the same as the distance from the lower pivot point to the lower rate limit. Extending the upper rate limit further ensures sufficient revenue collection during periods of high aluminum prices to recover BPA revenues lost during periods of low aluminum prices.

This alternative also includes the same adjustment mechanisms as incorporated into the proposed Variable rate (see section 2.2.1.4).

2.2.3 DSI Load Maintenance Alternative

An aluminum company's decisions regarding its level of regional operations depend on a number of factors. Labor, alumina, and transportation costs are major factors, besides electric power rates, entering into a company's operating decisions. In the short run, if the market price of aluminum exceeds the variable costs of production, a smelter is better off operating. Other things being equal, it will tend to operate at a fairly high level of operation. Over time, however, the relationship between fixed and variable cost of production may change. A smelter may seek to increase the share of variable cost and decrease the fixed component of production cost. The alternative rate design described in this section allows the smelters to recover most of their production cost (both fixed and variable) at all levels of aluminum prices. The expectation is higher smelter operating levels in the short run.

The lower portion of the rate is set so that the price of electricity decreases when the market price of aluminum falls below the current intermediate-term variable costs at the highest-cost regional smelter. The

lower pivot point is 65¢/lb., which is the intermediate-term variable cost at the region's highest cost smelter.

The lower slope is set at 1. That is, for every 1¢/lb. decrease in the market price of aluminum below the lower pivot point, the electricity rate decreases 1 mill/kWh. The lower rate limit is set at 15.0 mills/kWh, which is approximately equal to the worldwide average electricity rate to aluminum smelters. The lower rate limit will thus allow the Northwest smelters to produce aluminum economically during periods of low aluminum prices, thereby enhancing their competitiveness.

In this alternative, the upper pivot point is set so the price of electricity increases after the market price of aluminum is above the total cost at the region's highest cost smelter, including a return on capital. BPA has estimated total production cost at the highest cost smelter to be 72¢/lb. The upper pivot point was set at 80¢/lb. to allow a return on equity.

The upper slope is also equal to 1. Because the smelters may be receiving a return on capital prior to the rate increase, an upper slope of 1 allows BPA to recover losses more quickly when aluminum prices increase, while the smelters continue to receive the benefits of higher aluminum prices. The upper rate limit is set at 28.7 mills/kWh, which corresponds to BPA's current Surplus Firm Power Contract rate. The upper rate limit recognizes BPA's recent experiences in selling short-term surplus firm power by not attempting to extract a higher rate from the DSIs than BPA has been able to obtain in the surplus firm market.

This alternative does not include the adjustments of the pivot points during the last 5 years of the rate. It includes annual adjustment for inflation throughout the duration of the rate.

2.2.4 Alternatives to the Proposed Adjustment Mechanism

The aluminum price adjustment mechanism included as part of BPA's proposed Variable rate serves to lessen but not eliminate the possibility of nonrecovery of the IP Standard rate on average over the 10-year period of the rate. In BPA's proposal, this adjustment occurs in the last 5 years of the Variable rate. The lower pivot point cannot fall below 55¢/lb., which would be the variable cost at the highest-cost smelter if it undertook measures to modernize and conserve energy and secured labor concessions. BPA anticipates that the high-cost smelters may also undertake other measures to reduce their variable costs. The proposed Variable rate provides 5 years for the smelters to achieve cost reduction measures in the face of continuing low aluminum prices. Alternatives to the adjustment mechanisms proposed as part of the Variable rate design are discussed below.

2.2.4.1 No Revenue Protection Provisions

The upper and lower pivot points are adjusted only for inflation. Actual revenue under- or overrecoveries would be handled in BPA's general wholesale

rate adjustments. Under- or overrecoveries resulting from the Variable rate will affect future rates in the same way as under- or overrecoveries resulting from other causes.

2.2.4.2 Aluminum Price Adjusted To Reflect Current Variable Costs

Another alternative adjustment would be to adjust the pivot points over time to account for aluminum smelter cost of production changes (e.g., labor cost changes, alumina price changes) beyond those changes reflected in the above inflation adjustment. An adjustment to the pivot points could be made either before or after an efficiency or production cost change occurs at the smelters to reflect plant closures and/or to reflect changes in operating costs at the least-efficient plant.

Another variation would be to constrain any downward movement of the lower pivot point to the current variable cost of the highest-cost smelter. That is, the Variable rate would be subject to an adjustment for inflation and, in the last 5 years, for historical aluminum prices. The aluminum price adjustment could result in the lower and upper pivot points converging, but the convergence would occur at 61¢/lb. instead of BPA's proposed 55¢/lb. In this alternative, high smelter operating levels would be encouraged without other cost reduction measures such as the renegotiation of labor contracts or securing lower cost supplies of alumina.

2.2.4.3 Revenue Accounting Mechanisms

An alternative to the adjustment mechanism would be some form of "truing up," or revenue accounting, arrangement. This mechanism would ensure recovery of the IP Standard rate under all market conditions. A balancing account would accumulate the monthly difference between the revenue received with the Variable rate and the revenue which would have been collected at the IP Standard rate with the same DSI load. The account would accrue this difference with interest at the applicable U.S. Treasury borrowing rate. Upon termination of a smelter's operations or the Variable rate, the amount contained in the balancing account would become payable in the form of a surcharge or credit to the DSI. The obligation could be spread over a number of years but would not exceed the duration of the current DSI contracts (i.e., 5 years from expiration of the Variable rate). Billing adjustments would apply until the account obligation was satisfied.

2.2.4.4 Take-or-Pay Provision

Another alternative adjustment mechanism suggested, if a revenue accounting mechanism is not adopted, is a take-or-pay provision. A take-or-pay provision would require an aluminum company to pay for some minimum amount of power whether it used it or not. The take-or-pay minimum load could be set at the average of each smelter's commitments during the past three Incentive rate offers, or could be determined some other way.

2.2.4.5 Shorter Term

A shorter term for the Variable rate has been suggested as an alternative to an adjustment mechanism to reduce risk of a Variable rate. A shorter term

would lack the longer-term rate certainty that aluminum companies would need to commit to capital investment in their plants.

2.3 CON/MOD PROGRAM

A reduction in the overall cost per pound of aluminum production should improve the likelihood of the plants continuing to operate in the region and at higher production levels.

Plant efficiency improvements could result in more stable BPA system loads and revenues in the near term and could also secure load reductions in the long term as the region approaches need for new power resources. The objectives of a Con/Mod Program are twofold.

1. Near-term objective: To provide an incentive to encourage the aluminum companies to modernize the region's smelters, thereby maintaining BPA revenues and stabilizing loads on the region's electric power system.
2. Long-term objective: To provide additional power to the region when it is needed.

The Con/Mod would not be solely a conservation program. It has an important near-term objective that sets it apart from other BPA conservation programs. The purpose in offering conservation/modernization during a period of energy surplus is to maintain the revenues BPA receives from the energy intensive aluminum industry and to stabilize the system loads by encouraging the plants to operate at high production levels.

The term "conservation/modernization" suggests that BPA is equally interested in acquiring both the near-term and the long-term benefits through implementation of the program. Accomplishing the near-term objective, to maintain revenues to BPA, will also help to keep rates low for other BPA power purchasers. Acquiring conservation in the long term will provide energy savings that might otherwise require expensive new generation facilities.

While providing incentives, the Con/Mod program will also be designed to:

- (1) guarantee that conservation savings are available to BPA when needed;
- (2) enhance BPA total power revenues;
- (3) ensure that any BPA financial contribution will not be lost; and
- (4) limit BPA's annual costs to cost-effective levels.

The Con/Mod program will be limited to onsite modifications and/or retrofits of existing aluminum smelter facilities. These range from minor changes such as conversion to more energy-efficient lighting and motors to more substantial changes to improve process and production efficiency. Most activity will probably focus on potline improvements. Estimated total costs for these changes are \$360 million. These retrofits could save as much as 300 MW. To encourage retrofitting, BPA will offer incentives; the greater the incentive the more participation expected. BPA intends to base its incentive payments on the amount of energy saved per project.

The level of incentive payment for aluminum smelter conservation/modernization is the principal variable addressed as alternatives in this EIS. Alternatives to other features of the Con/Mod program exist.

One alternative to BPA's proposed Con/Mod program is to offer the program initially as a pilot program and expand it to other aluminum smelters, other DSIs, and industrial customers of utilities purchasing from BPA at a later time when the workability of the program could be proven. This alternative could allow BPA to offer somewhat higher initial incentive levels for potential conservation/modernization actions. The pilot program would initially target one or two plants that offer the greatest savings at the least cost or the oldest, least efficient plants with incentive levels based on a "win-win" criterion. This pilot program would have a budget limitation of less than the proposed amount of \$10 million per year and cover a payment period of less than 10-15 years.

Other alternatives to the proposed Con/Mod program relate to ways in which the program could be limited other than through a pilot program, or expanded. This could be through different total budgets, longer or shorter duration of the program, or establishing some other conditions.

Other possible alternatives to the proposed Con/Mod program could require the aluminum smelters to reduce their operating demand based on the energy efficiency improvements made under the Con/Mod program instead of their contract demand, or to require both reduction in operating demand and contract demand.

Some other alternatives have been discussed in the program development process, such as various means of guaranteeing confidentiality of certain data which may be required of the aluminum companies, but as long as something workable is developed, these other alternatives would not be environmentally relevant.

Throughout the world, aluminum metal is smelted almost exclusively by the Hall-Heroult electrolytic reduction process. Three principal production systems are available to accomplish this process: (1) prebake; (2) horizontal stud Soderberg; and (3) vertical stud Soderberg. The Northwest's 10 aluminum smelters have been grouped into 4 basic production categories (Resource Strategies, Inc., May 1985):

1. Old Prebake Smelters. These plants use prebake technology and were constructed during World War II from an identical set of engineering specifications. They are the Alcoa plant at Vancouver, the Kaiser plant at Mead, and the Reynolds plant at Troutdale.
2. Modern/Upgraded Prebake Smelters: Two smelters use prebake technology but either were constructed more recently or have been upgraded to modern standards. These are Alcoa's plant at Wenatchee (only partially served by BPA) and the Intalco plant at Ferndale.

3. Horizontal Stud Soderberg. This category includes two plants, the Kaiser plant at Tacoma and the Reynolds plant at Longview.
4. Vertical Stud Soderberg. This category includes three plants; all have been upgraded primarily for pollution control reasons. They are the Columbia Falls Aluminum Company's plant at Columbia Falls, Montana; the Commonwealth plant at Goldendale, and Martin Marietta's plant at The Dalles.

In general, modern prebake plants are viewed as the most efficient and as having the most desirable process. Although this process requires greater capital costs, energy and labor requirements are considerably less per unit produced than in the Soderberg processes. However, converting Soderberg plants to prebake technology is unlikely since the cost for major equipment change-outs would be prohibitive.

While major conversions do not seem likely, it is probable that most plants can improve efficiency within their existing production systems. Old prebake plants seem to offer the greatest opportunities for improvement; the modern prebake plant may have the least.

Most plants, when evaluating areas where process efficiency can be achieved, will most likely focus on design modifications of the following types:

1. Increasing the size of the anodes to the maximum extent possible, given the physical cell limitations.
2. Lowering the current density at which the cells are operated.
3. Installing computerized process control systems.
4. Installing continuous alumina feeding systems.
5. Installing new, more energy-efficient cathodes, which have been developed to an experimental stage.
6. Improving cell lining.

Old prebake facilities may also consider the option of rebuilding pot rooms with very large cells and state-of-the-art technology. This type of renovation could result in a complete site rebuild. At a minimum, new prebake potlines with larger capacity would require a new anode preparation facility.

2.4 IP-PF RATE LINK

A general relationship between the rate charged BPA's preference customers (currently the PF rate) and the DSI rates after June 30, 1985, is defined by section 7(c) of the Pacific Northwest Power Act. This relationship can be stated as:

$$IP = AWR + M - V$$

where

IP is the Industrial Firm Power rate charged the DSIs;

AWR is derived from the Applicable Wholesale Rate that BPA charges public agencies. This currently is the PF rate. The AWR is computed by adjusting wholesale rates to public agencies for DSI load shape. If new large single loads (NLSL) were to be served, the AWR would be based on a combination of the PF and New Resources Firm Power (NR) rates;

M is the typical margin above wholesale power cost included by public agencies in their industrial retail rates, subject to adjustments as defined by section 7(c)(2) of the Pacific Northwest Power Act; and

V is the value of DSI power system reserves provided by BPA's contractual right to restrict their load.

A predetermined fixed relationship over time between the IP and PF rates (IP-PF rate link) was suggested by the DSIs during the 1985 rate proceeding as a way to improve long-term predictability in their rates. A method fixing the link between the IP and PF rates is attractive to BPA in that issues relating to the relationship between the two rates will not be matters of contention in each future general rate proceeding. Unlike the Variable rate or Con/Mod program, an IP-PF rate link will apply to all DSIs, not just aluminum smelters.

Whether or not the IP-PF rate link is implemented, BPA will continue to determine the DSI rate following its statutory requirements. The link does not address the determination of the AWR since it is based on BPA's wholesale rates to public agencies. Rather, the link addresses the uncertainty of the other two components, M and V, in future rate cases. Even if BPA were to continue to use the same methodologies to compute M and V in future rate cases as were used in the 1985 rate case, the values of M and V will still be subject to changes in forecast data. To implement the IP-PF rate link, a relationship between M and V will be determined and this relationship will be fixed over time. The proposed IP-PF rate link is a mathematical relationship based on differences between the forecast margins and the value of reserves credit (i.e., M-V). The resulting formula prescribes an amount to be added to the applicable wholesale rate in subsequent BPA rate cases for determining the DSI rates. The link will not impact current DSI rates. The earliest the link could be utilized is for the BPA wholesale rates that supercede the current wholesale rates.

From the standpoint of the DSIs, foreknowledge of the values of M and V over an extended period will enhance rate stability and will expose the DSIs to a less uncertain future for corporate planning. Environmental consequences of the proposed rate link, therefore, depend on the degree to which a perception of increased rate stability helps to maintain long-term DSI operating levels.

Rate level is not an issue for the rate link. The PF, New Resource (NR), and IP rates will remain subject to periodic revisions through rate proceedings conducted in accordance with section 7(i) of the Pacific Northwest Power Act. IP-PF rate alternatives examined in this EIS relate to alternative levels of planning certainty for the DSIs. The potential environmental consequences of the alternatives vary depending on the levels of planning certainty provided under each alternative. The level of planning certainty depends in part on the duration of the IP-PF link. The IP-PF rate link could extend only through FY 1991, the 5-year duration alternative. Or the link could last through any specified date prior to or the same as the date the DSI contracts expire, June 30, 2001. The 5-year duration alternative provides more rate certainty to the DSIs than under the no action case. The DSIs may regard a 5 year duration as providing significantly less certainty than if the specified IP-PF link would remain in effect, absent any action by the Administrator, for a much longer time, such as to contract expiration.

Another factor affecting the planning certainty pertains to the manner in which the rate link is implemented. Under one alternative, the IP-PF rate link could be implemented contractually, the contract modification alternative. Or, the IP-PF rate link could be implemented in a long-term policy, the policy alternative. A rate link policy could be subject to changes following ratemaking procedures provided by section 7(i) of the Pacific Northwest Power Act. Changes to a contract amendment could be made if all the DSIs agreed to the changes but, as such, a contract modification would be more difficult to change than a policy. Relative to the policy alternative, the contract modification alternative would provide greater planning certainty to the DSIs.

2.5 ENVIRONMENTAL CONSEQUENCES SUMMARY

The alternatives discussed in this EIS and the combinations of those alternatives result in impacts in three environmental categories: smelter operations, resource operations and development, and socioeconomics.

Changes in smelter operation affect production levels, energy and materials consumption, pollution levels, and socioeconomic conditions. Impacts resulting from changes in electrical energy consumption and load shape affect primarily operations of the Federal Columbia River Power System and the timing of acquisition of new resources. Socioeconomic impacts are related to production levels which in turn can affect employment, and, therefore, general socioeconomic conditions in smelter communities, and electricity rates to BPA's customers.

Table 3 summarizes the impacts in each category of the no action alternative, the proposed Variable rate and its alternatives, the Con/Mod alternatives, and selected combinations of the Variable rate and Con/Mod. The combinations of the alternatives display cumulative impacts. The alternatives and combinations are compared to the no action alternative and show differences among them.

An IP-PF rate link provides a future mathematical relationship between the IP and PF rates which the DSIs perceive as increasing the predictability of their

Table 3

SUMMARY OF ENVIRONMENTAL IMPACTS OF ALTERNATIVES COMPARED TO NO ACTION ALTERNATIVE

Alternative	Smelter Operations		Resource Impacts		Socioeconomic Impacts		
	Operating Levels	Total Pollutants ^{1/}	River Operations	Resource Acquisition	Smelter Jobs	Regional Employment	Retail Rates
1. No Action	decreased from historic levels	less than permitted	more spill than historic levels	unchanged	5,091 ^{2/}	not affected ^{3/}	possible increase
Variable Rate:							
2. Proposal	similar to (1)	similar to (1)	similar to (1)	same as (1)	slightly less than (1)	not affected	no major impact
3. Revenue Protection	lower than (1)	lower than (1)	more than (1)	delayed	less than (1)	not affected	no major impact
4. Load Maintenance	higher than (1)	higher than (1)	less spill than (1)	same as (1)	more than (1)	not affected	no major impact
Con/Mod:							
5. 3 Mills/kWh	similar to (1)	similar to (1)	similar to (1)	same as (1)	slightly less than (1)	not affected	no major impact
6. 5 Mills/kWh	slightly higher than (1)	slightly higher than (1)	slightly less than (1)	possible delay	same as (1)	not affected	no major impact
7. 10 Mills/kWh	higher than (6)	higher than (6)	less than (1)	possible delay	more than (1)	not affected	no major impact
Selected Combinations of Alternatives:							
8. Revenue Protection w/ 3 Mills Con/Mod	similar to (3)	similar to (3)	similar to (3)	possible delay	similar to (3)	not affected	no major impact
9. Proposal w/ 5 Mills Con/Mod	slightly higher than (2)	slightly higher than (2)	slightly less than (2)	possible delay	slightly more than (1)	not affected	no major impact
10. Load Maintenance w/ 10 Mills Con/Mod	higher than (4)	higher than (4)	less than (4)	possible delay	similar to (4)	not affected	no major impact

^{1/} Pollutants are considered as being proportional to smelter operating levels. Emissions above those allowed in plant permits would not be a consequence of any alternative or combination.

^{2/} For the period FY 1987-1991 at a long-run aluminum price of 70¢/lb.

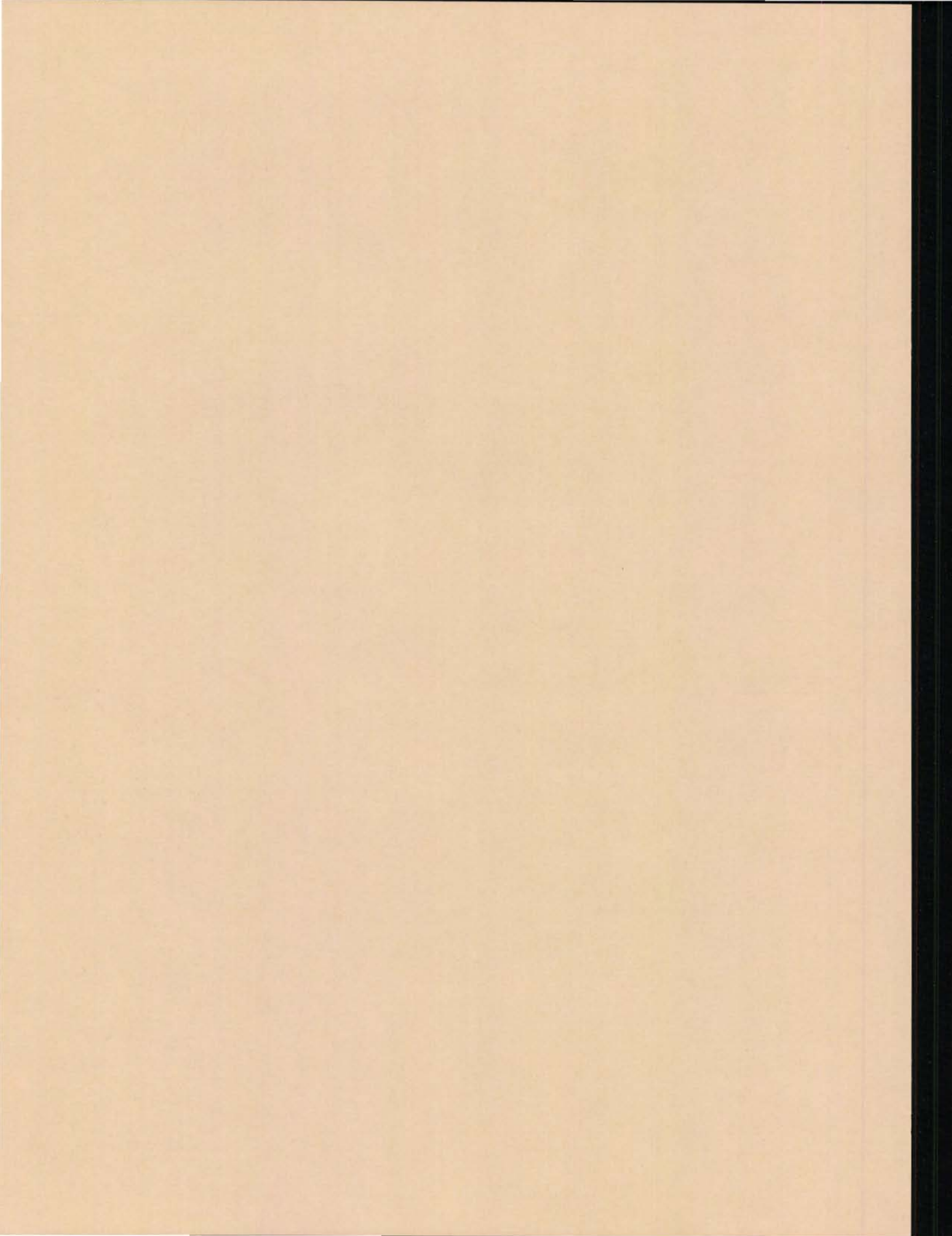
^{3/} "Not affected" means changes are numerically insignificant.

future rates and thereby improving their ability to make long-term plans. The environmental impacts are not included in Table 3 since implementing the IP-PF link alone (i.e., in the absence of a Variable rate or Con/Mod program) would not fundamentally change the economics of any DSI plant and is likely to have only small effects. For this reason it is also expected to have little effect on the nonaluminum DSIs since a Variable rate and the Con/Mod program are not applicable to them.

The increased planning certainty that the IP-PF rate link provides for the aluminum companies would be expected to slightly augment the effects of any of the Variable rates, Con/Mod program, or combinations thereof which were analyzed. A contractual rate link agreement rather than a policy statement by the Administrator would provide a still greater degree of certainty as perceived by the DSIs. It, therefore, may further augment the effects of a Variable rate, a Con/Mod program, or any combinations.

To the extent that an IP-PF rate link provides increased planning certainty to the DSIs, and they respond by increasing production levels over what they would be otherwise, pollutant levels at DSI plants, as well as direct DSI employment, would be increased. Impacts of generation of electric power would also be correspondingly increased. However, the rate link alternatives would not be expected to have a substantial effect on resource acquisition or on total regional employment. Nor would impacts to retail rates be expected with the rate link alternatives involving policy implementation. There is a slight risk of some adverse impacts to retail rates if the contract modification alternative was adopted, due to the Administrator's reduced flexibility to respond to adverse rate effects of the rate link.

AFFECTED ENVIRONMENT



Chapter 3

THE AFFECTED ENVIRONMENT

This chapter is divided into four major parts. The first broadly describes the environment of the Pacific Northwest. This environment may be affected by the proposals and alternatives due to changes in generating resource operations and development, and changes in power rates and availability to non-DSI customers. The second part, section 3.2, discusses in more detail certain aspects of the Pacific Northwest environment which are of particular concern because of their general relationship to BPA's activities. The third part briefly summarizes information contained in Appendix A concerning the environments affected particularly by the region's 10 aluminum smelters. Finally, section 3.4 describes the environmental regulations which govern the Northwest's aluminum smelters, and which are pertinent to an understanding of how BPA's actions might alter the physical environmental impacts of the smelters.

3.1 THE REGIONAL ENVIRONMENT AND ITS ELECTRIC POWER SYSTEM

The Pacific Northwest region consists primarily of the states of Washington, Oregon, Idaho, and Montana west of the Continental Divide, as shown in Figure 3. The BPA service area extends beyond this area into small parts of California, Nevada, Utah, Wyoming, and Montana east of the Continental Divide. In addition, BPA sells to the Pacific Southwest nonfirm and surplus firm energy not marketable in the Northwest. The region can be divided according to environmental similarity into 16 subareas including Western Montana as shown in Figure 4.

The region's climate is generally mild. West of the Cascades is mild and wet year-round, while the area east of the Cascades typically receives no more than 15 inches of precipitation and temperatures vary more seasonally. The entire region receives less precipitation during the summer than during the rest of the year. Numerous streams, many of which feed the Snake and Columbia Rivers, offer abundant opportunities for transportation, irrigation, commercial fishing, recreation, and the production of electricity.

Half of the region is forested. West of the Cascade Range the climate is particularly well suited to trees; three-quarters of this area is covered by forest. Less than one-third of the area east of the Cascades is forested. Range and agricultural land covers the second largest portion of the region. Rangeland occupies large areas in the Snake River and Rocky Mountain subregions. Agricultural lands are located primarily on the Columbia River Plateau, along the Snake River, and in the Willamette Valley.

Figure 3

BONNEVILLE POWER ADMINISTRATION SERVICE AREA

----- BPA Servicing Area

● BPA Area Office Location

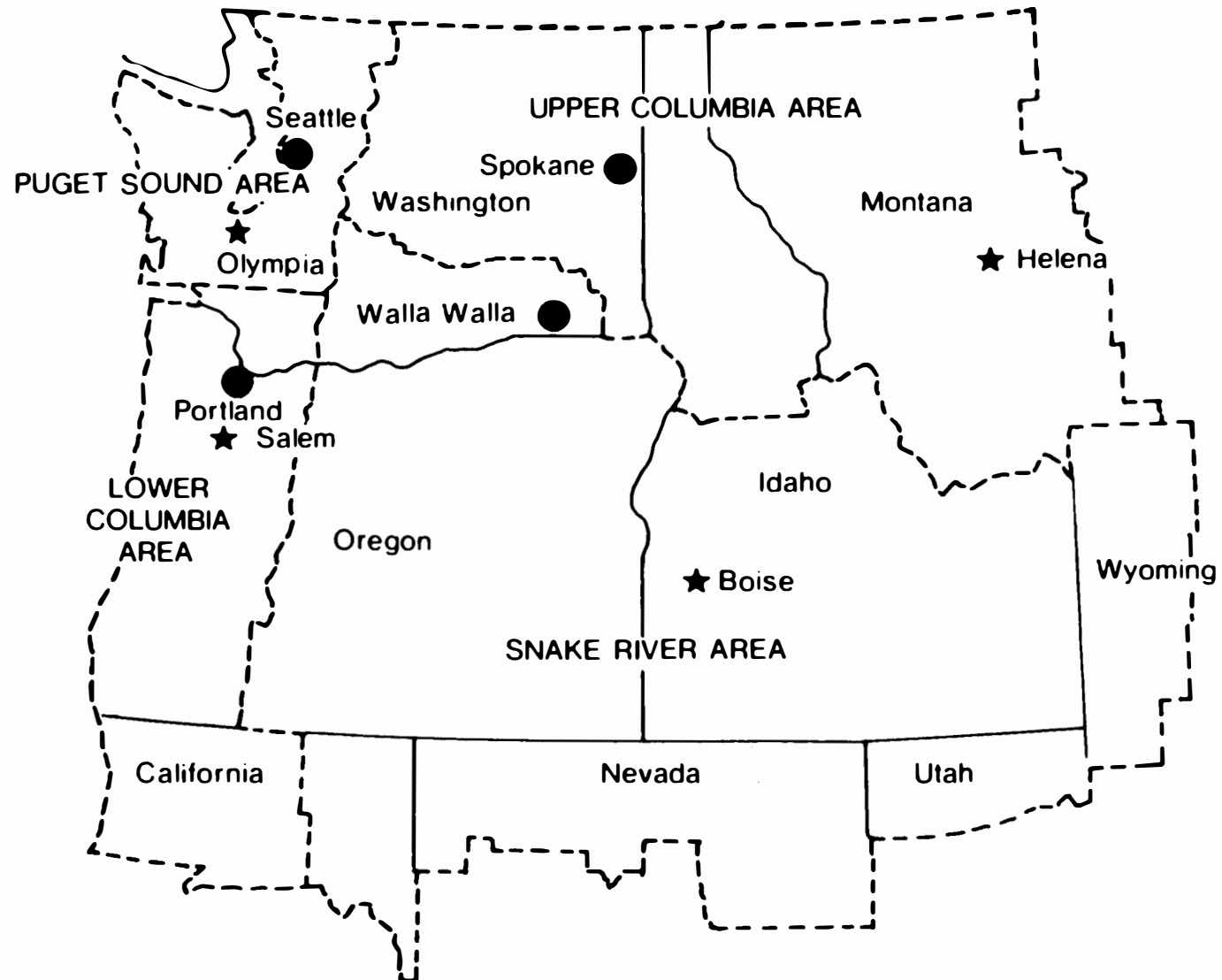
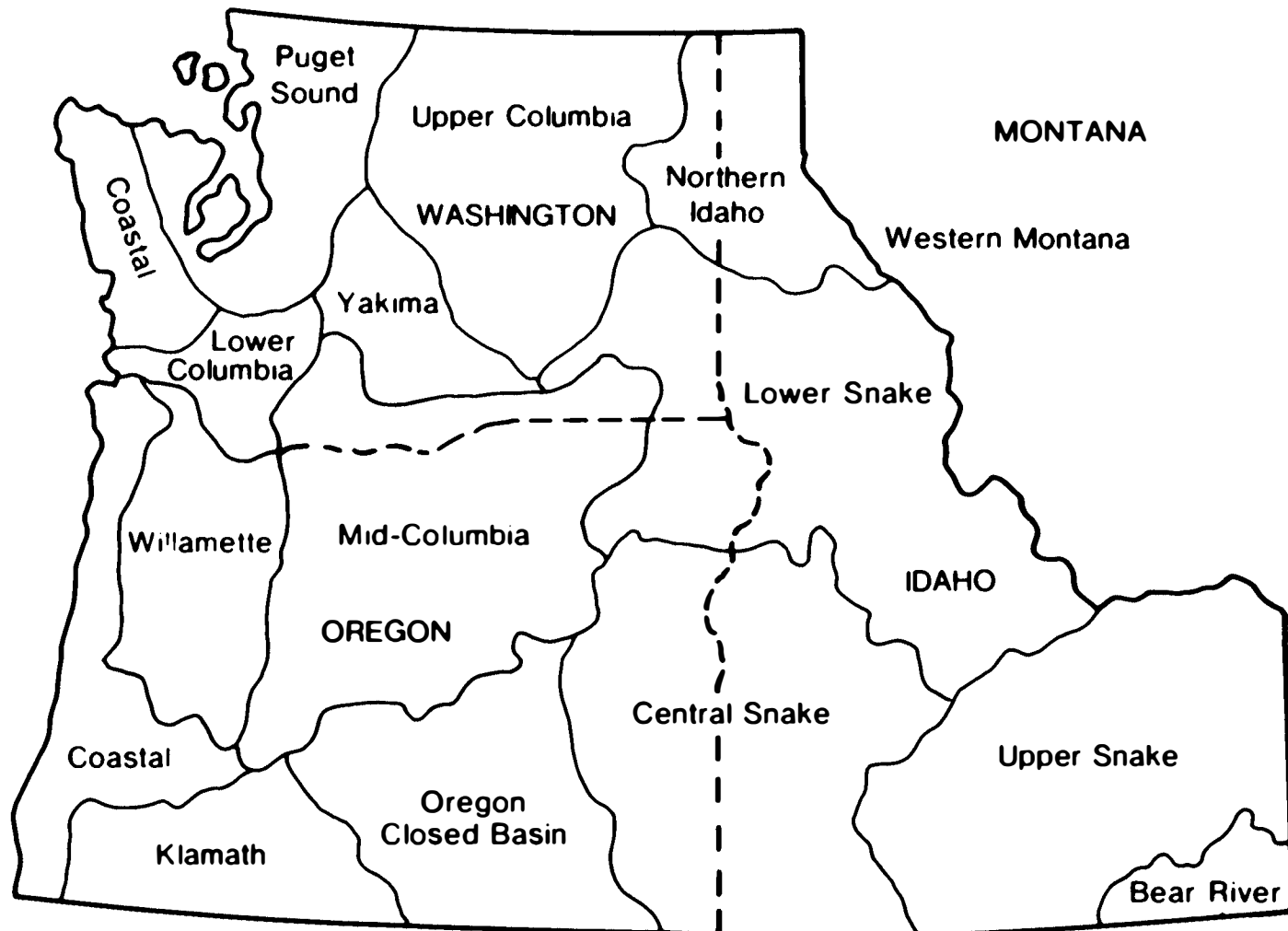


Figure 4

PACIFIC NORTHWEST MAP SHOWING
MAJOR ENVIRONMENTAL SUB-AREAS



About two-thirds of the region's land is publicly owned; half of that is owned by the Federal government. The bulk of the Federal property is managed by the U.S. Forest Service and the Bureau of Land Management. State and local governments own about one-sixth of the region's land; about one-third is privately owned.

The region's total population is about 8 million. The major population centers are Seattle-Tacoma, Portland-Vancouver, Eugene-Springfield, Spokane, and Boise-Nampa-Caldwell. During the past two decades, the region's population growth rate has exceeded the national average. Of the four States, Oregon and Washington have grown most rapidly.

About 3-1/2 million people are employed in the region. During the past 20 years, the cyclical nature of the region's economy has caused the region's unemployment rate to be higher than that of the nation as a whole. Within the region itself, Idaho has had the lowest unemployment rate, while western Montana has had the highest.

About two-thirds of the region's labor force is employed in the areas of retail and wholesale trade, services, government, and transportation. Transportation activities are especially important to the region's economy and involve an interstate highway system, coastal and inland water traffic, railroad lines from the regional centers to the major ports, and air transportation between the major cities.

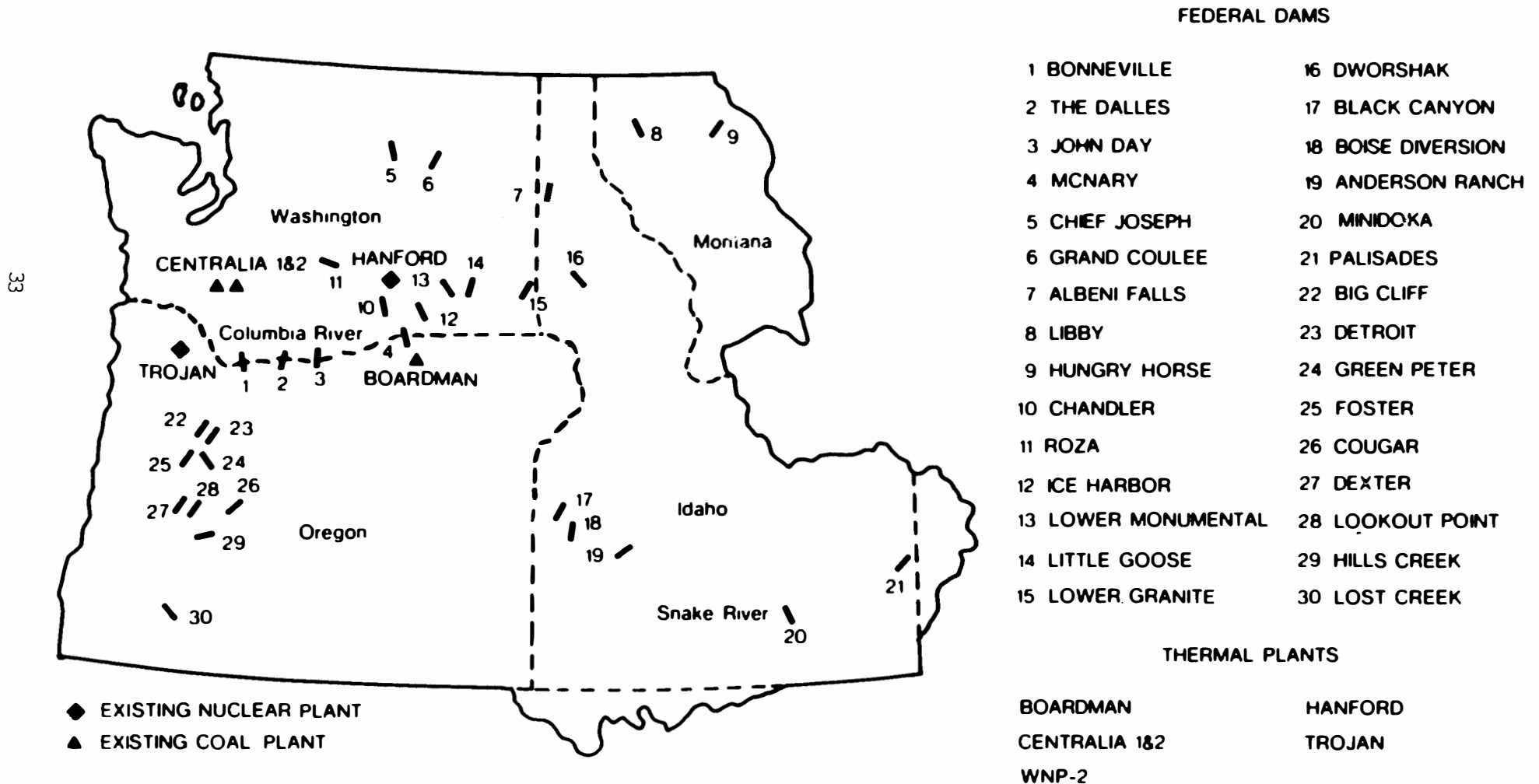
One-fourth of the regional labor force is employed in manufacturing and construction. The largest manufacturing employers are the lumber and wood products, transportation equipment, and electronics industries, although the relative importance of these and other manufacturing industries varies considerably among the States. Inexpensive electricity has been an important factor in the growth of certain industries in the region, particularly chemical and primary metal (including aluminum) production. The remaining labor force is employed in agriculture, forestry, commercial fishing, and mining. Agriculture employs the greater percentage of workers. (See section 3.2.3 for additional information on the major economic sectors in the region.)

Regional electricity consumption varies geographically and seasonally. The Puget Sound-Willamette Valley subregion, which accounts for two-thirds of the region's population, uses the greatest amount of electricity. Electric energy consumption of this subregion is highest during the winter when space heating needs are greatest. East of the Cascades, electric energy use is highest during the summer because of irrigation pumping and air conditioning loads. Historically, the region's large supply of inexpensive hydroelectricity and limited local supplies of gas and oil have resulted in a much greater reliance by homes and businesses on electricity for space heating than is true for the rest of the nation.

The region possesses one-third of the nation's hydroelectric potential. However, the most economically feasible sites have already been developed. There are 58 major hydroelectric dams in the region, of which 30 are Federally owned (see Figure 5). The Federal dams produce about half of the region's

Figure 5

PACIFIC NORTHWEST REGION AND LOCATION OF
MAJOR THERMAL PLANTS AND FEDERAL DAMS



electricity. Regional needs are also met by 3 nuclear plants and 14 coal-fired generating units. Eleven of the latter are outside of the BPA service area. Table 4 lists the major hydroelectric and thermal generating plants in the Northwest that are in operation or are under construction.

While much (72 percent) of the electricity produced in the Pacific Northwest is from hydroelectric facilities, which use renewable resources, the nearly all the other electricity is produced by facilities that consume nonrenewable resources. These facilities include oil- and gas-fired combustion turbines and coal and nuclear thermal plants.

Coal reserves in the West are estimated by the U.S. Bureau of Mines (U.S. Department of Interior, 1974) at over 178 billion short tons. Much of the low sulfur coal reserve (approximately 82 percent) is contained in the Northern Great Plains region of Montana, Wyoming, and North Dakota. Approximately 30,000 tons of coal are consumed daily in the production of electricity for the Pacific Northwest. Each year about 75 tons of nuclear fuel are used in the Trojan plant and Washington Nuclear Project No. 2 in the Pacific Northwest to produce nuclear generated electricity. The Hanford Generating Project uses waste energy from a plutonium production reactor.

Natural gas and oil in substantial quantities are not indigenous to the region. Small quantities of these resources are used for combustion turbines and other peaking units. Because of the historically higher cost of these fuels, electric utilities in the Pacific Northwest have not used and do not anticipate using these nonrenewable resources for baseload generation.

BPA owns and manages approximately three-fourths of the region's high-voltage transmission system. The system includes interties with the Pacific Southwest, British Columbia, and Montana, which allow for exchanges and power sales to entities outside the region.

The region's electricity consumers are served by either publicly owned or investor-owned utilities (IOUs). Publicly owned utilities include public utility districts, municipalities, and cooperatives. Typically, rural areas are served by publicly owned utilities while, with a few exceptions (most notably the cities of Seattle, Tacoma, and Eugene), urban areas are served by IOUs. Publicly owned utilities dominate in Washington; there are comparatively few in Oregon, Idaho, and Montana.

The publicly owned utilities are BPA's largest customer class, both in number (117) and in quantity of energy purchased. Many of these customers depend on BPA for their entire power supply, while a few own their own generation and supplement with purchases from BPA. Consistent with the "Preference Clause" provision of the Bonneville Project Act of 1937, BPA gives the publicly owned utilities priority access to power from the Federal base system. The Pacific Northwest Power Act continues this preference policy and commits BPA to meeting the power requirements of the publicly owned utilities.

Table 4

MAJOR NORTHWEST HYDROELECTRIC AND THERMAL POWER PLANTS

Plant	Location 1/	Total Name Plate Capacity (MW) 2/
Hydro in Operation		
Wells	Columbia, WA	774.3
Bonneville	Columbia, OR-WA	1,050
Chief Joseph	Columbia, WA	2,069
John Day	Columbia, OR-WA	2,160
Libby	Kootenai, MT	525
McNary	Columbia, OR-WA	980
The Dalles	Columbia, OR-WA	1,780
Grand Coulee	Columbia, WA	6,180
Rock Island	Columbia, WA	623.3
Rocky Reach	Columbia, WA	1,213.15
Boundary	Pend Oreille, WA	633.65
Brownlee	Snake, ID-OR	675
Ice Harbor	Snake, WA	603
Priest Rapids	Columbia, WA	788.5
Wanapum	Columbia, WA	831.25
Lower Granite	Snake, WA	810
Little Goose	Snake, WA	810
Lower Monumental	Snake, WA	810
Dworshak	North Fork, Clearwater, ID	400
Albeni Falls	Pend Oreille, ID	42.6
Hungry Horse	South Fork, Flathead, MT	285
Hells Canyon	Snake, ID - OR	450
Additional Hydro Units		
Authorized for Construction		
John Day	Columbia, OR-WA	540
Libby	Kootenai, MT	315
Nuclear in Operation		
Hanford	Richland, WA	860
Trojan	Rainier, OR	1,216
WNP-2	Richland, WA	1,100
Nuclear in State of Preservation for Possible completion		
WNP-1	Richland, WA	1,250
WNP-3	Satsop, WA	1,240

1/ Locations for hydro projects are the river and state. Locations for nuclear, coal, and combustion turbine resource are the nearest municipality.

2/ Capacities of hydroelectric projects were taken from Project Data and Operating Limits, Columbia River and Tributaries Review Study, U.S. Corps of Engineers, North Pacific Division, May 1985.

Table 4 (continued)

<u>Plant</u>	<u>Location 1/</u>	<u>Total Nameplate Capacity (MW)</u>
Coal in Operation		
Colstrip Nos. 1, 2, 3, & 4	Colstrip, MT	2,060
Jim Bridger, Nos. 1, 2, 3, & 4	Rock Springs, WY	2,000
Centralia Nos. 1 & 2	Centralia, WA	1,400
Boardman	Boardman, OR	530
Dave Johnston	Glenrock, WY	750
Valmy Nos. 1 & 2	Valmy, NV	500
Combustion Turbine in Operation		
Beaver	Clatskanie, OR	409

The region's seven IOUs either individually or jointly own generation resources. Under the Pacific Northwest Power Act, BPA is obligated to serve the IOUs' loads if so requested. Additionally, a provision unique to the Pacific Northwest Power Act creates what is called the Residential Purchase and Sale Agreement. Under this agreement, BPA purchases power equal to each utility's residential and farm load from IOUs and other utilities participating in the exchange at the utility's average system cost. In turn, BPA sells the participating utility an equal amount of power at the same rate as BPA's firm sales to preference customers. The benefits from the exchange are passed through to each utility's residential and small farm consumers in the form of lowered rates.

Besides public utilities, IOUs, and the DSIs, BPA also serves a few Federal agencies. These form a very small block of BPA sales and are served under the PF rate.

3.2 AREAS OF PARTICULAR CONCERN

This section identifies and describes the aspects of the existing Pacific Northwest environment that are most likely to be affected by BPA's power marketing decisions.

3.2.1 Columbia River and Tributaries

The Columbia River and its tributaries are one of the region's greatest natural resources. Close relationships exist between alternative uses of this resource and power production.

The Columbia River and its tributaries constitute the hydrologic system that generates the majority of the power marketed by BPA. Proposals or alternatives relating to the DSIs may cause changes in the demand for power. To meet these changed power demands, operations of the dams on the Columbia River may be altered, potentially influencing streamflows and water quality. Changes in river operations could, in turn, affect fish and wildlife and recreational uses of the river system. In addition, any effects of power rates on the use of electricity for irrigated farming may have implications for water usage, air and water quality, land use, and electric power generation.

3.2.1.1 Water Quality

Generally, surface water quality in the Northwest is better than that in many parts of the country. Water quality problems exist in some parts of the Columbia Basin, however, particularly on a seasonal basis. Seasonal temperature increases are a water quality problem in the major Columbia River tributaries during periods of low flow. This affects natural fish reproduction, particularly that of salmonids.

One water quality problem directly attributable to the dams is nitrogen supersaturation. This condition occurs in the Columbia and Lower Snake Rivers when flows greatly exceed powerhouse capacity or levels needed for power generation, and large amounts of water must be spilled to regulate reservoir levels. Nitrogen supersaturation is a threat to migratory salmonids.

Nutrients, such as nitrates and phosphates from agricultural fertilizers, have been a major cause of excessive aquatic algal growth in the Snake and Yakima River Basins and other areas where chemical fertilizers are used in conjunction with irrigation. This condition can be remedied if water and fertilizer use are better managed and sufficient streamflows are maintained.

3.2.1.2 Fish

The Columbia River and its tributaries are internationally recognized for their runs of anadromous fish and the commercial and recreational fisheries they support. Anadromous fish require access to fresh water rivers to spawn. Construction of Grand Coulee Dam on the Columbia River in 1938 eliminated access to over 500 miles of the River above the dam. Dams also have blocked 50 percent of the Snake River to fish migration.

Impounding of 450 miles of the Columbia River downstream from Grand Coulee Dam has eliminated salmonid spawning in the Columbia River mainstream except in the reach from Lake Wallula to Priest Rapids Dam (the Hanford Reach). Passage through dam turbines and increased migration time caused by the size and slow movement of reservoirs have increased mortality of migrant juvenile fish. In addition, during high flow conditions when large volumes of water are spilled, nitrogen supersaturation creates a potentially lethal condition for fish.

Other activities such as channeling, dredging, logging, and mining have affected migratory fish by destroying natural habitat and changing water

quantity and quality. Pollution from industrial, domestic, mining, and agricultural sources has lowered water quality in some areas by introducing silt, pesticides, organic wastes, and toxins. This pollution increases fish mortality.

As a result of these effects, artificial propagation (hatcheries and spawning channels) and fish passage facilities and collection and transportation programs now are employed to maintain anadromous fish populations. However, some populations are no longer at harvestable levels. Provisions in the Pacific Northwest Power Act ensure that further programs are developed for the protection and enhancement of fish and wildlife along the Columbia River and its tributaries.

In addition to anadromous fish, several varieties of resident fish inhabit the Columbia River drainage. Among those of recreational importance are several species of trout (rainbow, cutthroat, lake, brook, and brown), walleye, large- and small-mouth bass, catfish, whitefish, and landlocked populations of sturgeon. Most of the easily accessible trout waters are stocked with fish annually because natural production cannot keep pace with demand. While some reservoirs are good resident game fish producers, others have promoted the growth of undesirable fish (squawfish, carp, and suckers) or are poor fish producers because of a variety of factors.

3.2.1.3 Wildlife

A number of factors affect wildlife species in the Pacific Northwest. Many animals, such as small birds, rodents, weasels, snakes, and frogs, have small territories or ranges that are restricted by the variety, type, and abundance of cover. Beavers, muskrats, and river otters, for example, require specific vegetation for food. On the other hand, deer, elk, larger birds, and large carnivores have larger territories and use a variety of vegetation for food and cover. Finally, migratory animals, such as waterfowl, are influenced by weather and the availability of water and move between communities on a daily and seasonal basis.

Changes or disturbances to vegetation communities affect wildlife populations. The development or abandonment of agricultural land, especially irrigated cropland, has a distinct influence on wildlife diversity and numbers. Irrigation development enhances the habitats of ring-necked pheasants, gray partridges, scrub jays, leopard frogs, montane voles, and yellow-bellied marmots. However, it adversely affects species that include sharp-tailed grouse, short-horned lizards, and various animals that depend on a shrub-steppe ecosystem.

Changes or disturbances to water areas, wetlands, and the high-yield grain crops adjacent to wetlands contribute to an increase or decrease in waterfowl habitat. The region's wetlands are productive for resident species as well as for transient and/or wintering waterfowl, although many of the coastal and inland wetlands in the Pacific Northwest have been altered or destroyed by development.

Changes or disturbances to vegetation along river banks or other bodies of water are associated with shoreland construction, water level fluctuations, and shoreland erosion. Loss of this riparian habitat can adversely affect beavers, muskrats, swallows, and kingfishers. Construction and operation of the Federal dams have modified much of the original vegetation along the Columbia River and tributaries. In accordance with the Endangered Species Act (16 U.S.C. 1531 et. seq.), BPA proposals and alternatives examined in this document must avoid jeopardizing the existence of any endangered or threatened species or adversely changing critical habitat.

3.2.1.4 Recreation

The Columbia River and tributaries provide recreational opportunities for persons within and outside the Pacific Northwest including fishing, swimming, boating, and rafting. Reservoirs created by the dams have enhanced swimming and boating opportunities. Fluctuations in reservoir levels and streamflows can affect each of these activities. The enhanced habitat for bird species resulting from irrigated grain farming has improved recreational opportunities for hunters and bird watchers.

3.2.2 AIR QUALITY

Air quality in the Pacific Northwest varies with the level and types of human activity present. The urban areas often violate ambient air quality standards because of the concentration of vehicular and industrial activity. Some rural areas, especially in the Columbia Basin, experience high particulate concentrations as a result of wind-blown dust from agricultural operations and unpaved roads. Field and slash burning also can cause excessive particulate concentrations and poor visibility in areas near forestry operations and some agricultural operations. There also are localized air quality problems caused by particular industrial operations. Direct combustion of wood for home heating is becoming an increasing source of air pollution.

Areas within the region designated in violation of one or more Federal ambient air quality standards are listed in Table 5. These areas are referred to as nonattainment areas and typically include relatively small areas that center around urban or industrial zones.

3.2.3 NON-DSI CONSUMER SECTORS

This section describes four major consumer sectors: retail (i.e., non-DSI) industrial; agricultural; commercial; and residential which are components of the Pacific Northwest's physical and socioeconomic environment that could be affected indirectly by BPA's actions with respect to the region's aluminum smelters.

The overall finding made in the following sections is that industrial, agricultural, and commercial sectors of the Northwest economy generally are not very sensitive to electricity prices, and are therefore unlikely to be adversely affected by changes in BPA's PF rates. These sectors of the

Table 5

AIR QUALITY NONATTAINMENT AREAS IN THE BPA SERVICE AREA 1/ 2/

Area	Pollutants for Which Designation is Effective <u>3/</u>				
	Total Suspended Particulate	Carbon Monoxide	Sulfur Dioxide	Ozone	Nitrogen Dioxide
<u>Idaho</u>					
Silver Valley (Shoshone Co.)	unclassifiable <u>4/</u>		unclassi- fiable		
Lewiston	X				
Boise		XX			
Pocatello	XX				
Soda Springs	XX				
<u>Montana</u>					
Butte Area	XX				
Columbia Falls Area	XX				
City of Missoula	XX	XX			
Missoula Area	X				
<u>Oregon</u>					
Portland	X	XX		XX	
Eugene-Springfield	X	XX			
Salem		XX		XX	
Medford-Ashland	XX	XX		XX	
<u>Washington</u>					
Seattle	XX	XX		XX	
Spokane	XX	XX			
Longview	X				
Vancouver	XX			XX	
Yakima		XX			
Clarkston	X				
Renton	X				
Kent	X				
Tacoma	XX	XX	unclassi- fiable	XX	

1/ This table indicates the general location of nonattainment areas. Some areas are actually quite limited in size, and all have definitive, prescribed boundaries not identified on this table.

2/ Source: Code of Federal Regulations, Title 40, Protection of Environment, Part 81, U.S. Government Printing Office, Washington, D.C., revised July 1, 1985.

3/ Designation "X" indicates that the area or a portion of the area violates the Federal secondary air quality standards. Designation "XX" indicates that the area or a portion of the area violates the Federal primary air quality standards.

4/ Sufficient data or other circumstances prevent classifying a location as attainment or nonattainment. For example, Silver Valley and Tacoma are probably both "unclassifiable" for sulfur dioxide because smelters have recently closed in both areas and not enough time has passed to collect data to document attainment or nonattainment, and there may be uncertainty regarding reopening of the smelters.

Northwest economy respond principally to market demands, and little to electricity price. Exceptions may be certain paper products plants. Commercial firms which exist in communities largely dependent on customers or employers whose operating decisions are strongly influenced by electricity prices may also be affected. These effects would occur either because the customer would reduce purchases from the firm or affect local individuals' demands for goods and services, rather than because an electricity price change directly affected the firm's overall costs.

3.2.3.1 Retail Industrial

Industries served by the region's retail utilities consumed 3,582 average MW of electrical energy in 1984. Of this amount, industries served by public utilities purchased 1,721 average MW and industries served by IOUs purchased 1,861 average MW (BPA, 1985c).

The Pacific Northwest's non-DSI industrial consumers are a heterogeneous group of industries, varying in size of electric load, products, technology, and energy intensiveness. Retail electricity rates paid by industrial consumers of public utilities, who purchase all or a large portion of their power from BPA under the PF rate, are most directly affected by changes in BPA wholesale power rates. BPA wholesale power costs comprise most of the total electric bill for the majority of large industries purchasing power from BPA's public utility customers (BPA, 1985d).

The importance of electricity rates paid by industries varies depending on several factors: strength of product market, overall cost competitiveness, financial health of the individual firm, and degree of electrical energy intensiveness. With some exceptions, price of electricity is a much less significant factor than product demand and/or domestic and foreign competition in determining operating levels for most of the region's industries, including some large users of electricity (NEA, 1986). The exceptions are those industries which are inherently electricity intensive and those which, while not in industry categories regarded as electrically intensive, face sufficiently small operating margins such that all cost components, including electricity, become increasingly important in operating decisions.

The amount of electricity used by industry can be indirectly affected by two other factors. First, there can be an interdependence among industries sensitive to electric rate levels and other industries in a locality. Any change in production by a firm in response to rate changes can affect other local industries which are that firm's major suppliers or purchasers (Carlson, 1983). Second, changes in electricity consumption resulting from technology changes can be influenced by the price of electricity relative to other fuels. For instance, a potential exists in the food products industry and the pulp and paper industry for adaption to more electrically intensive processes from processes that currently use other fuels. Since conversion represents a long term investment, a firm needs to perceive the price of electricity relative to other fuels to be sufficiently favorable over the long term to justify this investment. One recent development which could slow any conversion to electric intensive processes (or accelerate conversion away from electricity use) is the simultaneous drop in natural gas and oil prices.

3.2.3.1.1. Food Products Industry - The food products industry in the Pacific Northwest is a mature, stable industry and the second largest employer in the region. Over one-half of the electricity purchased is used to preserve fruits and vegetables. Recent shifts in consumer preferences have resulted in a gradual shift in product mix from canned fruits and vegetables to fresh and frozen products. Nevertheless, this industry is expected to display fairly stable employment and output levels in the coming years.

Although one of the largest industrial consumers of electricity, the food products industry is not electrically intensive. Electricity accounts for less than 5 percent of production costs for most food products firms. Production levels in the food products industry, and, therefore, electricity consumption, are determined primarily by market activity (NEA, 1986).

3.2.3.1.2 Lumber and Wood Products Industry - The Pacific Northwest lumber and wood products industry has been experiencing a decline in the last 5 years. This industry has been adversely affected by high interest rates, domestic competition in the Southeast and foreign competition, and low timber prices. Despite the recent decline in output, the lumber and wood products industry still accounts for the largest share of the Pacific Northwest manufacturing employment. The lumber and wood products industry uses large amounts of electricity, primarily for motors in sawmills, planing mills, and plywood and structural members industry. However, electricity represents less than 5 percent of product value for this industry, and it is not likely that the industry as a whole would make significant production changes in response to electricity rate changes. The product market for lumber and wood products generally influences the industry's use of electricity rather than electricity price (NEA, 1986).

3.2.3.1.3 Paper Industry - The paper and allied products industry in the Pacific Northwest has been relatively stable despite the recent recession, due to a fairly stable demand for paper products. This industry has potential for expanding sales to Pacific Rim markets. However, foreign competition and the strength of the U.S. dollar could impede the Pacific Northwest pulp and paper industry's share of this market. Most of the domestic competition for the regions; paper and allied products industry is in the Southeast, with cheaper labor and pulpwood costs and easier access to eastern markets. This industry is fairly electrical energy intensive, particularly for paperboard, paper and pulp mills. For pulp mills employing a new thermomechanical pulping process, electricity costs can account for as much as 30 percent of total production costs. The paper and allied products industry does cogenerate a portion of its electricity needs, and self-generates from hydro and other sources. The overall outlook for the region's paper and allied products industry is for stable production levels. Future changes in electricity use, therefore, are more likely to result from process changes rather than changes in production levels. Production levels themselves are generally much more sensitive to the demand for paper products than to electricity prices (NEA, 1986). However, certain plants have been identified for whom electricity price could be important in determining operating levels (Carlson, 1983).

3.2.3.1.4 Chemical Industry - The Pacific Northwest chemical industry has also displayed relative stability due to a stable market. For instance, a primary market for the chlorine-caustic soda sector (which includes two DSIs) is the pulp and paper industry. Employment in the region's chemical industry comprises about 3 percent of total manufacturing employment; this share is projected to increase somewhat through the 1980s. The chemical industry as a whole is fairly electrically energy intensive. The share of total production costs in the chlorine-caustic soda industry, which like the aluminum industry uses an electrolytic process, is particularly significant, with estimates ranging as high as 25 percent. For the most part, however, demand for electricity is driven by changes in product demand for the chemical industry. The chemicals industry serves primarily a regional market, and its output (and demand for electricity) is largely dependent on the pulp and paper industry and the agricultural sector (NEA, 1986).

3.2.3.1.5 Primary Metals Industry - The primary metals industry in the region is dominated by the DSIs, primarily aluminum producers. However, there are other primary metal businesses which are served by retail utilities. These include blast furnaces, steel works and rolling mills, electrometallurgical products, steel pipes, and a new silicon metal alloys producer, among others. These non-DSI metals producers account for a relatively small share of total employment in the primary metals sector. However, they are electricity intensive industries (NEA, 1986).

3.2.3.1.6 Other Industries - The food products, lumber and wood products, pulp and paper, chemicals, and primary metals industries are the major Pacific Northwest industry groups in terms of electricity use. Other firms exist that employ large numbers of people but are not electricity intensive, such as those in the aerospace industry. Certain other firms, despite their relative smallness, may be sufficiently electricity intensive or face profit margins such that they are sensitive to electric rates (Carlson, 1983). In general, though, for most firms the health of product market and other factors are more significant than the price of electricity.

3.2.3.2 Agriculture

Seventy percent of the value of agricultural crops sold in the region are from commodities grown on farms with some irrigated acreage. Sustained high interest rates, a strong U.S. dollar, and declining commodity prices have adversely affected the region's irrigated agriculture industry.

Electricity for irrigation accounts for a small part of agricultural production costs, though the actual share varies with the production location and crop type. Total electricity costs for irrigation pumping are greater in areas of high-ground water or surface-water lift relative to low-lift areas. The electricity cost share varies from less than 1 percent for apples grown in low-lift areas to over 10 percent for alfalfa grown in high-lift areas.

Irrigation systems are fairly fixed, but farmers can reduce water and energy use through improving water management and irrigation scheduling, and conversion to low-pressure systems. Most of the high-lift areas have already

made major water and energy reductions during 1980-1984. No further significant response to increased electricity rates is expected from this industry. There is some potential for shifting consumption from peak load hours to the off-peak hours during April, May, September, and October. However, the total demand for electricity by irrigated agriculture will be more influenced by shifts in the product demand market and changes in the cost of capital than by modest changes in electricity rates (NEA, 1986).

3.2.3.3 Commercial Consumers

For most commercial firms, electricity costs are a minor consideration. The major costs these firms face are inventory, salaries, advertising, and other non-energy related costs. Commercial consumers are, however, significantly affected by the overall health of basic industries in their communities. Therefore, if major industries cut back on production or shut down completely for reasons relating to electricity prices, electricity supply, or any other reasons, the local markets faced by commercial consumers are adversely impacted. These indirect impacts would be felt first by businesses providing nonessential services, such as theaters and restaurants.

3.2.3.4 Residential Consumers

Residential consumers are unable to pass along power rate increases to other consumers (as do commercial and industrial consumers). The impact of increases in BPA's rates on individual consumers depends on: (1) the proportion of the utility's power purchased from BPA; (2) the utility's retail rate structure; and (3) the characteristics of the individual residential consumer. In addition to price, the individual residence's consumption for electricity is also a function of family income; heating degree days; cooling degree days; age, condition, and type of the residence; number and ages of occupants; and price of substitute fuels.

The impacts of higher electricity prices are most severe for low-income residential consumers including senior citizens on low fixed incomes. Low-income consumers spend disproportionately large portions of their incomes on all energy purchases. The cost of all energy has been estimated as high as 36 percent of the total low-income budget, as compared to 3 to 4 percent for the nonpoor (Public Utilities Fortnightly, 1986). It is also likely that low-income people live in houses and apartments with baseboard electric heat, the least costly to install. These residences may also be less well insulated for further construction cost-cutting. Reduction in the use of necessities (cooking, water heating, etc.) is more difficult than the reduction of luxuries (dishwashers, air conditioners, etc.).

3.3 ALUMINUM PLANT ENVIRONS

The environments in which the region's 10 aluminum plants exert their principal influences, both physically and socioeconomically, are described in Appendix A. Impacts of the aluminum plants are predominantly localized. This section is intended to point out particular characteristics of the individual aluminum smelter sites pertinent to environmental concerns. These characteristics are notably different than for the region in general, as described in section 3.1, or are unique to a plant or group of plants.

Locations of the 10 Pacific Northwest aluminum plants are shown in Figure 6. Except for the 3 plants in the Portland/Vancouver/Longview area and the 2 at The Dalles, Oregon and near Goldendale, Washington, the plants are remote from each other. The plants at Troutdale, Oregon, and Vancouver, Tacoma, and Mead in Washington are in or close to major urban areas. The others are in or near smaller cities or towns. The most remotely sited plant is the Commonwealth plant, which is about 17 miles south of the town of Goldendale, Washington.

All the plant sites are zoned for industrial use, but only in the cases of the Longview, Tacoma, Ferndale, and Vancouver plants is use of nearby areas devoted primarily to other major industrial facilities of similar scale. Substantial residential land use in close proximity to an aluminum smelter is evident at Mead and at Longview, where a residential neighborhood borders the plant site on the north.

Two plants are located within nonattainment areas for particulate air pollution, Kaiser in Tacoma, Washington and Reynolds Metals in Troutdale, Oregon (see Table 5). Washington's Department of Ecology (WDOE) State Implementation Plan (SIP) for the Tacoma area is tentatively considering better control of industry related road dust as a means for resolution of the particular problem. Troutdale is at the edge of the Portland - Vancouver nonattainment area for particulates. While industry contributes to the pollutant load, Oregon's Department of Environmental Quality (ODEQ) SIP has identified residential burning and road dust as the prime targets for managing particulate levels in this nonattainment area.

Six of the plants (those at Longview, Vancouver, Troutdale, The Dalles, and near Goldendale and Wenatchee) are adjacent to the Columbia River. These six plants discharge waste water into the Columbia. In general these waters are considered to be Class A waters (excellent) suitable for domestic water uses, salmonid life requisites, and swimming. Class A water quality standards and actual conditions are shown in Table 6. The other three waters receiving aluminum smelter discharges are Peone (Deadman) Creek in Washington - Class A, the Strait of Georgia - Class AA (extraordinary), and Hylebos Waterway in Washington - Class B (good).

The Columbia Falls Aluminum Company plant near Columbia Falls, Montana, is approximately 8 miles southwest of Glacier National Park. It is also near the Flathead River, a Wild and Scenic River, but does not discharge waste water into the river. The Vancouver plant is near Vancouver Lake, which has recently been reclaimed to enhance recreation. Other than the 6 plants located on the Columbia River, the remaining plants, those at Tacoma, Ferndale, and Mead, are not located near recreational sites.

The National Register of Historic Places lists 102 entries in cities located near aluminum smelter sites (see Table 7). All the aluminum smelters predate the National Historic Preservation Act of 1966. Approximately 100 sites are near the Vancouver plant found on or near the Columbia River or the Lake River-Vancouver Lake flood plain area in Clark County, Washington (BPA, 1977c, p. IV-190).

Figure 6

ALUMINUM PLANT LOCATIONS

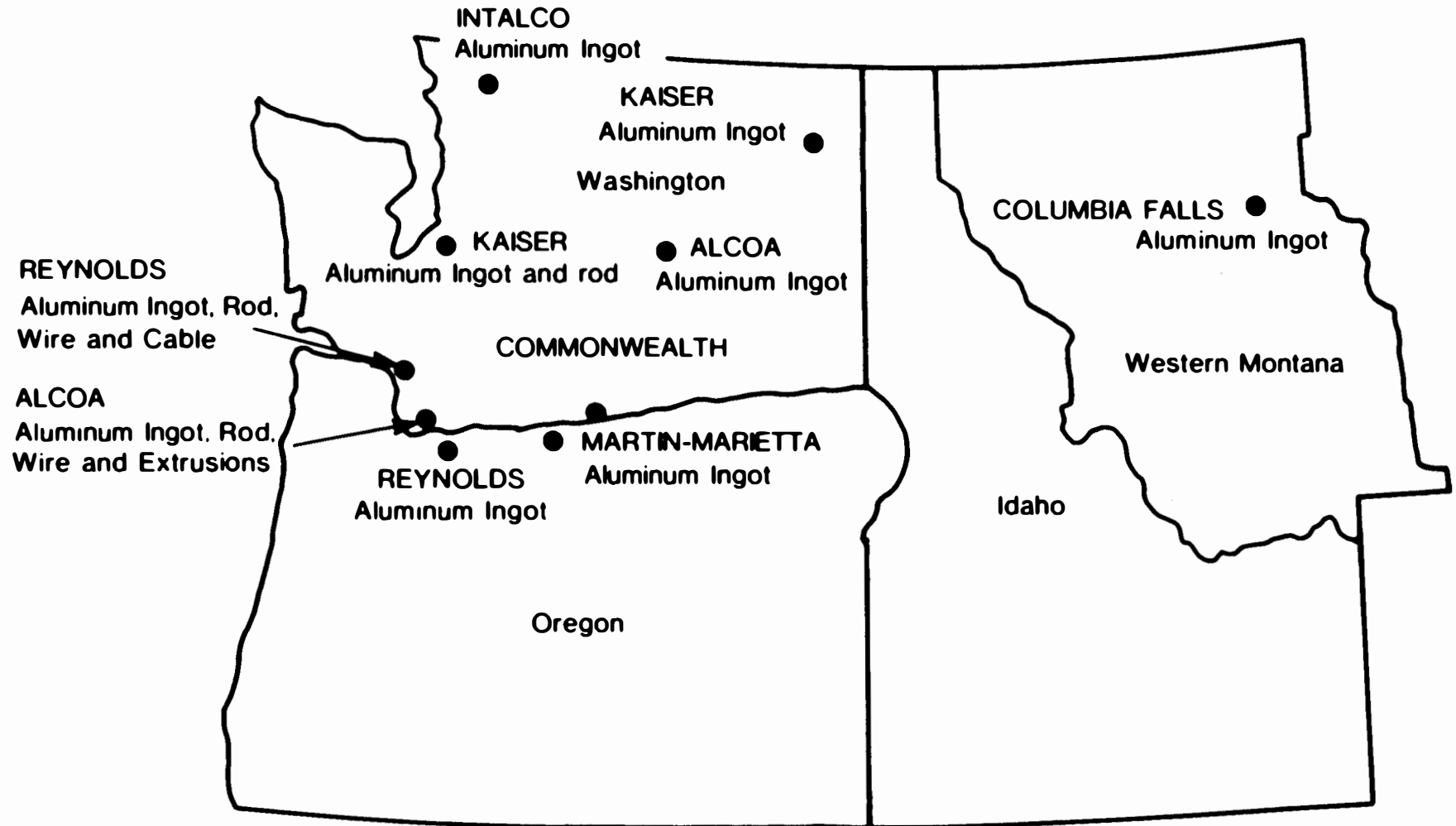


Table 6

COLUMBIA RIVER WATER QUALITY STANDARDS AND ACTUAL PARAMETER CONCENTRATION

Parameter	Standard	Actual Concentrations ^{1/}			
		Site 1 ^{2/}	Site 2 ^{3/}	Site 3 ^{4/}	
Turbidity	50 NTU or less	.6 - 12	no data	no data	
Fecal coliform	100 organisms/100 mL	21	no data	no data	
Dissolved oxygen	8 mg/L or greater	8.6-12.6	no data	no data	
Temperature	shall not exceed 18°C due to man	4-20°C	no data	no data	
pH	6.5 - 8.5	8.0-8.3	no data	no data	
Arsenic (dissolved)	.01 mg/L	.001-.002	.001	.001	
Barium (dissolved)	1.0 mg/L	.026-.031	.036	no data	
Boron (dissolved)	.5 mg/L	no data	.02	no data	
Cadmium (dissolved)	.003 mg/L	.001	.001	no data	
Chloride (dissolved)	30 mg/L	5	1.3	1.2	
Chromium (dissolved)	.02 mg/L	.001	.001	.01	
Copper (dissolved)	.005 mg/L	.004-.006	.003	.002	
Cyanide (dissolved)	.005 mg/L	no data	no data	no data	
Fluoride (dissolved)	1.0 mg/L	.2	.1	.1	
Iron (dissolved)	0.1 mg/L	.012-.078	.011	.013	
Lead (dissolved)	.05 mg/L	.01-.001	.002	no data	
Manganese (dissolved)	.05 mg/L	.001-.008	.003	.0044	
Phenols	.001 mg/L	no data	no data	no data	
Total Dissolved Solids	200.0 mg/L	81-120	no data	no data	
Zinc	.01 mg/L	.015-.040	.014	no data	

^{1/} Data from the U.S. Geological Service

^{2/} Columbia River at Warrendale. Data represent samples from 4 dates during 1982 and 1983.

^{3/} Columbia River at Vernita. Data represent median value of samples collected from 1973-1985.

^{4/} Columbia River at Richland. Data represent median value of samples collected from 1973-1985.

Table 7

NUMBER OF SITES LISTED IN THE NATIONAL
REGISTER OF HISTORIC PLACES

<u>Company</u>	<u>Plant Site</u>	<u>Number of Sites Listed</u>
Alcoa	Vancouver, WA	13
	Wenatchee, WA	8
	Addy, WA	0
Columbia Falls Aluminum Co.	Columbia Falls, MT	1
Commonwealth	Goldendale, WA	3
Intalco	Ferndale, WA	1
Kaiser	Mead, WA	0
	Tacoma, WA	42
	Trentwood, WA	0
Martin Marietta	The Dalles, OR	12
Reynolds	Longview, WA	20
	Troutdale, OR	2
Carborundum	Vancouver, WA	13
Georgia Pacific	Bellingham, WA	22
Hanna	Riddle, OR	0
Oremet	Albany, OR	18
Pacific Carbide	Portland, OR	156
Pennwalt	Portland, OR	156
Port Townsend	Port Townsend, WA	42
Gilmore Steel	Portland, OR	<u>156</u>
Total Sites		340

This information was collected from the following FEDERAL REGISTER notices of National Register of Historic Places: 44 FR 7416, February 6, 1979; 45 FR 17446, March 18, 1980; 46 FR 10622, February 3, 1981; 47 FR 4932, February 2, 1982; 48 FR 8626, March 1, 1983; 49 FR 4608, February 7, 1984; 50 FR 3983, January 29, 1985; 50 FR 5824, February 12, 1985; 50 FR 8850, March 5, 1985; 50 FR 15987, April 23, 1985; 50 FR 18323, April 30, 1985; 50 FR 20944, May 21, 1985; 50 FR 31780, August 6, 1985; 50 FR 46704, November 12, 1985.

3.4 THE REGULATORY ENVIRONMENT FOR THE NORTHWEST ALUMINUM SMELTERS

Environmental regulations control, for the most part, aluminum smelter air emissions, water discharges, and hazardous waste. In the early 1970s the Clean Air and Water Acts were passed by Congress. These established the framework for national air and water pollution control programs. The U.S. Environmental Protection Agency (EPA) promulgated pollution control standards and regulations as the Acts directed. Implementation of these programs has for the most part been delegated to the states, with EPA retaining oversight authority.

The states in assuming their delegated responsibilities have promulgated their own regulations which are equal to or more stringent than those issued by the EPA. Regulations outlined below are applicable to the aluminum industry. The regulatory agencies (ODEQ, WDOE, and the Montana Department of Health and Environmental Sciences (MDHES)) and EPA have succeeded in implementing these controls.

In the future, it is not likely these regulatory agencies will relax standards pertinent to aluminum smelters. In fact, both ODEQ and WDOE are currently in the process of revising aluminum smelter water discharge permits to assure better toxic pollutant control. Also, EPA is planning to issue regulations to control fine particulates (less than 10 microns) in ambient air.

3.4.1 Regulatory Overview - Water

The Clean Water Act (as amended, 33 USC 1251) set national policies to eliminate discharge of water pollutants into navigable waters. It also established a National Pollutant Discharge Elimination System (NPDES) permit program to control pollutants discharged from industrial sources.

Permit conditions are determined from (1) effluent limitation guidelines and (2) water quality standards. The effluent guidelines for aluminum smelters were issued in 40 CFR Part 421. Effluent limitation guidelines prescribe a specific discharge rate for each pollutant common to an industrial process on a production rate basis (e.g., pounds of pollutant per ton of aluminum produced). Regulated aluminum plant water pollutants include benzo(a)pyrene (B-a-P), antimony (Sb), nickel (Ni), aluminum (Al), fluoride (F), cyanide, and total suspended solids (TSS). Permitted and actual discharge rates for each Northwest smelter are given in chapter 4 of Appendix A.

In addition, water quality standards prescribe guidelines and pollutant (parameter) concentrations for safe water usage. Standards vary depending on a water's potential uses, such as domestic water supply, salmonid life requisites, stock watering, or swimming. As can be expected, standards for waters used domestically are most stringent. As an example, WDOE classifies its waters with the following designations: Class AA - extraordinary, Class A - excellent, Class B - good, and Class C - fair. Only Classes AA and A waters are considered acceptable for domestic water uses. Class AA standards are

slightly more stringent than Class A waters but generally have similar use designations. Class B waters are not suited for domestic uses or swimming. Actual standard criteria within a Class are based on the EPA publication "Quality Criteria for Water" and other information.

Plant discharges are not allowed to violate water quality standards beyond the mixing zones. (Mixing zones from aluminum plants generally range from 150 to 300 feet beyond the point of discharge.) Outside the mixing zone the receiving water sufficiently dilutes the discharge to render the concentration of each pollutant acceptable for the water's designated uses.

3.4.2 Regulatory Overview - Air

The Clean Air Act (CAA) (as amended, 42 USC 1857) required EPA to set national primary and secondary ambient air quality standards (NAAQS) and develop national emission standards for hazardous pollutants and new source performance standards. The Act also required states to develop State Implementation Plans to attain and maintain Federal air quality standards and establish preconstruction review of major new sources.

The aim of the NAAQS is to protect human health and welfare and, to the extent practical, prevent injury to plant and animal life. The SIPs focus on areas where pollutant levels exceed NAAQS and applicable state standards (Table 8). Parts of the Northwest that exceed NAAQS are indicated in Table 5.

In support of SIPs, but not necessarily directed toward nonattainment problems are plant-specific emission standards. The standards for aluminum smelters are summarized in Table 9.

In nonattainment areas, best available control technology (BACT) for pollutants that exceed ambient standards is required for new sources. If the new source is a major source or an existing source becomes a major source as a result of a proposed modification, lowest achievable emission rates (LAER) are required with an offset for those pollutants for which nonattainment has been designated. (In Washington and Montana a major source is defined as one producing 100 tons per year of any regulated pollutant. In Oregon a major source is any source that generates emissions in excess of significant levels shown in Table 10.) The primary difference between BACT and LAER is that BACT explicitly takes economic factors into account while LAER does not. The offset must effect a net beneficial air quality impact.

In addition, new source performance standards (NSPS) (40 CRF Part 60) and prevention of significant deterioration (PSD) regulations must be met by new aluminum smelters, smelter expansions, and certain types of modifications of smelters, as defined in the primary aluminum smelter NSPS and the PSD regulations. NSPS tend to focus on problem pollutants common to an industry type. For primary aluminum smelters, particulate and fluoride emissions are regulated. National emission standards for hazardous air pollutants (NESHAP) also apply to aluminum plants if they emit mercury, asbestos, beryllium, or vinyl chloride; aluminum smelters rarely if ever do so. In Oregon, PSD

applies when new emissions exceed the PSD level of significance as shown in Table 10. PSD permit procedures are designed to assure increases will not violate ambient air standards (Table 8). Also, for particulates and SO₂, increases in ambient concentrations cannot exceed levels shown in Table 11.

Fluoride (F) emissions from aluminum smelters have caused considerable environmental concern. The potential acute and chronic effects of F on vegetation and livestock that eat vegetation with high fluoride content is well documented. This problem was aggressively researched in the early 1970s by scientists and regulatory agencies. As a result, consensus guidelines for safe ambient and forage levels were established and used to regulate aluminum plant emissions (see Table 9). (Appendix A, Part 4.2.4 summarizes toxic effects from F.) To assure that F concentrations are at an acceptable ambient level, states require emission control and F monitoring. Typically, ambient monitoring takes place at locations determined to receive highest exposure. Emission measurements are also made for F periodically to assure continued compliance to F emission standards.

Particulate and SO₂ emissions are also controlled by emission standards (see Table 9). Although ambient monitoring is not always required of aluminum smelters for particulate and SO₂, emission measurements are periodically made to assure that emission standards are met.

3.4.3 Regulatory Overview - Hazardous Waste

The Resource Conservation and Recovery Act (42 USC 6921) provides for EPA identification and listing of hazardous wastes for regulation and applicable standards. EPA permits also are required for the treatment, storage, or disposal of hazardous waste.

The regulations promulgated do not apply to most wastes generated by the aluminum smelters, but states manage some aluminum smelter wastes as hazardous materials anyway. Of principal concern is waste potliner. This is a carbon liner used to protect and insulate the pot. In the hot reductive process cyanides form and accumulate in the potliner. Potliners from each of the plants are periodically replaced and stored onsite or shipped to a hazardous waste disposal site. Storage sites are now designed to protect against cyanide groundwater contamination.

WDOE, using its own toxicity test criteria, also manages wastes shown in Table 12. Most containerized waste is disposed of at Arlington, Oregon, in a hazardous waste disposal site. Oregon and Montana do not manage these wastes as hazardous material.

Table 8

AMBIENT AIR QUALITY STANDARDS ^{1/}

POLLUTANT	NATIONAL		WASHINGTON	OREGON	MONTANA
	PRIMARY	SECONDARY			
TOTAL SUSPENDED PARTICULATES					
Annual Geometric Mean	75 ug/m ³ ^{2/}	60 ug/m ³	60 ug/m ³	60 ug/m ³	75 ug/m ³
24-Hour Average	260 ug/m ³	150 ug/m ³	150 ug/m ³	150 ug/m ³	200 ug/m ³
Monthly	_____	_____	_____	100 ug/m ³	_____
SULFUR DIOXIDE (SO ₂)					
Annual Average	80 ug/m ³	_____	60 ug/m ³	60 ug/m ³	50 ug/m ³
24-Hour Average	365 ug/m ³	_____	260 ug/m ³	260 ug/m ³	260 ug/m ³
3-Hour Average	_____	1300 ug/m ³	_____	1300 ug/m ³	_____
1-Hour Average	_____	_____	1050 ug/m ³	_____	1300 ug/m ³
CARBON MONOXIDE					
8-Hour Average	10 mg/m ³ ^{2/}	10 mg/m ³	10 mg/m ³	10 mg/m ³	10 mg/m ³
1-Hour Average	40 mg/m ³	40 mg/m ³	40 mg/m ³	40 mg/m ³	27 mg/m ³
OZONE					
1-Hour Average	235 ug/m ³	235 ug/m ³	235 ug/m ³	235 ug/m ³	235 ug/m ³
NITROGEN DIOXIDE (NO ₂)					
Annual Average	100 ug/m ³	100 ug/m ³	100 ug/m ³	100 ug/m ³	100 ug/m ³
1-Hour Average	_____	_____	_____	_____	500 ug/m ³
LEAD					
Quarterly Average	1.5 ug/m ³	_____	_____	1.5 ug/m ³	1.5 ug/m ³
HYDROCARBONS					
3 hours (6-9 a.m.) (nonmethane)	_____	_____	_____	160 ug/m ³	_____
HYDROGEN SULFIDE (H ₂ S)					
1-Hour Average	_____	_____	_____	_____	0.05 ppm ^{4/}

1/ Washington and Montana also have regulations pertaining to ambient levels of fluorides. These are shown on Table 9 since they are particularly pertinent to aluminum smelters, although the regulations are applicable to fluoride air pollution from any source.

2/ mg/m³ = milligrams per cubic meter

3/ ug/m³ = micrograms per cubic meter

4/ ppm = parts per million

Table 9

ALUMINUM PLANT EMISSION AND AMBIENT AIR STANDARDS

POLLUTANT	STANDARDS		
	Oregon	Washington	Montana
	Emission	Emission	Emission
Total Fluoride (F)	3.5 lb/ton/mon 2.5 lb/ton/yr 22 tons/mon		2.0 lb/ton/mon
Total Particulate - Soderberg anode	13 lb/ton/mon 10 lb/ton/yr	15 lb/ton/day	
- prebake	15.6 lb/ton/mon 13.5 lb/ton/yr	15 lb/ton/day	
Sulfur Dioxide (SO ₂)	6/	60 lb/ton/mon	
	Ambient	Ambient	Ambient
Hydrogen Fluoride	7/	3.5 ug/m3/12 hrs 8/ 2.7 ug/m3/24 hrs 9/ 1.6 ug/m3/30 days 10/	
	Forage	Forage	Forage
Fluoride		40 ppm/12 mon 11/ 60 ppm/2 mon 12/ 80 ppm/2 mon/yr 13/ 40 ppm cured in forage	50 ug/g 14/ 35 ug/g
Opacity	not to exceed 20% at any time	20% except for 6 min. in any 60-minute period	not to exceed 10% any time
F Control	Best practical treatment and control technology	80-95% control efficiency (depending on system) 95% treatment	
Particulate Control	Best practical treatment and control technology	Reasonably available control technology	

- 1/ Pounds of pollutant allowable per ton of aluminum produced on a monthly average basis.
- 2/ Pounds of pollutant allowable per ton of aluminum produced on a yearly average basis.
- 3/ Maximum monthly emissions of pollutant allowable from any one plant.
- 4/ Washington State Standards do not prescribe an emission limit for fluorides. Instead, the State relies on its ambient and forage fluoride standards and individual smelter permit conditions for regulatory control.
- 5/ Pounds of pollutant allowable per ton of aluminum produced on a daily basis.
- 6/ ODEQ regulations do not prescribe SO₂ emission control rates. However, under plant site emissions limit criteria (Ore. 340-20-310), ODEQ has determined that SO₂ emissions be controlled and monitored on permit specific basis. Reynolds Metals Company shall not exceed 70 lbs/ton Aluminum and Martin Marietta Aluminum, Inc., shall not exceed 22.8 lbs/ton Aluminum.
- 7/ ODEQ regulations do not prescribe F ambient or forage standards, but do require monitoring. Further, permits have adopted WDOE's ambient and forage F standards as performance requirements.
- 8/ Micrograms per cubic meter average for any 12 consecutive hours.
- 9/ Micrograms per cubic meter average for any 24 consecutive hours.
- 10/ Micrograms per cubic meter average for any 30 consecutive days.
- 11/ Parts per million fluoride ion average for any 12 consecutive months.
- 12/ Parts per million fluoride ion average each month for more than 2 consecutive months.
- 13/ Parts per million fluoride ion more than once in any 2 consecutive months.
- 14/ Micrograms per gram monthly average.
- 15/ Micrograms per gram average for the grazing season.



Table 10

OREGON
SIGNIFICANT EMISSION RATES

Pollutant	Emission Rate (ton/yr)
Carbon monoxide	100
Nitrogen oxides	40
Sulfur dioxide	40
Particulate matter	25
Volatile Organic Compounds	40
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl chloride	1
Fluorides	3
Sulfuric acid mist	7
Hydrogen sulfide (H ₂ S)	10
Total reduced sulfur (including H ₂ S)	10
Any other pollutant regulated under the Clean Air Act	Any emission rate.
Each regulated pollutant	Emission rate that causes an air quality impact of 1 ug/m ³ or greater (24-hr basis) in any Class 1 area located within 10 km of the source.

Table 11

MAXIMUM PSD INCREMENTS

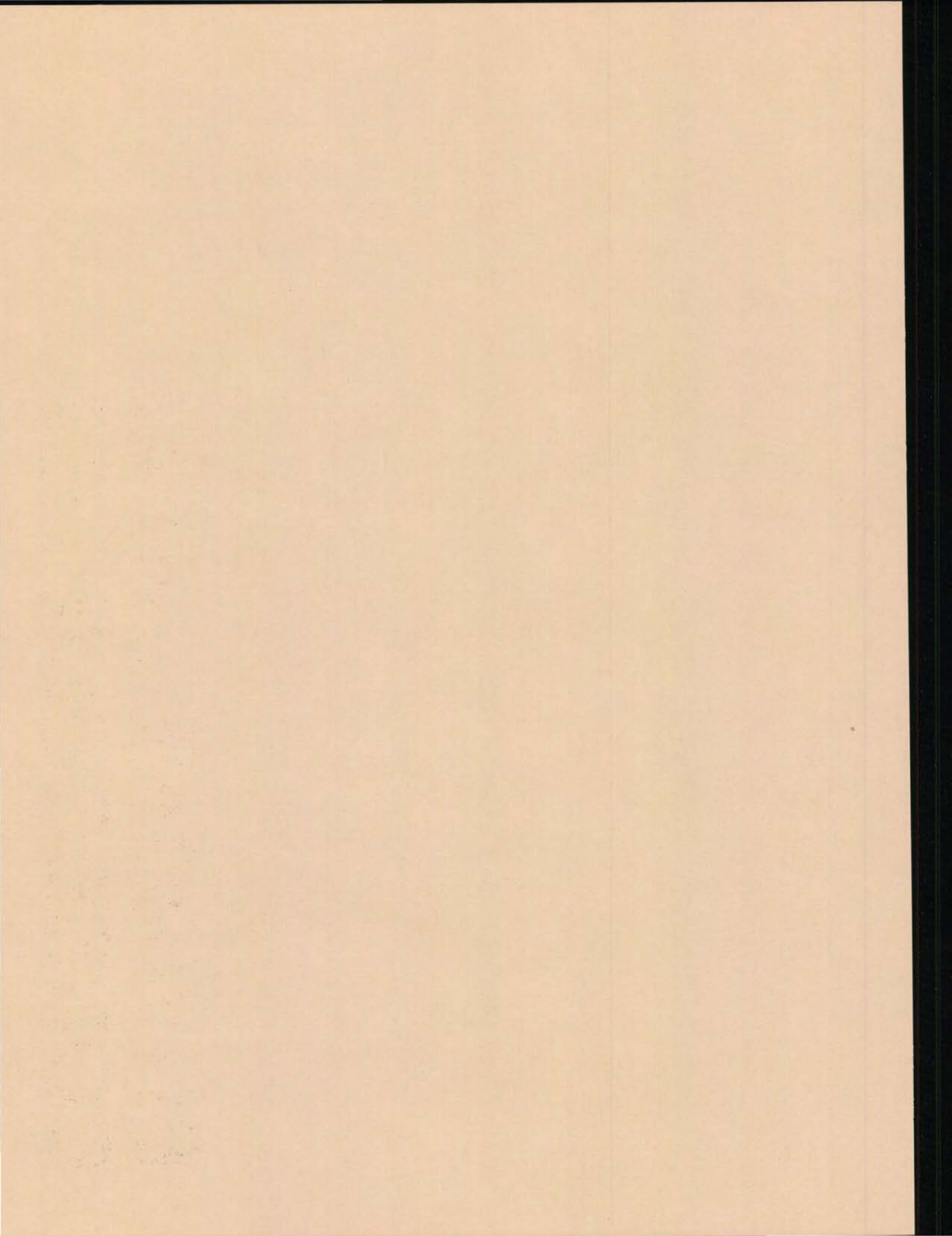
	<u>Micrograms per Cubic Meter</u>
<u>Class I Areas</u>	
Particulate Matter	
Annual geometric mean	5
24-hour maximum	10
Sulfur Dioxide	
Annual arithmetic mean	2
24-hour maximum	5
3-hour maximum	25
<u>Class II Areas</u>	
Particulate Matter	
Annual geometric mean	19
24-hour maximum	37
Sulfur Dioxide	
Annual arithmetic mean	20
24-hour maximum	91
3-hour maximum	512

Table 12

DANGEROUS ALUMINUM SMELTER WASTES SUBJECT TO
WDOE REGULATION

<u>Facility</u>	<u>Wastes</u>	<u>Amount/Year</u>	<u>Handling Method</u>
Kaiser, Tacoma	Spent Potlining	5,000 Tons	Waste Pile
	Leachate from	720,000 Gallons	Tank
	Spent Potlining Duct Dust	70 Tons	Waste Pile
Kaiser, Mead	Spent Potlining	4,300 Tons	Waste Pile
	Electromelt Dust	70 Tons	Waste Pile, Container
	Copper Dust	70 Tons	Container
	Coal Tar Oil	1,000 lbs.	Container
	Solvents/Thinners	14,000 lbs.	Tank/Container
Reynolds Metals, Longview	Black Mud	25,800 Tons	Surface Impoundment
Commonwealth, Goldendale	Scrubber Sludge	525,000 Gallons	Surface Impoundment
Alcoa, Wenatchee	Rod Blast Dust	72,000 lbs.	Container
	Electromelt Dust	36,000 lbs.	Container
	Spent Potlining	None	Storing Vancouver plant's spent pot- lining by Waste Pile
Alcoa, Vancouver	Spent Potlining	3,000 Tons	Container
	Electromelt Dust	56,400 lbs.	Container
	Stub Cleaning Catch	132,000 lbs.	Container
Intalco, Ferndale	Wastes currently being tested.		

ENVIRONMENTAL CONSEQUENCES



Chapter 4

ENVIRONMENTAL CONSEQUENCES

4.1 METHODOLOGY

4.1.1 Modeling

BPA has used a number of data sources and analysis techniques in the preparation of this EIS. A computer model, the Decision Analysis Model (model), was used to project changes that would result from implementation of the Variable rate and Con/Mod alternatives and certain combinations thereof. Within the model, a set relationship between the IP and PF rates exists. The model cannot test rate link alternatives since the response of the aluminum companies to the rate link would result from the subjective perception by their management of the degree of planning certainty provided by the link, and not to any specific, mathematically expressible factors. Therefore, the IP-PF rate link alternatives were not explicitly modeled, and are treated qualitatively in this EIS chapter (see section 4.5).

The model used for the analysis in this EIS is a refinement of that used in the DSI Options Study. Its selection as the principal tool for analysis was made because of several of its features.

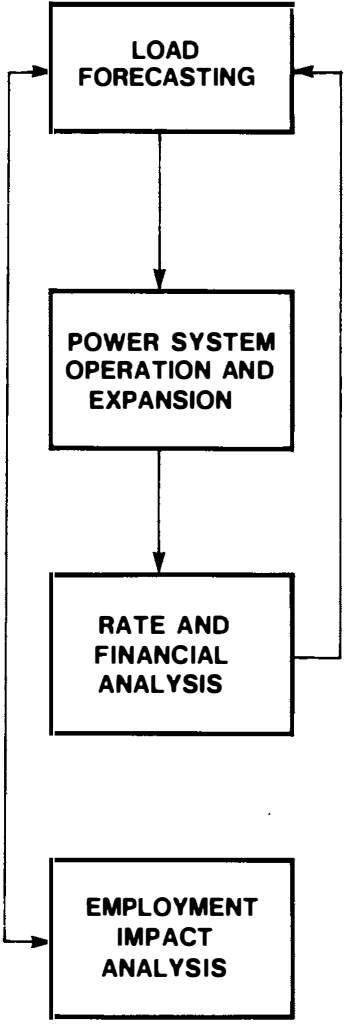
1. The model was basically conceived to deal with a variety of aluminum smelter options.
2. It can model a large number of options relatively quickly, and therefore was much faster than attempting to perform the analysis using several of BPA's complex models such as the Aluminum Smelter Model and Systems Analysis Model.
3. The model focuses broadly on an overall picture of the Northwest's utility economics and operations and therefore produces a variety of outputs useful to the EIS (see Figure 7). Some of these outputs, such as employment on a regionwide basis, are not produced by other BPA models and would have had to be derived exogenously had the model not been used.

A detailed description of the model is included in Appendix B. Parts of the model were adapted from other special-purpose models in use within BPA, while other parts were newly developed. A number of customer groups and other regional interests, including the DSIs, public utilities, and investor-owned utilities, actively participated in the design and construction of the model.

As the name of the model implies, it is intended to aid in the decisions to be made about the various options addressed herein. Important to those decisions are numerical estimates of the impacts or changes resulting from policy choices. The model provides estimates of a number of categories of potential

Figure 7

SYNOPSIS OF THE DSI DECISION ANALYSIS MODEL

DSI DECISION ANALYSIS MODEL	EXPLANATION: WHAT IT DOES
 <pre> graph TD A[LOAD FORECASTING] --> B[POWER SYSTEM OPERATION AND EXPANSION] B --> C[RATE AND FINANCIAL ANALYSIS] C --> D[EMPLOYMENT IMPACT ANALYSIS] D --> A </pre>	For each aluminum plant: - o Takes cost and price information as inputs - o Makes long-run investment or closure decisions based on expected profits - o Makes short-run operational decisions For non-aluminum loads: - o Can grow at base, high, or low rates - o Lets price elasticity effects be felt
	- o Simulates operation of system using random water years - o Estimates export sales - o Estimates long-run resource acquisitions - o Estimates annual costs of power system - o Estimates level of service to DSI interruptible load
	- o Estimates BPA rates by customer class - o Derives BPA revenues - o Estimates BPA cash flows
	o Estimates employment impacts in the aluminum and non-aluminum sector

impacts of DSI policies. Of particular interest to this EIS are aluminum smelter operating levels, generating resource output, electric rates, and employment changes. A number of improvements were made to the aluminum industry production forecasting portion of the model between the draft and final EIS. The version of the model used for the draft EIS did not incorporate the Variable rate into the long-term capacity planning logic; the Variable rate was only in the short-run operations portion of the model. Coding changes to the model now allow the Variable rate to be assessed in both the long-term and short-term routines.

The Variable rate logic also has been revised to incorporate more detailed aspects of the Variable rate design not previously modeled. These include the seasonal floor rate and the proposed adjustment to the pivot points based on the rolling average of historical aluminum prices. For this pivot point adjustment the user specifies lower bounds for the pivot points, the number of years the pivots are initially fixed, and the number of years over which the rolling average aluminum price is calculated.

The model output should be viewed with some caution. The model is not as accurate as BPA's more detailed, specialized models in determining some of the impacts of the options. Also, any model is only a simplification of the operations of the "real world." While the quantification within the model implies that some precision exists, in practice only approximations are possible because of the limits of both the model structure and the quality of the available data.

The model is a useful tool for determining the relative changes caused by the different options. Thus, valid comparisons among the options can be made, but the absolute values of results should be viewed with caution.

Conclusions and interpretations based on the model output are, therefore, supplemented by judgment; results of other studies performed for the design of the Variable rate; knowledge of the DSIs themselves gained through BPA's dealings with them over the years; the DSI Options Study; external consultants; and other sources. (See Appendix H for more information on the studies performed for the proposed Variable rate design.)

The model links four basic modules, which work together to determine the changes in the region's power supply system and the region's employment caused by adoption of each of the options. The modules are load forecasting, power system operation and expansion, rates and financial planning, and employment changes. Figure 7 illustrates how the modules are linked and what function each performs.

The load forecasting module projects loads for each year of the planning period. The most detail is provided for the aluminum industry, since that is the sector that will be directly affected. Both short-run and long-run operational decisions are modeled for each of the region's 10 aluminum smelters based on individual smelter production costs and other factors.

Simple econometric equations are used to project the loads of the nonaluminum DSIs and loads of the public and investor-owned utilities, in order to determine how they will respond to changing rate levels.

The power system expansion and operation, or resource analysis, module estimates how many new conservation or generating resources will be needed in each year to meet load growth, and what the costs of those resources will be. It also simulates the operation of the existing power system to estimate the costs of operating the system, the amount of service to interruptible DSI loads, and export sales.

The rates and financial module predicts how BPA's rates to each of its customer classes (priority firm, industrial firm, nonfirm energy, and surplus firm) will be affected by the different options. The financial portion of the model predicts how BPA's cash flow and U.S. Treasury payments would change.

And lastly, the employment module predicts the impact on four types of regional employment: direct DSI jobs; jobs that are indirectly dependent upon DSI jobs and income; other regional manufacturing jobs possibly affected by changes in BPA's PF rate; and secondary jobs dependent on those other manufacturing jobs or income.

The model can operate in four different ways. One mode of operation is to make a single random "draw" of values each year for each of three major variables that reflect uncertainty: aluminum ingot price, regional utility load growth, and availability of water for the operation of the hydrosystem. Such a set of random draws constitutes one "game" run.

A second type of run is called a sensitivity run. Here, the model starts a median case one game run. It then takes one input variable, increases or decreases it by a specified amount, and reruns the median case. It repeats this for each input variable. This allows a check of the "sensitivity" of model results to changes in its inputs.

The third mode of operation is called the "probabilistic" run. It involves passing through the model many times, making new random draws of the key variables each time. Each such pass is called a game. The results for all the games are averaged together to find the "expected value" of the results for such a probabilistic model run. This type of run also gives a picture of the range of uncertainty in the results. For example, the output can show both the expected PF rate, the highest and lowest PF rate in all the games, and the standard deviation of the PF rate. Probabilistic runs using 50 games were used in the analysis for this EIS. Increasing the number of games tends to enhance the differences among options.

The fourth mode of operation is to run again a single game of values of the major variables with the values based on the median set of input values rather than random draws. The median run does not produce the same results as the probabilistic run, since there are nonlinear relationships between the variables, and does not illustrate the variation of results possible.

For each alternative analyzed, the model produced a set of data which was subject to interpretation and environmental analysis. The model outputs of interest to the EIS and the use of each are listed in Table 13. The Variable rate proposal and the two alternatives described in sections 2.2.2 and 2.2.3 were modeled. Con/Mod alternatives were modeled on the basis of different amounts BPA might offer to pay for DSI conservation; specifically 3, 5, and 10 mills/kWh. Combinations of Variable rate alternatives and alternative levels of Con/Mod payment were also tested with the model to assess cumulative impacts. The no action alternative was modeled as the base case in each set of runs. In addition, a set of runs were made with a long-run expected aluminum price of 70¢/lb. and, in order to test impacts under a scenario of low aluminum prices, a set of runs was made with a long-run aluminum price of 65¢/lb.

Tables 14 through 23 summarize by way of averages for the time periods indicated: (1) the probability of each plant operating (i.e., not being closed) over 50 games, taking into account random elements of load growth, aluminum price, and availability of water to operate the hydroelectric system; and (2) the average capacity factor (i.e., projected yearly production divided by annual production capacity) over the games in which each plant operates. These tables show these data for both aluminum price scenarios studied. The principal influence shown among alternatives within any one option, between types of options or combinations, or between values for a given case for the two different aluminum prices is in the percent of games in which a plant is not closed. The average capacity factors for games in which the plants are open are generally quite high and vary relatively little within a period from alternative to alternative, from option to option, or with aluminum price.

4.1.2 New Cost Data

A late development in the Variable rate proceedings resulted in an independent review of BPA's smelter production cost estimates. This review, conducted by Resource Strategies, Inc. (RSI, 1986), indicated that the production cost estimates used by BPA were probably somewhat too high, i.e., actual smelter short-run variable costs were somewhat lower than assumed by BPA. The actual differences varied by smelter, ranging from a low of 2.2¢/lb. to a high of 5.6¢/lb., with an average difference of 4.0¢/lb. The predominant reason for the discrepancies, cited in the RSI report, is the deterioration in alumina markets, and therefore, alumina costs over the past year. These relatively recent developments were not incorporated into BPA cost estimates. It should be noted that RSI attributed a higher level of uncertainty to its own estimates of alumina costs than any other cost category.

BPA has decided not to incorporate the new cost estimates developed by RSI into the EIS analysis. The primary reason relates to the fact that the single largest source of cost difference arises from the currently depressed alumina markets. This is a temporary phenomenon. RSI itself projects alumina costs

Table 13

DECISION ANALYSIS MODEL OUTPUTS AND THEIR RELATIONSHIP TO IMPACTS

<u>Output</u>	<u>Information Supplied</u>	<u>Relationship to Environmental and Socioeconomic Impacts</u>
1. Individual Aluminum Smelter Production by Year, percent of games closed, and average capacity factors when open.	Shows aluminum smelter operation levels and likelihood of closures.	Level of plant operation affects the amount of pollutants discharged and, therefore, its physical environmental impacts. Plant operation level or closures affect employment and tax revenues, and therefore result in socioeconomic impacts.
2. Total Regional and Aluminum Smelter Loads by Year	Shows regional and aluminum smelter loads as a function of time.	Used to assess impacts as a result of changes in resource operations and resource development.
3. Rates by Year	Projected rates to various BPA customer classes.	Used to assess environmental and socioeconomic impacts as a result of rate changes to nonaluminum customers.
4. Other Employment	Shows expected employment changes in the nonaluminum sectors of the Pacific Northwest economy as a result of price elasticity of business activity with electricity price.	Used as input to the analysis of socioeconomic impacts as a consequence of rate impacts to nonaluminum customers.

to increase in real terms (net of inflation) over the next ten years. The Decision Analysis Model currently is structured to input costs in real terms. Substantial model changes would be required to accurately incorporate the future alumina market conditions and prices in the model. Further, RSI has indicated a high degree of uncertainty with respect to both current and expected alumina prices. These circumstances do not warrant changes to the modeling and cost assumptions.

One could speculate, based on other sensitivity analyses, as to the potential impact on DAM results of lower production costs in the near-term. In general, lower production costs will lead to a higher level of smelter operations at any given aluminum price, and subsequently higher load, employment, and emissions. Total regional loads would probably increase on the order of 200 MW in the near-term, until the lower initial costs were offset by the real increases through time. However, the rank order of results between alternatives, as well as the overall conclusions regarding results would not change.

4.2 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

The no action alternative, defined in section 2.1, may be viewed as having no environmental impact in itself. However, with no action by BPA, other forces could result in a future different from a simple extension of the current situation.

4.2.1 Aluminum Smelter Operations and Local Socioeconomic Impacts

Table 24 shows for the no action alternative average probabilities of operating, summarized from Tables 14 through 23, for each of the region's aluminum smelters, computed from the model output at a long-run expected aluminum price of 70¢/lb. As can be seen from Table 24, some plants have a quite high probability of remaining in operation according to the model (e.g., Intalco and Alcoa Wenatchee) while others have a relatively low probability of continuing operation. Those in the latter class are Reynolds at Troutdale; Alcoa at Vancouver; and Kaiser at Mead. All model results for the Alcoa smelter at Wenatchee are for the portion of the plant BPA serves only. These results constitute the most likely outcome, a result useful for decisionmaking and risk assessment, even though not necessarily a precise projection of the future. For example, some plants may close or operate less than the model predicts because of factors not taken into account by the model and some plants similarly may operate more. In particular, the model projects the smelters at The Dalles and Columbia Falls to both operate in a large majority of games at high capacity factors in all cases. Such projections may not be accurate since these plants would operate as tolling plants and the model may not accurately reflect decisionmaking by such plants. (Tolling is the conversion of alumina belonging to another into aluminum for a fee.) Secondly, there are indications that neither of these smelters would be able to operate without a Variable rate.

Plant specific physical and socioeconomic impacts of closure and of operating the 10 smelters are described in Chapter 4.3 of Appendix A.

Closure of an aluminum smelter would reduce the amount of air pollutants emitted into an airshed. Presumably, this would increase the opportunities for other industrial development in an area under prevention of significant deterioration rules (PSD), although the actual occurrence of such development would be dependent on many other site-specific factors. At a number of the sites, PSD rules are not currently a significant constraint to moderate industrial development. Implementing a proposal or alternative which would keep an aluminum plant open would basically maintain the status quo with respect to opportunities for other industrial development under PSD rules. If a smelter remains open, there is a possibility that it may expand. Smelter expansion would be treated under PSD rules just as any other new industrial development.

The tables in Appendices C and D show the expected quantities of air pollutants, waste water, and fluoride discharged as a water pollutant on an average annual basis for each of the 10 plants if they were to operate at the average annual production levels for FY 1987-1991, FY 1992-1996, and FY 1997-2000 computed by the model for the no action alternative. The pollutant quantities were computed assuming pollutant and waste water discharges are directly proportional to plant production levels and are based on Tables 4.1 and 4.12 of Appendix A (Table 4.12 has been corrected and the revised Table has been included in this final EIS as Appendix A).

4.2.2 Resource Operations and Development

Closure or reduced operation of smelters would not necessarily or positively allow the energy to be used for other purposes. The contract demands in the respective aluminum companies' Power Sales Contracts would not necessarily change, and the companies could, if they wished, use that power for plant expansions or replacements. However, such possibilities seem remote at this time considering the status of the aluminum industry.

The aluminum companies would likely reduce their Power Sales Contract operating demands to the amount needed to maintain operations at the level their costs and markets warrant. Three-quarters of the power freed-up by reductions in operating demand would be firm and could, therefore, support a firm export sale for such period that BPA could safely forecast the aluminum load to remain at those levels.

Loss of a substantial portion of DSI load could reduce BPA's flexibility to operate the federal power system since DSI load significantly contributes to that flexibility. Currently, BPA has the right to restrict the DSI load under certain conditions (see section 1.2); these contractual restriction rights provide the system reserves. If, due to DSI load curtailments, the remaining total DSI load was below the level required to maintain system reliability, BPA would have to seek alternative sources of system reserves. Therefore, BPA

TABLE 14

Smelter Operating Characteristics - Alcoa, Vancouver

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	34	91	31	57	73	42
	1992 - 1996	30	87	26	63	87	56
	1997 - 2000	26	86	22	61	91	56
Variable: Revenue	1987 - 1991	32	94	30	55	92	51
	1992 - 1996	27	87	24	59	87	51
	1997 - 2000	24	84	20	57	88	50
Proposal	1987 - 1991	32	94	30	56	95	53
	1992 - 1996	27	85	23	62	89	55
	1997 - 2000	26	85	22	60	89	53
Load	1987 - 1991	37	92	34	59	94	56
	1992 - 1996	33	86	28	65	89	58
	1997 - 2000	28	86	24	63	89	53
Con/Mod: 3 Mill	1987 - 1991	34	91	31	57	93	53
	1992 - 1996	30	87	26	64	88	56
	1997 - 2000	28	86	24	63	90	57
5 Mill	1987 - 1991	35	92	32	57	93	53
	1992 - 1996	32	85	27	64	88	56
	1997 - 2000	31	87	27	63	90	57
10 Mill	1987 - 1991	37	91	34	66	93	61
	1992 - 1996	44	84	37	74	86	64
	1997 - 2000	43	88	38	76	88	67
Combinations: Revenue/3 mill	1987 - 1991	33	95	31	55	93	51
	1992 - 1996	29	88	26	59	87	51
	1997 - 2000	26	85	22	57	89	51
Proposal/5 mill	1987 - 1991	33	94	31	57	95	54
	1992 - 1996	30	86	26	64	89	57
	1997 - 2000	30	86	26	63	90	57
Load/10 mill	1987 - 1991	40	91	36	69	94	65
	1992 - 1996	46	87	40	80	90	72
	1997 - 2000	45	90	41	79	87	69

TABLE 15

Smelter Operating Characteristics - Alcoa, Wenatchee

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	56	93	52	87	90	78
	1992 - 1996	60	86	50	84	86	72
	1997 - 2000	60	87	52	84	89	75
Variable: Revenue	1987 - 1991	53	93	49	81	92	75
	1992 - 1996	58	88	51	81	88	71
	1997 - 2000	58	88	51	82	89	73
Proposal	1987 - 1991	54	96	52	87	93	81
	1992 - 1996	60	89	53	85	89	76
	1997 - 2000	60	88	53	86	89	77
Load	1987 - 1991	72	93	67	94	92	87
	1992 - 1996	72	87	63	93	87	81
	1997 - 2000	68	88	60	90	89	80
Con/Mod: 3 Mill	1987 - 1991	58	93	54	88	90	79
	1992 - 1996	63	85	54	86	86	74
	1997 - 2000	64	85	54	86	88	76
5 Mill	1987 - 1991	59	93	55	88	90	79
	1992 - 1996	63	86	54	86	86	74
	1997 - 2000	64	85	54	86	88	76
10 Mill	1987 - 1991	59	92	54	88	90	79
	1992 - 1996	64	86	55	86	85	73
	1997 - 2000	66	85	52	86	87	75
Combinations: Revenue/3 mill	1987 - 1991	53	93	50	82	93	76
	1992 - 1996	60	87	52	83	88	73
	1997 - 2000	59	86	51	84	89	75
Proposal/5 mill	1987 - 1991	56	96	54	88	93	82
	1992 - 1996	61	88	53	86	89	77
	1997 - 2000	61	86	53	86	88	76
Load/10 mill	1987 - 1991	75	93	70	95	93	88
	1992 - 1996	78	86	67	93	88	82
	1997 - 2000	74	88	65	90	88	79

TABLE 16

Smelter Operating Characteristics - Columbia Falls

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	55	93	51	85	91	77
	1992 - 1996	60	87	52	82	87	71
	1997 - 2000	57	89	51	82	90	74
Variable: Revenue	1987 - 1991	52	93	48	78	94	73
	1992 - 1996	57	88	50	77	89	70
	1997 - 2000	53	89	47	80	90	72
Proposal	1987 - 1991	54	96	52	84	94	79
	1992 - 1996	58	90	52	80	89	71
	1997 - 2000	56	89	50	80	90	72
Load	1987 - 1991	72	94	68	88	93	82
	1992 - 1996	70	88	62	87	89	77
	1997 - 2000	62	90	56	86	90	77
Con/Mod: 3 Mill	1987 - 1991	55	93	51	85	91	77
	1992 - 1996	60	87	52	82	87	71
	1997 - 2000	57	89	51	82	89	73
5 Mill	1987 - 1991	57	93	53	89	90	80
	1992 - 1996	62	86	53	89	86	77
	1997 - 2000	62	88	55	90	87	78
10 Mill	1987 - 1991	61	92	56	91	90	82
	1992 - 1996	69	86	59	91	87	79
	1997 - 2000	69	87	60	92	86	79
Combinations: Revenue/3 mill	1987 - 1991	52	93	48	79	93	74
	1992 - 1996	57	88	50	80	89	71
	1997 - 2000	53	89	47	82	91	71
Proposal/5 mill	1987 - 1991	56	96	54	90	93	84
	1992 - 1996	61	90	55	87	90	78
	1997 - 2000	62	88	55	88	90	79
Load/10 mill	1987 - 1991	74	94	70	96	93	89
	1992 - 1996	76	87	66	94	88	83
	1997 - 2000	74	88	65	91	88	80

TABLE 17

Smelter Operating Characteristics - Intalco

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	83	92	76	94	92	87
	1992 - 1996	81	88	71	94	88	83
	1997 - 2000	80	91	73	92	90	83
Variable: Revenue	1987 - 1991	80	94	75	95	93	88
	1992 - 1996	78	88	69	95	88	84
	1997 - 2000	78	90	70	93	90	84
Proposal	1987 - 1991	82	93	76	94	94	88
	1992 - 1996	78	90	70	92	90	83
	1997 - 2000	78	90	70	92	90	83
Load	1987 - 1991	91	93	85	96	93	89
	1992 - 1996	85	89	76	95	89	85
	1997 - 2000	83	90	75	92	90	83
Con/Mod: 3 Mill	1987 - 1991	86	92	79	95	92	87
	1992 - 1996	82	88	72	96	88	85
	1997 - 2000	82	90	74	94	90	85
5 Mill	1987 - 1991	86	91	78	95	92	87
	1992 - 1996	82	88	72	96	88	85
	1997 - 2000	82	90	78	94	90	85
10 Mill	1987 - 1991	86	91	78	96	92	88
	1992 - 1996	84	87	73	96	87	84
	1997 - 2000	84	89	75	94	89	84
Combinations: Revenue/3 mill	1987 - 1991	85	93	79	95	93	88
	1992 - 1996	81	88	71	95	88	84
	1997 - 2000	81	90	73	93	90	84
Proposal/5 mill	1987 - 1991	85	94	80	96	94	90
	1992 - 1996	71	89	63	95	90	86
	1997 - 2000	81	90	73	94	90	85
Load/10 mill	1987 - 1991	94	92	87	96	94	90
	1992 - 1996	90	89	80	94	89	84
	1997 - 2000	88	89	78	91	90	82

TABLE 18

Smelter Operating Characteristics - Kaiser, Mead

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	35	91	32	59	92	54
	1992 - 1996	32	85	27	64	87	56
	1997 - 2000	27	85	23	63	88	55
Variable: Revenue	1987 - 1991	32	92	29	57	92	52
	1992 - 1996	28	87	24	62	87	54
	1997 - 2000	24	83	20	60	88	53
Proposal	1987 - 1991	34	92	31	58	95	55
	1992 - 1996	28	86	24	63	89	56
	1997 - 2000	26	84	22	63	88	55
Load	1987 - 1991	38	92	35	66	94	62
	1992 - 1996	36	86	31	69	89	61
	1997 - 2000	29	85	25	68	89	61
Con/Mod: 3 Mill	1987 - 1991	35	92	32	59	93	55
	1992 - 1996	32	86	28	64	87	56
	1997 - 2000	27	85	23	63	89	56
5 Mill	1987 - 1991	35	92	32	59	93	55
	1992 - 1996	32	86	28	64	88	56
	1997 - 2000	30	85	26	65	89	58
10 Mill	1987 - 1991	37	91	34	67	93	62
	1992 - 1996	38	85	32	72	86	62
	1997 - 2000	39	84	33	73	88	64
Combinations: Revenue/3 mill	1987 - 1991	32	92	29	57	92	52
	1992 - 1996	28	87	24	62	87	54
	1997 - 2000	24	83	20	60	88	53
Proposal/5 mill	1987 - 1991	34	92	31	58	95	55
	1992 - 1996	28	85	24	63	89	56
	1997 - 2000	26	83	22	64	89	57
Load/10 mill	1987 - 1991	40	91	36	70	94	66
	1992 - 1996	42	85	36	76	88	67
	1997 - 2000	42	87	37	76	87	66

TABLE 19

Smelter Operating Characteristics - Kaiser, Tacoma

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
No Action (Incentive Rate)	1987 - 1991	46	91	42	76	91	69
	1992 - 1996	54	85	46	78	87	68
	1997 - 2000	52	88	46	78	89	69
Variable: Revenue	1987 - 1991	39	93	36	67	92	62
	1992 - 1996	44	87	38	70	88	62
	1997 - 2000	42	88	37	72	89	64
Proposal	1987 - 1991	44	94	41	74	94	70
	1992 - 1996	52	88	46	76	88	67
	1997 - 2000	49	88	43	76	89	68
Load	1987 - 1991	53	93	49	80	94	75
	1992 - 1996	60	88	53	82	88	72
	1997 - 2000	57	88	50	81	90	73
Con/Mod: 3 Mill	1987 - 1991	46	91	42	77	90	69
	1992 - 1996	54	85	46	78	86	67
	1997 - 2000	52	88	46	78	89	69
5 Mill	1987 - 1991	46	91	42	78	90	70
	1992 - 1996	54	85	46	80	87	70
	1997 - 2000	52	88	46	80	89	71
10 Mill	1987 - 1991	49	91	45	80	90	72
	1992 - 1996	56	85	48	81	86	70
	1997 - 2000	55	86	47	82	88	72
Combinations: Revenue/3 mill	1987 - 1991	41	93	38	68	92	63
	1992 - 1996	46	87	40	72	87	63
	1997 - 2000	43	87	37	73	89	65
Proposal/5 mill	1987 - 1991	45	94	42	74	94	70
	1992 - 1996	52	88	46	76	88	63
	1997 - 2000	49	88	43	76	89	65
Load/10 mill	1987 - 1991	56	93	52	81	94	70
	1992 - 1996	61	87	53	84	88	74
	1997 - 2000	57	88	50	82	88	72

TABLE 20

Smelter Operating Characteristics - Commonwealth

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	49	93	46	75	92	69
	1992 - 1996	50	87	44	74	87	64
	1997 - 2000	48	89	43	73	91	66
Variable: Revenue	1987 - 1991	47	92	43	71	92	65
	1992 - 1996	47	88	41	70	90	63
	1997 - 2000	45	89	40	70	91	64
Proposal	1987 - 1991	47	95	45	73	94	69
	1992 - 1996	48	89	43	73	90	66
	1997 - 2000	46	89	41	73	91	66
Load	1987 - 1991	52	94	49	84	93	78
	1992 - 1996	54	87	47	81	89	72
	1997 - 2000	52	90	47	77	92	71
Con/Mod: 3 Mill	1987 - 1991	49	93	46	75	92	69
	1992 - 1996	50	86	43	74	87	64
	1997 - 2000	49	89	44	73	91	66
5 Mill	1987 - 1991	49	93	46	75	92	69
	1992 - 1996	50	86	43	74	87	64
	1997 - 2000	50	88	44	73	90	66
10 Mill	1987 - 1991	52	93	48	80	92	74
	1992 - 1996	57	86	49	81	87	71
	1997 - 2000	55	88	48	82	89	73
Combinations: Revenue/3 mill	1987 - 1991	48	94	45	71	93	66
	1992 - 1996	47	87	41	70	89	62
	1997 - 2000	43	89	38	70	91	64
Proposal/5 mill	1987 - 1991	48	95	46	74	95	70
	1992 - 1996	47	88	41	74	90	67
	1997 - 2000	47	89	42	75	91	68
Load/10 mill	1987 - 1991	55	94	52	92	93	86
	1992 - 1996	63	87	55	90	89	80
	1997 - 2000	60	89	53	87	89	77

TABLE 21

Smelter Operating Characteristics - Martin-Marietta, The Dalles

		Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
FY Period		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	53	94	50	83	93	77
	1992 - 1996	57	89	51	81	89	72
	1997 - 2000	55	91	50	79	92	73
Variable: Revenue	1987 - 1991	50	94	47	76	95	72
	1992 - 1996	53	90	48	76	90	68
	1997 - 2000	51	91	46	75	92	69
Proposal	1987 - 1991	50	96	48	82	95	78
	1992 - 1996	56	90	50	80	91	73
	1997 - 2000	53	91	48	77	92	71
Load	1987 - 1991	63	95	60	87	94	82
	1992 - 1996	61	89	54	83	90	75
	1997 - 2000	56	91	51	78	93	73
Con/Mod: 3 Mill	1987 - 1991	53	94	50	83	93	77
	1992 - 1996	57	89	51	81	89	72
	1997 - 2000	56	91	51	79	92	73
5 Mill	1987 - 1991	53	94	50	88	93	82
	1992 - 1996	57	89	51	86	89	77
	1997 - 2000	57	90	51	86	91	78
10 Mill	1987 - 1991	57	94	54	88	93	82
	1992 - 1996	63	89	56	86	89	77
	1997 - 2000	64	90	58	86	90	77
Combinations: Revenue/3 mill	1987 - 1991	50	94	47	77	95	73
	1992 - 1996	53	90	47	78	90	70
	1997 - 2000	51	91	46	77	93	72
Proposal/5 mill	1987 - 1991	51	96	49	88	95	84
	1992 - 1996	56	91	51	86	91	78
	1997 - 2000	55	90	50	86	91	78
Load/10 mill	1987 - 1991	64	95	61	95	95	90
	1992 - 1996	69	89	61	93	90	84
	1997 - 2000	67	91	61	90	91	82

TABLE 22

Smelter Operating Characteristics - Reynolds, Longview

		Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
	FY Period	A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	46	90	44	77	89	69
	1992 - 1996	54	83	45	78	85	66
	1997 - 2000	51	87	44	78	88	69
Variable: Revenue	1987 - 1991	41	92	38	67	92	62
	1992 - 1996	46	86	40	70	87	61
	1997 - 2000	43	85	37	72	88	63
Proposal	1987 - 1991	45	93	42	74	93	69
	1992 - 1996	52	87	45	76	87	66
	1997 - 2000	49	87	43	76	88	67
Load	1987 - 1991	53	93	49	90	93	74
	1992 - 1996	60	87	52	81	87	71
	1997 - 2000	57	87	50	81	89	72
Con/Mod: 3 Mill	1987 - 1991	46	90	41	77	89	69
	1992 - 1996	54	83	45	78	85	66
	1997 - 2000	52	87	45	78	88	69
5 Mill	1987 - 1991	48	91	44	79	89	70
	1992 - 1996	56	84	47	80	85	68
	1997 - 2000	54	86	46	80	89	71
10 Mill	1987 - 1991	50	90	45	80	89	71
	1992 - 1996	56	84	47	81	85	69
	1997 - 2000	55	85	47	82	87	71
Combinations: Revenue/3 mill	1987 - 1991	42	92	39	68	92	63
	1992 - 1996	48	86	41	72	87	63
	1997 - 2000	46	86	40	73	87	64
Proposal/5 mill	1987 - 1991	47	94	44	75	93	70
	1992 - 1996	54	87	47	76	88	67
	1997 - 2000	51	86	44	76	88	67
Load/10 mill	1987 - 1991	56	92	52	90	92	85
	1992 - 1996	61	86	53	88	88	77
	1997 - 2000	57	87	50	87	87	76

TABLE 23

Smelter Operating Characteristics - Reynolds, Troutdale

	FY Period	Long-Term Aluminum Price = 65¢/lb.			Long-Term Aluminum Price = 70¢/lb.		
		A	B	A x B	C	D	C x D
		Percent of Games Open	Average Capacity Factor When Open (%)		Percent of Games Open	Average Capacity Factor When Open (%)	
No Action (Incentive Rate)	1987 - 1991	22	91	20	44	91	40
	1992 - 1996	19	88	17	44	85	37
	1997 - 2000	15	88	13	42	87	37
Variable: Revenue	1987 - 1991	18	71	16	42	91	38
	1992 - 1996	19	88	17	41	85	35
	1997 - 2000	14	88	12	37	87	32
Proposal	1987 - 1991	22	93	21	43	93	42
	1992 - 1996	20	89	18	41	87	36
	1997 - 2000	16	88	14	39	87	34
Load	1987 - 1991	23	92	21	45	93	42
	1992 - 1996	20	88	18	46	87	40
	1997 - 2000	16	88	14	41	87	36
Con/Mod: 3 Mill	1987 - 1991	22	91	20	44	91	40
	1992 - 1996	19	88	17	44	86	38
	1997 - 2000	15	88	13	42	87	37
5 Mill	1987 - 1991	24	91	22	45	92	41
	1992 - 1996	20	88	18	47	85	40
	1997 - 2000	17	81	14	47	85	40
10 Mill	1987 - 1991	25	91	23	47	91	43
	1992 - 1996	28	84	24	56	85	48
	1997 - 2000	26	84	22	55	85	47
Combinations: Revenue/3 mill	1987 - 1991	18	71	16	42	91	38
	1992 - 1996	19	88	17	31	85	26
	1997 - 2000	14	88	12	37	87	32
Proposal/5 mill	1987 - 1991	24	94	23	45	93	42
	1992 - 1996	21	89	19	44	88	39
	1997 - 2000	18	87	16	44	86	38
Load/10 mill	1987 - 1991	26	93	24	49	92	45
	1992 - 1996	29	85	25	59	86	51
	1997 - 2000	26	86	22	59	87	51

Table 24

PERCENT OF GAMES OPEN

	No Action Alternative - 70¢/lb.		
	<u>FY 1987-1991</u>	<u>FY 1992-1996</u>	<u>FY 1997-2000</u>
Alcoa, Vancouver	57	63	61
Alcoa, Wenatchee	87	84	84
Columbia Falls	85	82	82
Intalco	94	94	92
Kaiser, Mead	59	64	63
Kaiser, Tacoma	76	78	78
Commonwealth	75	74	73
Martin-Marietta, The Dalles	83	81	79
Reynolds, Longview	77	78	78
Reynolds, Troutdale	44	44	42

may forego the revenues from the freed-up energy and instead hold some of the freed-up power for reserve purposes. Future resource decisions could be influenced by BPA's reserve requirements being met more by generating units and less by DSI restriction rights.

In addition, the DSIs' extremely high load factor (usually a constant load over a 24-hour period) allows BPA to more easily meet minimum river flows during utility light load hours, to provide for interregional energy exchanges, and to more efficiently operate regional baseload thermal facilities. Loss of DSI load could mean minimum flow constraints would be met more frequently through spill, and future energy exchanges might be less feasible or economical. Minimum flows could also occur a greater percentage of the time.

Finally, serving the DSIs' first quartile through a combination of nonfirm energy, if available, and borrowed "firm energy" from the future allows for higher utilization of the hydrosystem's power capability and maintains BPA's operating flexibility. By borrowing energy from the future to serve the DSIs' first quartile, BPA draws the reservoir levels below what would be required to meet future DSI firm load. By releasing water early, the additional drawdown serves as an extra protection against possible flooding downstream and the possibility of spilling large amounts of water in the spring. Delivery of this energy does not endanger service to other future firm loads since the DSIs must repay this energy if streamflows prove to be insufficient to refill the reservoirs.

BPA may be able to negotiate export sales for a majority of firm energy made available by closure or reduced operation of aluminum smelters until such time as that energy is needed to meet regional firm loads including aluminum smelter loads if market conditions warrant. Marketing arrangements would

largely determine the shape of firm export sales on an annual, monthly, and hourly basis and the shape would likely differ from that currently delivered to the DSIs. The DSI firm load is typically rather flat on a monthly and hourly basis. Export firm sales would probably have more shaping associated with them. Greater amounts of energy would probably be sold in the fall when nonfirm energy is generally less abundant and intertie loading is currently lower than during other times of the year. Also, it is expected that more of this energy would be sold during heavy load hours because of the more favorable market conditions at that time. Overall, this could result in a change in river flows, particularly on an hourly basis. Higher flows would be expected during heavy load hours with corresponding lower flows during the light load hours.

Eventually, firm power no longer used by the aluminum industry could be used to serve nonaluminum load growth as the region moves toward a load/resource balance, although the confidence with which the region could do this would be dependent on whether capacity closures would be permanent or not, and on what prospects the aluminum companies seem to have for utilizing surplus contract demand. New resources or conservation otherwise required to meet load growth may be postponed. The region could avoid the environmental impacts of these resources during the period in which the equivalent aluminum smelter load could be used to serve regional load growth.

The nonfirm power made available could be used in the near term to increase displacement of oil-fired, gas-fired, coal-fired, and nuclear generation. It also could be used to provide more service to other limited Northwest nonfirm energy markets, such as the utilities that may buy nonfirm energy under BPA's policy for nonfirm energy to loads with alternate fuel capability.

Because surplus firm sales generally return more revenues than nonfirm sales, BPA and the region may market less nonfirm energy over the intertie to allow for increased firm sales when total market or intertie capacity limits the amount of energy which can be sold. This may result in an inability to market all or a portion of the total energy made available by aluminum smelter load reductions. Increased spill on the system could occur under these conditions. The actual amount of spill resulting from aluminum smelter load reductions would depend upon the amount of the load reduction, water conditions, the status of intertie expansions, and market considerations. It is expected that in many years most of the additional amount of energy predicted to be available could be marketed with minimal impacts on system spill. The possibility remains, however, that in some situations greater system spill would result from aluminum smelter load reductions, particularly in high water years.

Spill in the right quantities and at the right times of year is important to downstream migrating juvenile salmon and steelhead in the Columbia River and its tributaries. Spill is provided at dams without adequate bypass facilities during downstream migration to carry the juvenile fish over the dams and thereby reduce the mortality that occurs when fish pass through the turbines.

Too much spill, however, causes nitrogen supersaturation of the water, which is also fatal to fish. There are established programs and constraints to provide spill at dams without adequate bypass systems during downstream migration. Provision of the Water Budget, a hydrosystem planning constraint to provide flow for downstream, springtime migrating salmon, would not be affected. However, at other times the lower smelter loads could accelerate refill of reservoirs and thereby reduce flows for a period. This could adversely affect species of fish that migrate downstream at times when Water Budget flows are not a constraint.

An increase in spill resulting from losses of aluminum smelter load would on balance be beneficial to fish. Any additional spill over that provided by spill programs would carry more downstream migrating fish over a dam rather than through the turbines. In some conditions, nitrogen supersaturation does become a problem. This occurs during periods of high flow in 8 percent of water years that are above average, and when reservoirs must be lowered quickly for flood control. Nitrogen supersaturation is mitigated partially by routing water through turbines at dams having designs tending to produce high levels of nitrogen supersaturation when spilling; by shifting generation among dams to reduce high levels of spill at any one; and by spilling more at dams further downstream to reduce the cumulative effect of nitrogen supersaturation on water quality. Nevertheless, any increase in spill could increase the frequency and severity of nitrogen supersaturation.

If energy freed-up because of closure or reduced operation of an aluminum smelter were used to displace coal and/or nuclear generation, the operational impacts of these resources would be reduced overall, and eliminated entirely for a time for the specific plants displaced. Changes in operational impacts for generic nuclear and coal plants and for combustion turbines are shown in Appendix E. Small hydro operation would be unaffected by closure of aluminum smelters since they usually are not scheduled; they operate as streamflows dictate.

4.2.3 Regional Socioeconomic Impacts

Closure or reduced operation of some or all of the smelters could result in a significant loss of revenues to BPA. The magnitude of this revenue reduction would depend on BPA's ability to market the displaced power at rate levels greater than or equivalent to those paid by the DSIs. A significant revenue reduction would require an overall wholesale power rate increase in order for BPA to recover its costs and continue timely payments to the U.S. Treasury. An overall rate increase would increase costs to the remaining DSIs and to utilities purchasing wholesale power from BPA. Therefore, closure or reduced operation of some aluminum smelters could ultimately have impacts on retail industrial, commercial, and residential consumers. Certain factors at the retail level, however, would mitigate the effects of such a wholesale rate increase to some extent (see the discussion in section 4.3.3).

As discussed in section 3.2.3, four major non-DSI consumer sectors are affected by BPA actions. Potential impact to most retail industrial and agricultural consumers is not expected to be great since the price of

electricity is a much less significant factor relative to product demand and domestic and foreign competition in determining operating levels for most of the region's industries. For most commercial firms, impacts relate to the overall health of the basic industries in their communities, rather than directly to electricity price. If these basic industries shut down or cut back production, commercial consumer markets could be adversely impacted. Residential consumers could also be impacted, particularly low-income consumers whose cost of energy can be as high as 36 percent of their total budget. The model did not compute changes in employment resulting from changes in consumers' disposable income or from changes to retail activity, but these effects are likely to be marginal at best.

The employment impacts of smelter closures or reduced operation would tend to be concentrated in immediate areas surrounding the affected aluminum plants. However, there would be some residual effects to regional employment. Certain regional businesses that supply goods and services to the aluminum smelters would face a reduction in demand for their products, thus potentially resulting in employee layoffs. Additionally, operating levels of some energy intensive industries purchasing power from retail utilities could be adversely affected if lost revenues to BPA from aluminum plant closures or reduced operations ultimately results in significant rate increases at the retail level. Decreased operating levels for retail industrial consumers could result in additional layoffs. Finally, wholesale rate increases resulting from aluminum plant closures could discourage some new industries from locating in the Pacific Northwest. This would be more of a factor for those electrical energy intensive industries for whom rate level and long-term rate stability are important.

4.2.4 Sensitivity Analysis of the No Action Alternative Under A Scenario of Low Future Aluminum Prices

The probability of any given aluminum price scenario is speculative. Many of the forecasts available to BPA indicate a long-run expected price of 70¢/lb. A scenario of 65¢/lb. was analyzed to determine potential impacts under adverse aluminum prices and also to test the proposal and alternatives in terms of mitigating the effects of possible future low aluminum prices.

4.2.4.1 Aluminum Smelter Operations

Table 25 summarizes probabilities of smelters operating under the no action alternative by means of averages for certain periods calculated from the model output for a long-run expected aluminum price of 65¢/lb. Comparison with Table 24 for a long-run expected aluminum price of 70¢/lb. shows the major impact future aluminum prices could have on the viability of the region's aluminum industry. At a long-run expected aluminum price of 65¢/lb. per pound, all the region's smelters are significantly worse off. Since BPA has minimal, if any, influence over aluminum price, this is not really an impact of the no action alternative; it is a result of external factors.

Table 25

PERCENT OF GAMES OPEN

	No Action Alternative - 65¢/lb.		
	<u>FY 1987-1991</u>	<u>FY 1992-1996</u>	<u>FY 1997-2000</u>
Alcoa, Vancouver	34	30	26
Alcoa, Wenatchee	56	60	60
Columbia Falls	55	60	57
Intalco	83	81	80
Kaiser, Mead	35	32	27
Kaiser, Tacoma	46	54	52
Commonwealth	49	50	48
Martin-Marietta, The Dalles	53	57	55
Reynolds, Longview	46	54	51
Reynolds, Troutdale	22	19	15

If future aluminum prices turned out to be low, it appears from the model results that additional smelters likely would close, and others would reduce operations compared to a case in which long-run aluminum prices turn out to be higher. Impacts of smelter closures and/or of operations at capacity are discussed in Chapter 4 of Appendix A. Appendices C and D show the expected quantities of air and water pollutants generated by the smelters calculated from the model output for the no action alternative at both future long-run aluminum prices.

4.2.4.2 Resource Operations and Development

Additional aluminum smelter closures or reduced operations, compared to what is likely to occur under the no action alternative if higher aluminum prices materialize over the future generally would have the same effects on resource operations and development as described in section 4.2.2. With an increased probability of more smelter closures and greater reductions in production, however, the effects would be made greater. The low aluminum price scenario is predicted by the model to result in yearly reductions in total generation averaging about 400 average annual MW when compared to the higher aluminum price case for the no action alternative (see Table 26). Much of this difference is in secondary hydro generation. These differences are functions of secondary energy market activity, yearly water conditions, load growth, and other factors in addition to size of the Northwest aluminum smelter load. With more surplus energy to market as a result of more smelter closures or reduced operation, the likelihood of being able to market all the energy that becomes available to other purchasers is less. Thus, impacts on fish from increased spill become more probable.

With more Northwest aluminum smelter closures, new resources or conservation otherwise required to meet load growth could be postponed longer, and greater displacement of oil-fired, gas-fired, coal-fired, and nuclear generation could be made in the near term.

Table 26

AVERAGE TOTAL LOADS: NO ACTION ALTERNATIVE
(Ave. Annual MW)

<u>Period</u>	<u>65¢/lb. 1/</u>	<u>70¢/lb. 1/</u>
FY 1987-1991	20,999	21,360
FY 1992-1996	21,692	22,045
FY 1997-2000	22,891	23,351

1/ Long-run aluminum price.

4.2.4.3 Regional Socioeconomic Impacts

Tables 27 and 28 compare BPA rates and employment for the no action alternative at both long-run aluminum prices. BPA rates are adversely affected in the near term and generally benefit later with the lower aluminum price. Employment effects of a lower aluminum price are adverse in both the aluminum and nonaluminum sectors until later in the study period when nonaluminum employment appears to recover.

Low aluminum prices in combination with the no action alternative, resulting in more plant closures or reduced operations than if higher aluminum prices materialize, could result in greater levels of adverse regional socioeconomic impacts than described in 4.2.3.

4.2.5 Sensitivity of the No Action Alternative to Potential Aluminum Smelter Closures

The probabilistic analysis described and used generally in this Chapter of the final EIS subsumes all games, including those where smelters are completely closed, and reports one result for that year. If one simply excluded some plants from the model and reran it (using the same random selection of variables for each game and year), the results would appear different because loads, revenues, costs, and other factors within the model would be different and would affect each other somewhat differently. BPA believes, and the model results indicate, that even at 70¢/lb. some plant closures may take place under no action. Therefore, for purposes of this EIS, BPA conducted a sensitivity analysis for the Variable rate proposal and alternatives to examine the impacts if permanent closure of the two plants most at risk occurred under a scenario of a 70¢/lb. long-run aluminum price. In this analysis, these plants would remain closed irrespective of aluminum prices in the model.

Table 27

PROJECTED BPA POWER RATES BY CUSTOMER CLASS:
NO ACTION ALTERNATIVE AT TWO POTENTIAL LONG-RUN ALUMINUM PRICES 1/

<u>Year/Customer Class</u>	<u>At 65¢/lb. Aluminum</u> (mills/kWh)	<u>At 70¢/lb. Aluminum</u> (mills/kWh)
<u>FY 1988:</u>		
Priority Firm	17.7	17.4
Industrial Firm Standard	19.4	19.5
Ave. Aluminum DSI Revenue <u>2/</u>	18.8	18.8
New Resource Firm	20.7	20.3
<u>FY 1990:</u>		
Priority Firm	20.4	19.9
Industrial Firm Standard	18.8	18.5
Ave. Aluminum DSI Revenue <u>2/</u>	18.0	17.9
New Resource Firm	23.6	23.0
<u>FY 1995:</u>		
Priority Firm	19.4	19.6
Industrial Firm Standard	17.7	18.0
Ave. Aluminum DSI Revenue <u>2/</u>	17.7	17.7
New Resource Firm	27.5	28.4
<u>FY 2000:</u>		
Priority Firm	19.1	19.6
Industrial Firm Standard	17.4	17.9
Ave. Aluminum DSI Revenue <u>2/</u>	17.0	17.3
New Resource Firm	32.6	34.0

1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show the general influence on BPA rate changes of aluminum price.

2/ Industrial Firm Standard rate adjusted for the effect of incentive rates implemented in the model under the no action alternative.

Table 28

PROJECTED AVERAGE ANNUAL EMPLOYMENT:
NO ACTION ALTERNATIVE AT TWO POTENTIAL LONG-RUN ALUMINUM PRICES 1/

<u>Period/Sector</u>	<u>At 65¢/lb. Aluminum</u>	<u>At 70¢/lb. Aluminum</u>
<u>FY 1987 - FY 1991:</u>		
Aluminum DSIs	3,390	5,091
Other Employment	3,659,752	3,659,942
Total Employment	3,663,142	3,665,033
<u>FY 1992 - FY 1996:</u>		
Aluminum DSIs	3,190	4,749
Other Employment	3,975,740	3,975,633
Total Employment	3,978,930	3,980,382
<u>FY 1997 - FY 2000:</u>		
Aluminum DSIs	3,095	4,808
Other Employment	4,294,865	4,294,563
Total Employment	4,297,960	4,299,371

BPA believes that among the plants most in jeopardy of being or remaining closed in the near future under the no action alternative are:

(1) The Dalles since it is now closed. Significant hurdles need to be overcome by the investors seeking to reopen the plant. In particular, the investors have indicated that institution of a Variable rate is a requirement for restarting the smelter (Brett Wilcox, Public Hearing Re: Proposed Variable Power Rate, The Dalles, Oregon, March 14, 1986).

(2) Columbia Falls, which is also a reasonably efficient plant, but one which has recently been taken over by new management who may face a shortage of operating funds. The new management is seeking to operate the plant as a tolling smelter. The investors, which include the State of Montana, also have stated the necessity of a Variable power rate for future operation of this smelter.

These two plants were assumed closed in the sensitivity analysis done with the model. In addition, several other smelters are at risk of closure under the no action alternative. As indicated in the Variable Industrial Rate Design Study (Appendix H), the Alcoa, Vancouver; Kaiser, Mead; and Reynolds, Troutdale plants are all considered in jeopardy of closing in the no action scenario. Impacts on resource operations and development, and power rates, would be similar if one or two of these other plants closed instead of Columbia Falls.

4.2.5.1 Aluminum Smelter Operations

Physical and localized socioeconomic impacts of closure of the aforementioned smelters are described in Chapter 4 of Appendix A.

With some additional Northwest aluminum smelter capacity permanently closed, other of the Northwest smelters could be affected, either through changes in their electric rates or through changes in the demand/supply relationship for aluminum. The model does not account for this latter effect; however, closure of one additional relatively high cost plant would not sufficiently change the world supply-demand situation to have much impact. The model does look at effects resulting from changed aluminum smelter power rates. Table 29 shows the percent of games open for the eight plants assumed to operate in this analysis with two plant closures at a long-run aluminum price of 70¢/lb.

Comparison of Table 29 and Table 24 shows little difference in operation of the eight aluminum smelters operating in both model runs. This result occurs because the Incentive rate is assumed to be implemented under no action, in a similar fashion to maintain operations of the eight smelters in both cases. The Incentive rate insulates the other smelters from rate effects that might otherwise reduce their operations had no Incentive rate been available.

Table 29

PERCENT GAMES OPEN WITH TWO SMELTERS CLOSED 1/

	No Action Alternative - 70¢/lb.		
	<u>FY 1987-1991</u>	<u>FY 1992-1996</u>	<u>FY 1997-2000</u>
Alcoa, Vancouver	57	64	62
Alcoa, Wenatchee	87	84	84
Intalco	93	93	92
Kaiser, Mead	58	65	64
Kaiser, Tacoma	75	78	78
Commonwealth	76	78	76
Reynolds, Longview	76	78	78
Reynolds, Troutdale	44	44	40

1/ Model results with Columbia Falls and The Dalles held closed.

4.2.5.2 Resource Operations and Development

A comparison of aluminum smelter and total load for the no action alternative with the Columbia Falls and The Dalles smelters closed versus the no action alternative with all the smelters allowed to operate as the model dictated is presented in Table 30.

Table 30

PROJECTED AVERAGE ALUMINUM SMELTER AND TOTAL LOADS:
 NO ACTION WITH AND WITHOUT TWO SMELTERS CLOSED 1/
 (Ave. Annual MW)

<u>Smelter Loads</u>	Plants Closed <u>2/</u>	All Plants Operated As <u>Model Dictates</u>
FY 1987 - 1991	1,611	1,960
FY 1992 - 1996	1,498	1,806
FY 1997 - 2000	1,519	1,840
<u>Total Loads</u>		
FY 1987 - 1991	21,227	21,360
FY 1992 - 1996	22,008	22,045
FY 1997 - 2000	23,246	23,351

1/ At a long-run aluminum price of 70¢/lb.

2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.

Differences in smelter load are 300 to 350 average annual MW, but total load differences are much smaller. The differences occur principally as changes in secondary hydroelectric generation. These differences are functions of secondary energy market activity, yearly water conditions, load growth, and other factors in addition to size of the Northwest aluminum smelter load. With more surplus energy to market as a result of more smelter closures or reduced operation, the likelihood of being able to market all the energy that becomes available to other purchasers is less. Thus, impacts on fish from increased spill become more probable.

With more Northwest aluminum smelter closures, new resources or conservation otherwise required to meet load growth could be postponed longer, and greater displacement of oil-fired, gas-fired, coal-fired, and nuclear generation could be made in the near term.

If the Columbia Falls smelter should close, the power it normally requires would be exported to the west. Without the smelter load and under certain transmission outage conditions, the system currently is not capable of transferring all the power from Hungry Horse and Libby Dams and from coal plants in Eastern Montana. To maintain system reliability in the short-term (whether the smelter closes or not), BPA plans to expand the Libby Dam automatic generator-dropping scheme now in place. Additional generation reduction may also be necessary at Libby and at Hungry Horse. Less generation at these dams may result in spill.

In the long-term, the transmission system would need to be reinforced, which would probably include constructing a 230-kV transmission line from Libby to Bonners Ferry and Rathdrum or from Columbia Falls to Hot Springs. The need for transmission system reinforcement and alternative means to remedy such problems would be the subject of a separate environmental document.

4.2.5.3 Regional Socioeconomic Impacts

Smelter closure in the no action case would tend to cause BPA's rates to increase in the near term compared to no plant closure, as can be seen from Table 31. To the extent the higher rate were passed on to customers, conservation may be encouraged. The result of smelter closure and regional conservation together would increase the amount of surplus BPA currently projects will be available in the near term. BPA would attempt to market this surplus. Nevertheless increasing the near term surplus may hamper BPA's ability to market the surplus with its higher marketing rates. As a result, the average revenues BPA would receive from marketing the surplus may be lower. To the extent that revenues from secondary sales are depressed, BPA's total revenues may be impacted. This may also cause upward pressure on BPA's other rates.

In the longer term, because of the additional surplus power due to permanent closure. BPA could use the surplus power to meet load growth for a few more years. In a sense, it pushes load/resource balance out into the future. The result is that BPA's rates are lower in the no action with plant closures than in the no action without plant closure in the long term because new resource costs are not included as soon in BPA's wholesale rates.

Higher near-term rates would tend to suppress economic activity, having slight adverse effect on regional employment, and other socioeconomic impacts. Projected changes in employment resulting from closure of the two aluminum smelters under the no action alternative are shown in Table 32.

4.3 ENVIRONMENTAL CONSEQUENCES OF THE VARIABLE RATE ALTERNATIVES

Calculated from the model output, Table 33 shows average probabilities of operating under each Variable rate alternative for each of the 10 aluminum smelters for the period FY 1987-FY 1996 (the period a Variable rate is proposed to be in effect, excluding the first six months of the first year) and the FY 1997-2000 period when only the IP Standard rate is in effect. These values are for long-run aluminum prices of 65¢/lb. and 70¢/lb. respectively. The model imposes the Variable rate being modeled on all the smelters; the model does not have the ability to determine endogenously whether a smelter would elect a Variable rate. Generally, the results indicate that a smelter's likelihood of operation in a year is increased with the proposed Variable rate relative to the revenue protection rate. Similarly, a smelter's likelihood of operation is still higher when the price of power is based on the load maintenance rate rather than the proposed Variable rate. Nevertheless, the model results indicate that the differences in impacts between rate alternatives are relatively small in absolute terms.

Table 31

PROJECTED BPA POWER RATES BY CUSTOMER CLASS
NO ACTION ALTERNATIVE WITH TWO POTENTIAL LONG-RUN
PLANT CLOSURE SCENARIOS 1/

<u>Year/Customer Class</u>	<u>No Plant Closure</u> (mills/kWh)	<u>Two Plants Closed</u> <u>2/</u> (mills/kWh)
<u>FY 1988:</u>		
Priority Firm	17.4	17.6
Industrial Firm Standard	19.5	19.3
Ave. Aluminum DSI Revenue <u>3/</u>	18.8	18.6
New Resource Firm	20.3	20.5
<u>FY 1990:</u>		
Priority Firm	19.9	20.1
Industrial Firm Standard	18.5	18.4
Ave. Aluminum DSI Revenue <u>3/</u>	17.9	17.7
New Resource Firm	23.0	23.1
<u>FY 1995:</u>		
Priority Firm	19.6	19.4
Industrial Firm Standard	18.0	17.8
Ave. Aluminum DSI Revenue <u>2/</u>	17.7	17.4
New Resource Firm	28.4	27.7
<u>FY 2000:</u>		
Priority Firm	19.6	19.3
Industrial Firm Standard	17.9	17.5
Ave. Aluminum DSI Revenue <u>2/</u>	17.3	16.9
New Resource Firm	34.0	32.8

1/ At a long-run aluminum price of 70¢/lb.

2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.

3/ Industrial Firm Standard rate adjusted for the effect of incentive rates implemented in the model under the no action alternative.

Table 32

PROJECTED AVERAGE ANNUAL EMPLOYMENT:
NO ACTION ALTERNATIVE WITH TWO POTENTIAL LONG-RUN
PLANT CLOSURE SCENARIOS 1/

<u>Period/Sector</u>	<u>No Plant Closures</u>	<u>Two Plants Closed <u>2/</u></u>
<u>FY 1987 - FY 1991:</u>		
Aluminum DSIs	5,091	4,073
Other Employment	3,659,942	3,659,879
Total Employment	3,665,033	3,663,952
<u>FY 1992 - FY 1996:</u>		
Aluminum DSIs	4,749	3,879
Other Employment	3,975,633	3,975,744
Total Employment	3,980,382	3,979,623
<u>FY 1997 - FY 2000:</u>		
Aluminum DSIs	4,808	3,903
Other Employment	4,294,563	4,294,828
Total Employment	4,299,371	4,298,731

1/ At a long-run aluminum price of 70¢/lb.

2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.

However, an individual smelter's long-term planning and decisionmaking may be influenced by factors that are not incorporated in the logic of the model, for example Martin-Marietta's and ARCO's decisions to leave the aluminum industry, a smelter's ability to negotiate labor concessions, the degree of certainty they perceive as to future electric rates, aluminum price expectations, and other factors.

4.3.1 Aluminum Smelter Operations and Local Socioeconomic Impacts

A reason for the lack of much apparent difference between the proposed Variable rate and the no action alternative on the smelters' operation is that the no action alternative includes BPA's existing Incentive rate mechanism which, as modeled, encourages aluminum plant load similar to the proposed Variable rate. However, there is uncertainty in the implementation of an Incentive rate during periods of low aluminum smelter loads. Further, the Incentive rate is only offered for a relatively short duration (i.e., 6 months to 1 year).

Table 33

PERCENT OF GAMES OPEN - VARIABLE RATE 1/

	<u>Alcoa</u> <u>Vancouver</u>		<u>Alcoa</u> <u>Wenatchee</u>		<u>Columbia Falls</u>		<u>Intalco</u>		<u>Kaiser</u> <u>Mead</u>		<u>Kaiser</u> <u>Tacoma</u>		<u>Commonwealth</u>		<u>The Dalles</u>		<u>Reynolds</u> <u>Longview</u>		<u>Reynolds</u> <u>Troutdale</u>	
	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>
No Action (Incentive Rate)																				
FY 1987 - 1991	34	57	56	87	55	85	83	94	35	59	46	76	49	75	53	83	46	77	22	44
FY 1992 - 1996	30	64	60	84	60	82	81	94	32	64	54	78	50	74	57	81	54	78	19	44
FY 1997 - 2000	26	61	60	84	57	82	80	92	27	63	52	78	48	73	55	79	51	78	15	42
Variable:																				
<u>Revenue</u>																				
FY 1987 - 1991	32	55	53	81	52	78	80	95	32	57	39	67	47	71	50	76	41	67	18	42
FY 1992 - 1996	27	59	58	81	57	77	78	95	28	62	44	70	47	70	53	76	46	70	19	41
FY 1997 - 2000	24	57	58	82	53	80	78	93	24	60	42	72	45	70	51	75	43	72	14	37
Proposal																				
FY 1987 - 1991	32	56	54	87	54	84	82	94	34	58	44	74	47	73	50	82	5	74	22	43
FY 1992 - 1996	27	62	60	85	58	80	78	92	28	63	52	76	48	73	56	80	52	76	20	41
FY 1997 - 2000	26	60	60	86	56	80	78	92	26	63	49	76	46	73	53	77	49	76	16	39
<u>Load</u>																				
FY 1987 - 1991	37	59	72	94	72	88	91	96	38	66	53	80	52	84	63	87	53	80	23	45
FY 1992 - 1996	33	65	72	93	70	87	85	95	36	69	60	82	54	81	61	83	60	82	20	46
FY 1997 - 2000	28	63	68	90	62	86	83	92	29	68	57	81	52	77	56	78	57	81	16	41

1/ At long-run aluminum prices of 65¢/lb. and 70¢/lb. as indicated.

Implementation of a DSI Incentive rate requires BPA to demonstrate that its total revenues would be higher with the Incentive rate than without it. BPA's ability to collect higher revenues with an Incentive rate depends, in part, on increasing sales to the DSIs. In addition, revenue levels depend on BPA's ability to sell nonfirm energy and surplus firm power, and the rates at which those sales are made. The sales and rate levels depend on a number of factors including streamflow conditions, generation costs of utilities that purchase BPA power, transmission constraints, and supplies of power that compete with BPA sales.

The model treats the Incentive rate as 75 percent certain at a particular low aluminum price to reflect the uncertainty that an Incentive rate will be implemented. In the model, the Incentive rate operates in the same manner as the lower rate components of the Variable rate alternatives. The model's approximation of the Incentive rate is a simplification necessary for modeling. That is, 75 percent of the time when the market price of aluminum is below 60¢/lb., the power rate for the DSI declines. The Incentive rate in the no action alternative is modeled to be offered under the same conditions throughout the period of study. In actuality, the Incentive rate would probably be offered less frequently as time passes and load/resource balance is approached. The model reduces the DSIs' power rate 0.5 mills/kWh for every 1¢/lb. reduction in aluminum price below 60¢/lb. The rate reduction is constrained so that the Incentive rate will never be less than 18 mills/kWh. This reflects BPA's current experience with Incentive rate offers, approximating both past Incentive rates and the opportunity costs of sales against which Incentive rate revenues are judged.

4.3.1.1 Revenue Protection Alternative

The model predicts a greater likelihood of plant closures and reduced operation of aluminum smelters under the revenue protection alternative than under either BPA's proposal, load maintenance alternative, or the no action alternative. Therefore physical impacts of the aluminum smelters' operations would be lowest under this alternative.

Socioeconomic impacts on smelter communities are likely to be more adverse under the revenue protection Variable rate than under the no action alternative since production levels are reduced when plants are open and probabilities of closure are increased for every plant. The model predicts reductions in average aluminum smelter employment (at 70¢/lb. long-run aluminum price) of 269 jobs, 148 jobs, and 226 jobs respectively for the periods FYs 1987-1991, 1992-1996, and 1997-2000 when compared to the no action alternative (see Table 36). These jobs tend more to be at the less efficient, higher cost plants, so the adverse employment effects and consequent socioeconomic impacts would be disproportionately distributed among the smelter communities. Impacts of closure or operation at capacity of all 10 smelters are discussed in Chapter 4 of Appendix A.

4.3.1.2 BPA Proposal

Under the proposed Variable rate, the average DSI electricity price is lower than under the revenue protection alternative, but higher than projected under the no action alternative. The proposal is designed to allow even the highest-cost plant (Troutdale) to recover most of its short-run variable costs under most circumstances. (Table 2 of Appendix H shows estimated short-term variable costs for each of the 10 smelters.)

The model projects plant closure probabilities which are generally very close to those projected for the no action alternative.

Quantities of air and water pollutants produced by the smelters would be very close to those produced under the no action alternative. None of the currently operating plants is known to be in violation of any environmental regulations or permit conditions.

Aluminum smelter employment is also very much the same as under the no action alternative. Comparing aluminum smelter employment (at 70¢/lb.) shows average reductions of 28, 1, and 78 jobs, respectively for the periods FYs 1987-1991, 1992-1996, and 1997-2000 (see Table 36). In order of magnitude, these are changes of 2 percent or less. Thus, on the basis of the model results, it appears that the impact on smelter communities will be similar if the proposed Variable rate is chosen over the no action alternative.

4.3.1.3 Load Maintenance

The load maintenance alternative provides substantial incentives to the aluminum industry to keep its Northwest plants open. With a rate structure more favorable to the smelters than either the no action alternative or the proposed Variable rate, capital should be easier to raise and other barriers to reopening plants or maintaining operations may be more easily overcome. For example, large concessions from labor may not be required to maintain operations.

The load maintenance alternative, of all the Variable rate alternatives or no action, would likely result in the greatest quantities of air and water pollutants emitted from the aluminum smelters. However, these quantities can be inferred from the model results to still be less on average than discussed for operation at capacity in Chapter 4 of Appendix A. Plants should still be able to operate within established environmental regulatory parameters.

Aluminum smelter employment also would be the highest of any other Variable rate alternative analyzed, and higher than with no action. Smelter employment would increase, relative to levels projected by the model for the no action alternative (assuming a 70¢/lb. long-run aluminum price), by 360, 381, and 163 jobs for the periods FYs 1987-1991, 1992-1996, and 1997-2000, respectively. These are order of magnitude increases of 3 to 8 percent. Much of this change would occur at the plants which are less efficient or have higher production costs. Most of the benefits would accrue to the communities containing such plants.

4.3.2 Resource Operations and Development

Projected changes in coal, nuclear, and combustion turbine operational impacts computed from model output for the Variable rate alternatives are included in Appendix E. Total generation projections are highest on average for the load maintenance alternative and lowest for the revenue protection alternative, with the no action alternative and proposed Variable rate generally between these cases (see Table 34). Most of the differences come from changes in secondary hydro generation and coal-fired generation, and are dependent on availability of water to operate the dams, secondary energy market activity, and other factors as well as smelter loads.

Table 34

AVERAGE TOTAL GENERATION AT 70¢/LB.
(Ave. Annual MW)

	<u>No Action</u>	<u>Revenue Protection</u>	<u>Proposal</u>	<u>Load Maintenance</u>
FY 1987-1991	21,360	21,320	21,370	21,445
FY 1992-1996	22,045	22,042	22,047	22,129
FY 1997-2000	23,351	23,388	23,340	23,422

Only the load maintenance alternative shows a substantial difference in generation from the other cases. This alternative could accelerate to a small degree the development of other resources, with less than 100 average MW of additional generating capability being needed to meet loads under this alternative than with no action. This would be comparable to one quarter of the capability of a typical coal-fired generating unit.

4.3.3 Regional Socioeconomic Impacts

Although communities especially dependent on an aluminum smelter (e.g., Columbia Falls) may be substantially affected by a Variable rate (see section 4.3.1), regionwide impacts, based largely on the model results, do not appear to be significant.

4.3.3.1 Rate Effects

Table 35 presents comparisons of projected rate levels (in 1985 dollars) for three major customer classes: PF, IP Standard, and NR. The annual average revenue collected per kWh from an aluminum DSI also is shown. BPA sells firm power under the PF rate to Federal agencies and public utilities. The PF rate schedule also is applicable to the portion of the IOU and public utility residential and farm load that qualifies under the power exchange provisions of the Pacific Northwest Power Act. BPA currently provides service to the DSIs, including nonaluminum DSIs, under the IP rate schedule -- usually

charging the IP Standard rate for this service. For serving load growth of regional IOUs and for serving any new large single loads (additions of over 10 MW in any one year at any one facility) of public utilities, the NR rate schedule is applied.

As Table 35 indicates, average aluminum DSI rate paid with the revenue protection alternative are projected to be 7.9 mills/kWh, 6.6 mills/kWh and 1.8 mills/kWh higher than under the no action alternative for FY 1988, FY 1990 and FY 1995, respectively. The projected average aluminum DSI rate paid under the proposed Variable rate and the load maintenance alternative are only slightly higher than under the no action case. Since the Variable rate structure is assumed to expire in FY 1996, the average annual rate charged the aluminum DSIs in FY 2000, under each of the three Variable rate alternatives is the IP Standard rate. In the no action alternative, the average rate paid by the DSIs may be less than the IP Standard rate because of Incentive rate effects.

Projected PF, IP Standard, and NR rate levels for FY 1988, FY 1990, FY 1995, and FY 2000 under the proposed Variable rate and the load maintenance alternative are similar to the rates projected for the no action alternative. Wholesale rate levels with the revenue protection alternative are slightly lower than those for the no action alternative in FY 1988, FY 1990 and FY 1995, although similar to no action rate levels in FY 2000.

Even if the proposed Variable rate or either of the alternative Variable rate structures were to result in differences in wholesale rate levels from the no action alternative significantly greater than shown in Table 35, effects on end-use consumers would be mitigated by several factors. First, all consumers in the Pacific Northwest, with the exception of the DSIs, are served by retail public or private utilities. The costs of power purchased from BPA for these consumers account for only a portion of total electricity costs. Second, while most public utilities rely on BPA for their total power supply, some public utilities and all of the region's private utilities have their own generating resources. This further mitigates effects of changes in BPA's wholesale rates for power.

For most businesses and industries, electricity costs are a small component of total operating costs (see discussion in section 3.2.3 and 4.2.3). Therefore, electric rate increases have less effect on profitability than factors such as the demand for products or services, cost of materials, labor costs, and management practices. However, certain non-DSI industrial consumers are electrically intensive and, depending on their current product market situation, can be sensitive to rate changes. These energy intensive industries can respond to major rate increases in several ways. Depending on the servicing utilities' rate structures, they may be able to shift a portion of their energy requirement to offpeak hours to avoid some capacity charges. They may be able to purchase less expensive nonfirm (interruptible) energy. Other measures could include installation of fuel switching capabilities or installing onsite generation. However, the need for these measures would be less critical if markets for products are strong. (For additional discussion

Table 35

PROJECTED POWER RATES BY CUSTOMER CLASS:
NO ACTION ALTERNATIVE AND VARIABLE RATE ALTERNATIVES 1/
(1985 Dollars; 70¢/Lb. Aluminum)

Year/Customer Class	No Action Case (mills/kWh)	Variation From No Action Alternative		
		Revenue Protection Alternative (mills/kWh)	Proposed Variable Rate (mills/kWh)	Load Maintenance Alternative (mills/kWh)
FY 1988:				
Priority Firm	17.4	-0.6	-0.3	-0.2
Industrial Firm				
Standard 2/ Average Aluminum	19.5	0.0	0.0	0.0
DSI Revenue 3/ New Resource Firm	18.8 20.3	+7.9 -0.6	+2.4 -0.3	+1.0 -0.2
FY 1990:				
Priority Firm	19.9	-1.6	-0.5	-0.4
Industrial Firm				
Standard 2/ Average Aluminum	18.5	-0.2	-0.1	-0.1
DSI Revenue 3/ New Resource Firm	17.9 23.0	+6.6 -1.7	+1.6 -0.6	+0.1 -0.4
FY 1995:				
Priority Firm	19.6	-0.4	-0.2	-0.2
Industrial Firm				
Standard 2/ Average Aluminum	18.0	-0.3	-0.1	0.0
DSI Revenue 3/ New Resource Firm	17.7 28.4	+1.8 -0.4	+0.8 -0.1	+0.5 0.0
FY 2000:				
Priority Firm	19.6	+0.2	0.0	-0.1
Industrial Firm				
Standard 2/ New Resource Firm	17.9 34.0	+0.2 +0.4	0.0 0.0	-0.1 0.

- 1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.
- 2/ This analysis assumes that nonaluminum DSIs would continue to be served at the IP Standard rate if the Variable rate option is implemented.
- 3/ Average aluminum DSI revenue differs from IP Standard rate level under no action because of effects of the Incentive rate.

of effects of wholesale electricity rate changes on residential, commercial, industrial, and agricultural consumers, see BPA's Final 1983 Wholesale Power Rate EIS, pp. II-12-II-28.) The impacts projected by the Decision Analysis Model of any of the Variable rate alternatives on the PF and NR rates appear to be too slight to significantly affect operations at even those non-DSI industries which are fairly electrically intensive.

4.3.3.2 Employment Effects

Table 36 shows average annual employment levels under the no action alternative projected by the model (at 70¢/lb. long-run aluminum price) for the aluminum DSIs and all other manufacturing and nonmanufacturing industries for three periods, FY 1987-1991, FY 1992-1996, and FY 1997-2000. Also shown are variations from the no action alternative in average annual employment for the proposed Variable rate and the alternatives.

Total employment for each of the alternatives, including the proposed Variable rate, varies only slightly from the no action alternative. These small employment impacts are consistent with the low level of impacts of each of the Variable rate alternatives on DSI production levels and BPA's wholesale rates. The small regional impacts are a consequence of the fact that the entire aluminum industry constitutes a relatively small portion of total regional employment. Changes in aluminum smelter employment of the magnitude indicated in Table 36 for the revenue protection or load maintenance alternatives would be significant if concentrated in the smaller communities containing smelters.

Table 36

PROJECTED AVERAGE ANNUAL REGIONAL EMPLOYMENT
FOR A LONG-RUN ALUMINUM PRICE OF 70¢/LB.
NO ACTION ALTERNATIVE AND VARIABLE RATE ALTERNATIVES

<u>Period/Sector</u>	<u>No Action Case</u>	<u>Variation</u>	<u>From No Action</u>	<u>Alternative</u>
		<u>Revenue Protection Alternative</u>	<u>Proposed Variable Rate</u>	<u>Load Maintenance Alternative</u>
<u>FY 1987 - 1991:</u>				
Aluminum DSIs	5,091	-269	-28	+360
Other Employment	3,659,942	+524	+187	+135
Total Employment	3,665,033	+255	+159	+495
<u>FY 1992 - 1996:</u>				
Aluminum DSIs	4,749	-148	-1	+381
Other Employment	3,975,633	+372	+113	+64
Total Employment	3,980,382	+224	+112	+445
<u>FY 1997 - 2000:</u>				
Aluminum DSIs	4,808	-226	-78	+163
Other Employment	4,294,563	-218	+12	+18
Total Employment	4,299,371	-444	-66	+181

4.3.4 Effects of Other Alternative Adjustment Mechanisms

The truing-up device or balancing account mechanism amounts to a short-term loan for power costs with interest compounded monthly at the prevailing U.S. Treasury rate. Smelter managers may continue to make operating decisions based on the Standard rate since such an arrangement does not change the underlying economics driving the decisions concerning the plant operating levels. Modeling to simulate a balancing account mechanism was not performed. This type of accounting mechanism would be effective if the problems facing the smelters were caused by temporary short-term cash flow difficulties; the problems facing the regional smelters require longer-term solutions. The management team of some aluminum smelters may perceive a balancing account as an accrued liability which could influence their short-run operating decisions. A balancing account adjustment mechanism would not reduce the volatility of the DSI loads in response to low aluminum prices. If smelter managers did not accept this mechanism, impacts would be the same as under the no action alternative.

A take-or-pay provision has also been suggested as an alternative to the balancing account as a means of mitigating risk to BPA of a Variable rate. BPA assessed a take-or-pay provision, or customer charge, for aluminum smelters both in the Options Study (BPA, 1985a) and in the 1985 Rate case (BPA, 1985e). Traditionally, the aluminum industry has accepted take-or-pay contracts for both electricity and alumina in order to secure a continuous long-term supply of both. Structural changes in the industry occurring over the past 7-10 years stemming from the rise of government-influenced smelter capacity and the use of terminal exchanges for ingot trading have caused aluminum companies to adjust operating strategies. Price instability during recent years has been largely a result of producers' inability to adjust production levels in response to changes in demand. There are technical, economic, and financial reasons for this situation, not the least of which is the existence of fixed components in input costs.

The trend the industry seems to be taking in response to these structural changes is to increase operating flexibility, i.e., to lower fixed costs. The inclusion of a customer charge or take-or-pay provision in power rates in the PNW is contrary to this trend, and would tend to increase the perceived risk of making investments in regional smelters. In addition, to the extent that a customer charge would reduce positive cash flow (or increase negative cash flow) for high-cost regional plants, particularly those operated by firms in poor financial condition or firms intending to exit the industry, it possibly could lead to earlier or more extensive capacity closures than would otherwise be the case. It is this increased risk that led BPA to its decision in the 1985 rate proceeding to omit a customer charge from its wholesale power rate to the DSIs beginning July 1, 1985.

Adjustment of the pivot points prospectively or retrospectively to account for changes in production costs reduces the benefits to the smelters of lowering production costs. A retrospective adjustment may even discourage cost reductions. The perceived risk that a smelter may not be able to recover the

cost of its investments to conserve or modernize, because of the moving pivot points, may deter a smelter from undertaking those investments. Additionally, setting a target (e.g., a 1¢/lb. cost reduction per year) that a smelter must achieve without determining whether such a target is realistic also reduces the benefits to a smelter. A target approach may actually penalize smelters that undertake cost reduction measures if the time between undertaking the measure and realizing the savings is greater than prescribed. If a smelter perceived these targets as unrealistic, a smelter may forego choosing the Variable rate in the first place. BPA's proposal provides an incentive to undertake cost reduction measures by enabling smelters to retain the full benefit of its efforts in preventing its production costs from increasing at the same rate as the inflation index.

A shorter term, if substantially less than 10 years, for the Variable rate would discourage smelters from making capital investments in their plants to modernize, since they would lack the long-term rate certainty provided by the proposal. In addition, a shorter term could reduce the likelihood of recovery of the IP Standard rate on average since aluminum prices are more likely to be low in the near-term.

4.3.5 Sensitivity of Variable Rate Analysis to a Low Long-Run Aluminum Price

A second model run using a long-run expected aluminum price of 65¢/lb. was made to test the effects of Variable rate alternatives under this potentiality. This run also showed a substantial adverse effect from the lower aluminum prices on smelter operations under all Variable rate alternatives as was observed for the no action alternative (see Tables 24 and 25 and section 4.2.4). Similar overall trends among the Variable rate alternatives were shown at 65¢/lb. as were discussed in sections 4.3.1 through 4.3.3 for the long-run aluminum price of 70¢/lb.; that is, the revenue protection alternative still produces the lowest loads and the load maintenance alternative the highest. The load maintenance alternatives seem to have a greater effect on the medium efficiency/medium priced plants in terms of likelihood of staying open than it does for either the high cost plants (which have quite low probabilities of being open under any rate alternative at 65¢/lb.) or the low cost plants (which retain a relatively good chance of being open even at the low aluminum price).

Generation at the lower aluminum price is substantially lower than at 70¢/lb. as is expected (compare Tables 34 and 37), but shows similar relationships among alternatives as at 70¢/lb. Only the load maintenance alternative shows a substantial difference in generation from the other cases in Table 37.

Table 37

AVERAGE TOTAL GENERATION AT 65¢/LB.
(Ave. Annual MW)

	<u>No Action</u>	<u>Revenue Protection</u>	<u>Proposal</u>	<u>Load Maintenance</u>
FY 1987-1991	20,999	20,979	21,005	21,137
FY 1992-1996	21,709	21,709	21,699	21,789
FY 1997-2000	22,891	22,885	22,876	22,982

effects of the Variable rate alternatives on rates to other customer classes, in comparison with the no action alternative for a long-run price of 65¢/lb., are shown in Table 38. Rates generally appear to be higher than at 70¢/lb. (see Table 35) in the near-term but lower in the long-term. Rate changes among alternatives seem to bear no specific consistent relationship between the two aluminum prices, but changes are of generally comparable magnitude.

Employment for the 65¢/lb. long-run price is shown in Table 39. Aluminum smelter employment is much lower in all cases at the lower aluminum price than at 70¢/lb. (see Table 36). Changes in nonaluminum employment are minor. In the near-term, the load maintenance alternative at 65¢/lb. seems to offer a substantially greater aluminum smelter employment increase over the no action alternative, and the extreme values of the differences from the Variable rate alternative are greater at 65¢/lb. than at 70¢/lb.

4.3.6 Sensitivity of Impacts of the Variable Rate
Alternatives to Assumed Plant Closures Under No Action

As discussed in section 4.2.5, continued operation or reopening of at least two smelters, those at Columbia Falls and The Dalles, appear to be dependent on the availability of some form of Variable rate. The analysis presented in this section compares the impacts if these plants close or remain closed under the no action alternative, but remain open or reopen with implementation of a Variable rate.

Table 38

PROJECTED POWER RATES BY CUSTOMER CLASS:
NO ACTION ALTERNATIVE AND VARIABLE RATE ALTERNATIVES 1/
(1985 Dollars; 65¢/Lb. Aluminum)

<u>Year/Customer Class</u>	<u>No Action Case</u> (mills/kWh)	<u>Variation From No Action Alternative</u>		
		<u>Revenue Protection Alternative</u> (mills/kWh)	<u>Proposed Variable Rate</u> (mills/kWh)	<u>Load Maintenance Alternative</u> (mills/kWh)
<u>FY 1988:</u>				
Priority Firm	17.7	-0.5	-0.3	-0.2
Industrial Firm				
Standard <u>2/</u>	19.4	0.0	0.0	0.0
Average Aluminum				
DSI Revenue <u>3/</u>	18.8	+8.2	+2.2	+0.4
New Resource Firm	20.7	-0.5	-0.3	-0.2
<u>FY 1990:</u>				
Priority Firm	20.4	-1.4	-0.3	-0.1
Industrial Firm				
Standard <u>2/</u>	18.8	-0.4	-0.1	+0.1
Average Aluminum				
DSI Revenue <u>3/</u>	18.0	+7.1	+1.9	+0.1
New Resource Firm	23.6	-1.4	-0.3	-0.1
<u>FY 1995:</u>				
Priority Firm	19.4	-0.4	-0.2	0
Industrial Firm				
Standard <u>2/</u>	17.7	-0.4	-0.1	0
Average Aluminum				
DSI Revenue <u>3/</u>	17.7	+0.9	+0.1	-0.2
New Resource Firm	27.5	-0.4	0	+0.4
<u>FY 2000:</u>				
Priority Firm	19.1	0	-0.2	0
Industrial Firm				
Standard <u>2/</u>	17.4	0	-0.2	0
New Resource Firm	32.6	-0.3	-0.5	+0.4

- 1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.
- 2/ This analysis assumes that nonaluminum DSIs would continue to be served at the IP Standard rate if the Variable rate option is implemented.
- 3/ Average aluminum DSI revenue differs from IP Standard rate level under no action because of effects of the Incentive rate.

Table 39

PROJECTED AVERAGE ANNUAL REGIONAL EMPLOYMENT
FOR A LONG-RUN ALUMINUM PRICE OF 65¢/LB.
NO ACTION ALTERNATIVE AND VARIABLE RATE ALTERNATIVES

<u>Period/Sector</u>	<u>Variation From No Action Alternative</u>			
	<u>No Action Case</u>	<u>Revenue Protection Alternative</u>	<u>Proposed Variable Rate</u>	<u>DSI Load Maintenance Alternative</u>
<u>FY 1987 - 1991:</u>				
Aluminum DSIs	3,390	-208	-26	+553
Other Employment	3,659,752	+480	+155	+62
Total Employment	3,663,142	+272	+129	+615
<u>FY 1992 - 1996:</u>				
Aluminum DSIs	3,190	-179	-79	+399
Other Employment	3,975,740	+214	-2	-39
Total Employment	3,978,930	+35	-81	+360
<u>FY 1997 - 2000:</u>				
Aluminum DSIs	3,095	-232	-78	+236
Other Employment	4,294,865	+17	+62	-60
Total Employment	4,297,960	-215	-16	+176

4.3.6.1 Aluminum Smelter Operations

Reopening The Dalles smelter or preventing the Columbia Falls smelter from closing through the offering of a Variable rate would have significant localized socioeconomic benefits to the communities affected while incurring or prolonging some adverse physical environmental impacts. These impacts are discussed in Appendix A, Chapter 4.

Operation of the remaining eight aluminum smelters are little affected by closure of the two plants under the no action scenario (see section 4.2.5.1), so the impacts on them and their communities of going from no action with two plants closed to either of the Variable rate alternatives or the proposed Variable rate would be the same, essentially, as previously described in section 4.3.1.

4.3.6.2 Resource Operations and Development

Table 40 shows total loads for the no action alternative with two plant closures versus each of the Variable rates with all smelters allowed to operate as the model dictates.

Table 40

AVERAGE TOTAL LOAD: NO ACTION WITH TWO PLANTS
CLOSED VERSUS VARIABLE RATES WITH PLANTS OPEN 1/
(Ave. Annual MW)

	No Action With <u>2 Plants Closed</u> <u>2/</u>	Revenue <u>Protection</u>	<u>Proposal</u>	Load <u>Maintenance</u>
FY 1987-1991	21,227	21,320	21,370	21,445
FY 1992-1996	22,008	22,042	22,047	22,129
FY 1997-2000	23,246	23,388	23,340	23,422

1/ At a long-run aluminum price of 70¢/lb.

2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.

In this scenario, implementing a Variable rate would increase loads. In the near-term, this increased load would be met principally through increased generation from the hydrosystem. This would tend to reduce the potential for spill with its attendant affects (see section 4.2.2). In the long-run, resources, with their associated environmental impacts, may need to be acquired sooner with a Variable rate than under no action.

4.3.6.3 Regional Socioeconomic Impacts

A comparison of projected wholesale rates to other customer classes with the no action alternative with two plants closed to the projected wholesale rates under the Variable rate alternatives is presented in Table 41. The projected PR and NR rate level for FY 1988 and FY 1990 with the Variable rate alternatives are just slightly lower than the rates projected for the no action alternative. After FY 1991, the difference between the wholesale rates with the Variable rate alternative and the no action alternative begins to decrease. In FY 2000, the PF and IP Standard rates with the Variable rate alternatives are slightly higher than those projected in the no action alternative, while there has been a substantial increase in the NR rate level. The reason for this is the acceleration of resource acquisition in the long-term relative to the no action alternative as explained above.

The average aluminum DSI revenue under the revenue protection alternative is still higher than the no action when plant closures are assumed. In FY 1988 and FY 1990 the projected DSI aluminum revenues are 8.1 mill/kWh and 6.8 mills/kWh higher, respectively, than no action. The projected average aluminum DSI revenue with the proposed Variable rate and the load maintenance alternative are much less different from the no action.

A similar comparison for employment between the alternative Variable rates and the no action alternative is presented in Table 42.

Table 41

PROJECTED POWER RATES BY CUSTOMER CLASS:
NO ACTION ALTERNATIVE WITH TWO PLANTS CLOSED AND
VARIABLE RATE ALTERNATIVES 1/
(1985 Dollars; 70¢/lb. Aluminum)

<u>Year/Customer Class</u>	<u>Variation From No Action Alternative</u>			
	<u>No Action w/2</u>	<u>Revenue</u>	<u>Proposed</u>	<u>Load</u>
	<u>Plants Closed 2/</u>	<u>Protection</u>	<u>Variable</u>	<u>Maintenance</u>
	<u>(mills/kWh)</u>	<u>(mills/kWh)</u>	<u>(mills/kWh)</u>	<u>(mills/kWh)</u>
<u>FY 1988:</u>				
Priority Firm	17.6	-0.8	-0.5	-0.4
Industrial Firm				
Standard 3/ Average Aluminum	19.3	+0.2	+0.2	+0.2
DSI Revenue 4/	18.6	+8.1	+2.6	+1.2
New Resource Firm	20.5	-0.8	-0.0	-0.4
<u>FY 1990:</u>				
Priority Firm	20.1	-1.8	-0.7	-0.6
Industrial Firm				
Standard 3/ Average Aluminum	18.4	-0.1	0.0	0.0
DSI Revenue 4/	17.7	+6.8	+1.8	+0.3
New Resource Firm	23.1	-1.8	-0.7	-0.5
<u>FY 1995:</u>				
Priority Firm	19.4	-0.2	-0.0	-0.0
Industrial Firm				
Standard 3/ Average Aluminum	17.8	-0.1	+0.1	+0.2
DSI Revenue 4/	17.4	+2.1	+1.1	+0.8
New Resource Firm	27.7	+0.3	+0.6	+0.7
<u>FY 2000:</u>				
Priority Firm	19.3	+0.5	+0.3	+0.2
Industrial Firm				
Standard 3/ New Resource Firm	17.5 32.8	+0.6 +1.6	+0.4 +1.2	+0.3 +1.2

- 1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this Table is to show rate level differences among alternatives.
- 2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.
- 3/ This analysis assumes that nonaluminum DSIs would continue to be served at the IP Standard rate if the Variable rate option is implemented.
- 4/ Average aluminum DSI revenue differs from IP Standard rate level under no action because of effects of the Incentive rate.

Table 42

PROJECTED AVERAGE REGIONAL EMPLOYMENT:
NO ACTION ALTERNATIVE WITH TWO PLANTS CLOSED
AND VARIABLE RATE ALTERNATIVES 1/

<u>Period/Sector</u>	<u>No Action With Two Plants Closed</u> <u>2/</u>	<u>Variation From No Action Alternative</u>		
		<u>Revenue Protection Alternative</u>	<u>Proposed Variable Reate</u>	<u>Load Maintenance Alternative</u>
<u>FY 1987 - 1991:</u>				
Aluminum DSIs	4,073	+749	+990	+1378
Other Employment	3,659,879	+587	+250	+198
Total Employment	3,663,952	+1336	+1240	+1576
<u>FY 1992 - 1996:</u>				
Aluminum DSIs	3,879	+722	+869	+1251
Other Employment	3,975,744	+261	+2	-47
Total Employment	3,979,623	+983	+871	+1204
<u>FY 1997 - 2000:</u>				
Aluminum	3,903	+679	+827	+1068
Other Employment	4,294,828	-483	-253	-247
Total Employment	4,298,731	+196	+574	+821

1/ At a long-run aluminum price of 70¢/lb.

2/ Assumes the smelters at Columbia Falls and The Dalles are closed throughout the analysis.

The employment impacts are dominated by the effects of creating and maintaining jobs at the two smelters, and on a regionwide basis are always positive. Near-term benefits of the Variable rate alternatives on nonaluminum employment are greater if the two smelters were to close (compare Tables 36 and 42), but in the longer term the nonaluminum employment suffers relatively little.

4.4 ENVIRONMENTAL CONSEQUENCES OF THE CONSERVATION/MODERNIZATION PROGRAM

4.4.1 Environmental Impacts of Aluminum Smelter Conservation Measures

The actual physical modifications and process changes used to effect Con/Mod at Northwest aluminum smelters are not expected to have a significant environmental impact for two reasons: (1) Federal and State environmental regulatory control already exists, and (2) modifications or retrofits to

aluminum smelters are not anticipated to have a significant potential for increasing pollutant discharges. The environmental regulations and standards which govern aluminum smelter design, modification, and operations are described in chapter 3.4.

The intent and focus of Con/Mod is to improve plant efficiency, not necessarily to increase plant capacity. However, it is possible that through efficiency improvements, increased plant capacity could become economic. Since pollutant discharges are often regulated on a production rate basis (see chapter 3.4), pollutant discharges may increase proportionately to production. However, increases in plant production capacity would be required to be reported to the responsible State environmental agency, and a permit modification or new permits would usually be required. If production capacity increases as a result of Con/Mod, their electrical power demand would not necessarily decrease, and could increase in the short term. However, if this were the case, BPA would impose conditions to call back load later when needed to meet load growth.

Temporary increases of dust and/or siltation may result from outside construction activity. Overall, these effects are viewed as minor and of short duration in relation to overall plant operational discharges and the type of work to be performed in aluminum smelter modernization. If a site-specific problem were identified, mitigation could be readily applied. These activities are also generally subject to regulation to prevent nuisance conditions.

Through plant improvements it is reasonable to expect a reduction of pollutant discharges. Automated alumina feed systems with bath sensors, larger anodes, and better hood designs are retrofits that would lessen the amount of time a pot is open and therefore could reduce plant emissions. Further, the automated feed systems would reduce the frequency of anode effects. (An anode effect is a chemical imbalance resulting from insufficient amounts of alumina during which CO, carbon tetrafluoride (CF₄), and other gases are given off.) Finally, pollutant discharges will be reduced as plants update their pollution control equipment. Examples of currently needed improvements include new treatment facilities for toxic water pollutants and improved hood designs to trap pot emissions better.

The full range of measures the smelters might undertake under the program cannot be defined at this time. Changes in air or water pollution from increased production induced by a Con/Mod program would not necessarily be offset by improvements in efficiency since there is no direct correlation between plant efficiency and discharges of air or water pollutants. The Con/Mod program could result in several scenarios.

- (1) Plant production capacity remains the same and the regulatory agency decides the changes in the plant resulting from Con/Mod do not require modification of the plant's environmental permits. In this case, average emissions of the plant may increase because the plant produces more metal over time since it is now more economic to operate. But the maximum emissions would not change because it is restricted to the same permitted levels as before.
- (2) Plant production capacity remains the same and the regulatory agency decides the permits must be modified. In this case, the maximum emissions will be whatever the agency allows them to be: an increase, a decrease, or no change. A decrease is considered more likely, however, since several of the expected modifications to smelters should reduce emissions; an agency's proclivity would be to tighten rather than relax requirements; and a plant modification may incur additional requirements, such as PSD rules or New Source Performance Standards, not previously incurred. Even if emission limits are tightened, actual emissions over time could increase if plants, formerly operating at low average production levels, now would operate at high production levels because it is more economical.
- (3) Smelter production capacity increases as part of the Con/Mod program. In this case, the regulatory agency would generally modify the permits, and, as in scenario 2 above, would likely reduce the allowed emissions on a quantity per unit of production basis. At any given time, or on average, the emissions could be higher or lower than before depending on the permitted emission rate before and after, and production levels before and after.

The commonality in all these scenarios is the involvement of the responsible environmental regulatory agency. It is unlikely the agency would permit the smelters to implement conservation or modernization measures which would result in substantial harm to the environment.

Generally, smelters are required to report, as a condition of their permit, any physical or operational change which would increase air pollutant emissions, discharges of water pollutants, or hazardous waste generation, outside of a simple change in production level within design production capacity, to the responsible environmental regulatory agency. The smelters are also required to monitor their environmental performance and make periodic reports to the agencies, and the plants are periodically inspected by regulatory agency personnel. For any change in emissions discovered through the preceding, the regulatory agency has authority to require a change in one or more of the plants environmental permits. For any substantial change in the smelter, such as an increase in capacity or a change in the type of pollution control device, a permit modification or a new permit would be required. Permits also expire periodically and must be renewed for a plant to continue to operate. When a permit is being granted, renewed, or modified, the regulatory agency assures compliance to the regulations and standards

described in chapter 3.4. However, it also generally goes beyond strictly what the regulations and standards require, and may impose stricter measures or additional requirements if needed to protect the environment or if they are otherwise practical (e.g., a smelter's past performance indicates it can meet a stricter permit).

4.4.2 Aluminum Smelter Operations and Local Socioeconomic Impacts

Con/Mod programs were modeled at alternative incentive levels; that is different amounts BPA would pay for aluminum smelter conservation on a mills/kWh basis. Three levels of incentive were used--3 mills/kWh, 5 mills/kWh, and 10 mills/kWh. The model results for each alternative funding level are shown for each smelter in Table 43 in terms of average probabilities of operating for FYs 1987-1991, 1992-1996, and 1997-2000.

Since a Con/Mod program would be optional to all smelters, offering a Con/Mod incentive at any level will not alter operation of those smelters for which that level of incentive does not make Con/Mod measures attractive, nor prevent them from closing.

4.4.2.1 3 Mills/kWh Incentive Alternative

At 3 mills/kWh and a long-run aluminum price of 70¢/lb., increases in probability of operation are slight or non-existent for all smelters as shown in Table 43.

Aluminum smelter impacts are, therefore, essentially the same as for the no action alternative. Con/Mod, to the small extent it may occur, is not expected to change smelter operational impacts substantially (see section 4.4.1). There could be some minor smelter employment impacts since one of the objectives of a Con/Mod measure is likely to be a reduction in labor costs as well as power costs. This is not shown, however, by the smelter employment results from the model (see Table 47 in section 4.4.4.2) which shows an overall near-term reduction of less than 1 percent and long-term gains of also less than 1 percent.

4.4.2.2 5 Mills/kWh Incentive Alternative

When funding levels are increased to 5 mills/kWh with a long-run aluminum price of 70¢/lb., the model predicts some increase in operation at a number of plants, but no particular plant characteristic seems to trigger such an increase. The increase is as great as 8 percent for Columbia Falls in FY 1997-2000, but is more typically 1 or 2 percent for most plants in most periods (see Table 43).

Table 43

PERCENT OF GAMES OPEN - CON/MOD 1/

	Alcoa		Alcoa		Columbia Falls		Intalco		Kaiser		Kaiser		Commonwealth		The Dalles		Reynolds		Reynolds	
	Vancouver		Wenatchee						Mead		Tacoma						Longview		Troutdale	
	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢
No Action (Incentive Rate)																				
FY 1987 - 1991	34	57	56	87	55	85	83	94	35	59	46	76	49	75	53	83	46	77	22	44
FY 1992 - 1996	30	64	60	84	60	82	81	94	32	64	54	78	50	74	57	81	54	78	19	44
FY 1997 - 2000	26	61	60	84	57	82	80	92	27	63	52	78	48	73	55	79	51	78	15	42
Con/Mod:																				
3 Mills																				
FY 1987 - 1991	34	57	58	88	55	85	86	95	35	59	46	77	49	75	53	83	46	77	22	44
FY 1992 - 1996	30	64	63	86	60	82	82	96	32	64	54	78	50	74	57	81	54	78	19	44
FY 1997 - 2000	28	63	64	86	57	82	82	94	27	63	52	78	49	73	56	79	52	78	15	42
5 Mills																				
FY 1987 - 1991	35	57	59	88	57	89	86	95	35	59	46	78	49	75	53	88	48	79	24	45
FY 1992 - 1996	32	64	63	86	62	89	82	96	32	64	54	80	50	74	57	86	56	80	20	47
FY 1997 - 2000	31	63	64	86	62	90	87	94	30	65	52	80	50	73	57	86	54	80	17	47
10 Mills																				
FY 1987 - 1991	37	66	59	88	61	91	86	96	37	67	49	80	52	80	57	88	50	80	25	47
FY 1992 - 1996	44	74	64	86	69	91	84	96	38	72	56	81	57	81	63	86	56	81	28	56
FY 1997 - 2000	43	76	66	86	69	92	84	94	39	73	55	82	55	82	64	86	55	82	26	55

1/ At long-run aluminum prices of 65¢/lb. and 70¢/lb. as indicated.

Environmental impacts from smelter operations of this alternative are a little greater than for the 3 mills/kWh incentive alternative. Smelter employment impacts are projected as a negligible decrease in the near-term, and increases of less than 5 percent in the later periods, on average, as can be seen from Table 47, section 4.4.4.2.

4.4.2.3 10 Mills/kWh Incentive Alternative

At a 10 mills/kWh Con/Mod incentive and a long-run aluminum price of 70¢/lb., all the plants are projected to increase their probability of operating over the no action alternative. Some plants improve by over 10 percent in some periods. Generally, the more efficient, lower cost smelters show smaller improvements than the higher cost plants and improvements are greater in the later periods, probably because the aluminum price in the model trends higher in later periods.

Impacts of the smelters that increase their level of operation under this alternative would produce correspondingly more pollutants and solid waste, but would be presumed to remain within regulated limits. Physical and socioeconomic impacts of all smelters are described in Chapter 4 of Appendix A. Projected smelter employment impacts show gains over all periods (see Table 47, section 4.4.4.2) in comparison with the no action alternative.

4.4.3 Resource Operations and Development

Changes in aluminum smelter and total loads as a consequence of alternate Con/Mod incentives, assuming a long-run aluminum price of 70¢/lb., are shown in Table 44. The table shows little change at 3 mills/kWh, some notable increase at 5 mills/kWh in the long-term, and substantive increases at 10 mills/kWh. At 3 mills/kWh, load decreases resulting from improved energy efficiency are greater than increases due to higher average smelter operating levels; at 5 mills/kWh, the opposite is true. Changes in total load are less than changes in smelter load, a result of reduced availability or increased cost to nonaluminum customers of energy due to increases in smelter loads. BPA has resources currently to serve these higher loads. The Con/Mod generally results in higher smelter loads because, when a smelter improves its efficiency, it becomes more economic to operate and is operated to produce more aluminum. Decreases in consumption on a per pound of production basis are offset by an increase in the average production over time. Unless capacity is also increased, the peak or maximum load of the plant is reduced but its average load is increased.

The estimated amount of load at capacity for each plant, with and without conservation, is shown in Table 45.

The changes in emissions, discharges, and other impacts computed directly from the model results for coal, nuclear, and combustion turbine resources are tabulated in Appendix C.

Table 44

PROJECTED AVERAGE ALUMINUM SMELTER AND TOTAL LOADS:
CON/MOD INCENTIVES AT 70¢/LB. ALUMINUM PRICE
(Ave. Annual MW)

	<u>No Action</u>	<u>3 mills/kWh</u>	<u>5 mills/kWh</u>	<u>10 mills/kWh</u>
<u>Smelter Loads</u>				
FY 1987-1991	1,960	1,951	1,965	2,036
FY 1992-1996	1,806	1,819	1,860	1,949
FY 1997-2000	1,840	1,853	1,902	1,990
<u>Total Loads</u>				
FY 1987-1991	21,360	21,358	21,367	21,407
FY 1992-1996	22,045	22,040	22,061	22,091
FY 1997-2000	23,351	23,341	23,369	23,386

Table 45

ESTIMATED AMOUNT OF LOAD AT CURRENT CAPACITY
(WITH AND WITHOUT EFFICIENCY IMPROVEMENTS)

<u>Smelter</u>	<u>Load at Capacity Operation (MW)</u>	<u>Estimated Load at Capacity Operation with Improvements (MW)</u>	<u>Reduction (MW)</u>
Alcoa, Vancouver	244.28	207.51	36.77
Alcoa, Wenatchee <u>1/</u>	220.00	201.75	18.30
Columbia Falls	320.55	291.78	28.77
Intalco	430.96	395.04	35.92
Kaiser, Mead	458.70	389.84	68.86
Kaiser, Tacoma	151.60	136.62	14.98
Commonwealth	288.90	262.75	26.15
The Dalles	152.05	138.29	13.76
Reynolds, Longview	412.66	371.81	40.85
Reynolds, Troutdale	<u>263.38</u>	<u>223.74</u>	<u>39.64</u>
TOTAL	2943.08	2619.13	324.00

1/ Smelter load served by BPA.

One of the objectives of the aluminum smelter Con/Mod program is to induce conservation which can be used to meet BPA load growth when needed. Impacts of the program on future resource development can vary depending on the means chosen to preserve the conservation aspects of the program for when needed. The program proposes a combination of a limit on contract demand and an inspection/monitoring mechanism to assure that the Con/Mod measures are installed, operated, and maintained. An alternative to the inspection/monitoring to assure conservation does occur would be a restriction on contract demand on an individual smelter. This would constrain power consumption by the smelter to its new, post Con/Mod demand for energy at maximum production. (An aluminum smelter's contract demand is the maximum power it is entitled to under current contracts with BPA; the operating demand is the maximum power entitled to the smelter based upon annual negotiations with BPA.) A restriction in operating demand alone would not prevent the aluminum company from using the energy it saved at one plant at another or for expansion.

BPA plans its resource operations and acquisitions on the basis of expected DSI loads and not on the basis of maximum potential DSI loads. Several aluminum companies have large surpluses of contract demand they are likely never to use. Therefore, reductions in contract demand alone do not necessarily assure use of the smelter conservation by the region to meet load growth. Contract demand limitations do restrict the ability of the aluminum companies to place additional load on BPA, so in that sense may be desirable.

In the long-term, the reduced aluminum smelter load resulting under these alternatives could mean new resources could be postponed, delaying the environmental impacts of their development and operation.

4.4.4 Regional Socioeconomic Impacts

4.4.4.1 Rate Impacts

The impacts of the Con/Mod alternatives to BPA's wholesale rates, assuming a long-run aluminum price of 70¢/lb., are expected to be insignificant. Table 46 shows projected PF, IP, and NR rate levels (in 1985 dollars) for FY 1988, FY 1990, FY 1995, and FY 2000 for the no action alternative and for each of the three Con/Mod alternative incentive levels. The wholesale rates projected under each of the alternatives are little different from the rates projected under the no action alternative. Therefore, no significant rate impacts would be expected at either the wholesale level or the retail level under any of the Con/Mod alternatives.

Table 46

PROJECTED POWER RATES BY CUSTOMER CLASS:
 NO ACTION CASE AND CON/MOD ALTERNATIVES 1/
 (1985 Dollars; 70¢/lb. Aluminum)

<u>Year/Customer Class</u>	<u>No Action Case (mills/kWh)</u>	<u>Variation From No Action Alternative</u>		
		<u>3 Mills Con/Mod (mills/kWh)</u>	<u>5 Mills Con/Mod (mills/kWh)</u>	<u>10 Mills Con/Mod (mills/kWh)</u>
<u>FY 1988:</u>				
Priority Firm	17.4	0.0	+0.1	+0.1
Industrial Firm				
Standard <u>2/</u>	19.5	0.0	0.0	0.0
New Resource Firm	20.3	0.0	0.0	+0.1
<u>FY 1990:</u>				
Priority Firm	19.9	0.0	0.0	0.0
Industrial Firm				
Standard <u>2/</u>	18.5	-0.1	-0.1	-0.1
New Resource Firm	23.0	0.0	0.0	0.0
<u>FY 1995:</u>				
Priority Firm	19.6	+0.1	+0.1	+0.2
Industrial Firm				
Standard <u>2/</u>	18.0	+0.1	+0.1	+0.2
New Resource Firm	28.4	+0.2	+0.1	+0.3
<u>FY 2000:</u>				
Priority Firm	19.6	0.0	0.0	+0.1
Industrial Firm				
Standard <u>2/</u>	17.9	0.0	0.0	+0.1
New Resource Firm	34.0	-0.1	-0.4	-0.3

1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.

2/ Average DSI rates under no action would be less because of the effects of the Incentive rate. The effective rate paid by some smelters under the Con/Mod alternative will be less through FY 1996 than the IP Standard rate because of payments to those plants under the Con/Mod programs.

4.4.4.2 Regional Employment Impacts

Regional employment impacts of the Con/Mod alternatives would be insignificant. Table 47 shows projected average annual aluminum smelter and other employment for each of the alternatives. In the near term at 3 mills kWh, labor efficiency improvements offset employment gains due to increased operating rates, resulting in a net loss of smelter jobs. Total regional employment for each alternative for all three periods varies only slightly from the no action alternative.

Table 47

PROJECTED AVERAGE ANNUAL REGIONAL EMPLOYMENT
FOR A LONG-RUN ALUMINUM PRICE OF 70¢/LB.
NO ACTION CASE AND CON/MOD ALTERNATIVES

Period/Sector	No Action Case	Variation From No Action Alternative		
		3 Mills Con/Mod	5 Mills Con/Mod	10 Mills Con/Mod
FY 1987 - 1991:				
Aluminum	5,091	-39	+7	+192
Other Employment	3,659,942	-1	0	+2
Total Employment	3,665,033	-40	+7	+194
FY 1992 - 1996:				
Aluminum	4,749	+33	+148	+398
Other Employment	3,975,633	-22	-45	-73
Total Employment	3,980,382	+11	+103	+325
FY 1997 - 2000:				
Aluminum	4,808	+32	+170	+424
Other Employment	4,294,563	-8	+21	+10
Total Employment	4,299,371	+24	+191	+434

4.4.5 Impacts of Alternatives Relating to Program Scope

Impacts of alternatives to constrain the scope of the Con/Mod program to some lesser level, such as a reduced annual budget, shorter program duration, or a pilot program would simply accomplish a lesser degree of program participation, and would result in some fraction of the environmental and socioeconomic impacts that may occur from the cases discussed above. A targeted program would produce the same type of affects, but only at or for the smelter or smelters targeted and the respective community or communities. A program expanded through larger budget, longer duration, or other means may result in some additional conservation/modernization activity by the smelters. However, technological limits dictate the amount of conservation/modernization that can be achieved and, since all smelters seem to undertake Con/Mod at 10 mills/kWh, an expanded program would likely result in negligible differences in environmental impact from the 10 mills/kWh alternative.

4.4.6 Sensitivity of the Con/Mod Analysis to a Low Long-Run Aluminum Price

A second model run which assumed a long-run expected aluminum price of 65¢/lb. was made to test the effects of the alternative Con/Mod incentive levels under this potentiality. This run again showed the major affect aluminum price has on smelter operations in general (see Table 24, Table 25, and section 4.2.4). Similar overall trends among the incentive levels were shown at 65¢/lb. as were discussed in section 4.4.2; that is, the 3 and 5 mills/kWh levels of incentive had generally little or no effect (except for Columbia Falls), and the 10 mills/kWh had substantial effect. At 10 mills/kWh, improvement in plant closure probabilities are again better in the latter periods, and improvements generally are greater for the higher cost smelters.

Smelter loads and generation at the lower aluminum price are substantially lower than at 70¢/lb. as expected (compare Tables 44 and 48), but show similar relationships among the alternatives.

Table 48

PROJECTED AVERAGE ALUMINUM SMELTER AND TOTAL LOADS CON/MOD INCENTIVES AT 65¢/LB. ALUMINUM PRICE (Ave. Annual MW)

	<u>No Action</u>	<u>3 mills/kWh</u>	<u>5 mills/kWh</u>	<u>10 mills/kWh</u>
<u>Smelter Loads</u>				
FY 1987-1991	1,326	1,321	1,339	1,394
FY 1992-1996	1,221	1,229	1,254	1,349
FY 1997-2000	1,195	1,216	1,251	1,369
<u>Total Loads</u>				
FY 1987-1991	21,038	21,036	21,046	21,076
FY 1992-1996	21,840	21,838	21,850	21,899
FY 1997-2000	23,011	23,013	23,021	23,099

Effects of the alternative Con/Mod incentive levels with a long-run aluminum price of 65¢/lb. on rates to other customer classes in comparison with the no action alternative are shown in Table 49. Rates appear to be generally higher under any incentive level for the 65¢/lb. scenario than at 70¢/lb. in the near-term but generally are lower in the long-term. Rate changes from no action among alternatives seem to bear no specific consistent relationship between the two aluminum prices, but are of lower average magnitude in the 65¢/lb. analysis. Rate levels in general would not appear to be significantly affected by Con/Mod program levels in the 65¢/lb. scenario.

Table 49

PROJECTED POWER RATES BY CUSTOMER CLASS:
 NO ACTION CASE AND CON/MOD ALTERNATIVES 1/
 (1985 Dollars; 65¢/Lb. Aluminum)

<u>Year/Customer Class</u>	No Action Case (mills/kWh)	<u>Variation From No Action Alternative</u>		
		3 Mills Con/Mod (mills/kWh)	5 Mills Con/Mod (mills/kWh)	10 Mills Con/Mod (mills/kWh)
<u>FY 1988:</u>				
Priority Firm	17.7	0.0	0.0	0.0
Industrial Firm				
Standard <u>2/</u>	19.4	0.0	0.0	0.0
New Resource Firm	20.7	0.0	0.0	0.0
<u>FY 1990:</u>				
Priority Firm	20.4	-0.1	0.0	0.0
Industrial Firm				
Standard <u>2/</u>	18.8	-0.1	-0.1	-0.1
New Resource Firm	23.6	-0.1	-0.1	-0.1
<u>FY 1995:</u>				
Priority Firm	19.4	0.0	0.0	+0.1
Industrial Firm				
Standard <u>2/</u>	17.7	0.0	0.0	+0.1
New Resource Firm	27.5	-0.1	-0.2	+0.2
<u>FY 2000:</u>				
Priority Firm	19.1	0.0	-0.1	0.0
Industrial Firm				
Standard <u>2/</u>	17.4	-0.1	-0.1	0.0
New Resource Firm	32.6	-0.2	-0.4	-0.3

1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.

2/ Average DSI rates under no action would be less because of the effects of the Incentive rate. The effective rate paid by some smelters under the Con/Mod alternative will be less through FY 1996 than the IP Standard rate because of payments to those plants under the Con/Mod programs.

Employment for the 65¢/lb. long-run price case is shown in Table 50. Aluminum smelter employment is much lower in all cases at the lower aluminum price (compare Tables 47 and 50). Changes in nonaluminum employment are minor. As in the 70¢/lb. scenario, magnitudes of changes in aluminum employment from no action are minor in the 65¢/lb. case for each Con/Mod alternative.

4.5 ENVIRONMENTAL CONSEQUENCES OF THE IP-PF RATE LINK

BPA is considering a rate link that would fix the relationship between the rates its preference customers pay (currently the PF rate) and the IP Standard rate charged the DSIs. Unlike the other two proposals addressed in this EIS, the IP-PF rate link will apply to all the DSIs, not just the aluminum smelters, and will not be discretionary on the DSIs' part. The IP-PF rate link and alternatives under consideration are described in section 2.4.

It is impossible to model the impacts of the IP-PF rate link precisely. Its effect results from the DSIs' perception of the degree of rate and planning certainty the IP-PF rate link would provide versus that provided by the post-1985 relationship between the two rates established by the Pacific Northwest Power Act. Therefore, impacts are discussed in a generally qualitative manner.

Table 50

PROJECTED AVERAGE ANNUAL REGIONAL EMPLOYMENT FOR A LONG-RUN ALUMINUM PRICE OF 65¢/LB. NO ACTION CASE AND CON/MOD ALTERNATIVES

<u>Period/Sector</u>	<u>No Action Case</u>	<u>Variation From No Action Alternative</u>		
		<u>3 Mills Con/Mod</u>	<u>5 Mills Con/Mod</u>	<u>10 Mills Con/Mod</u>
<u>FY 1987 - 1991:</u>				
Aluminum	3,390	+2	+50	+199
Other Employment	3,659,752	+6	+4	+8
Total Employment	3,663,142	+8	+54	+207
<u>FY 1992 - 1996:</u>				
Aluminum	3,190	+18	+83	+355
Other Employment	3,975,740	-15	-22	-77
Total Employment	3,978,930	+3	+61	+278
<u>FY 1997 - 2000:</u>				
Aluminum	3,095	+55	+150	+484
Other Employment	4,294,865	+18	+5	-1
Total Employment	4,297,960	+73	+155	+483

The immediate effect of the IP-PF rate link is to reduce the level of uncertainty in the DSI rate relative to the uncertainty that would exist if levels of the industrial margin (M) and value of reserves credit (V) (see section 2.4) were computed for each individual rate case during the period the link would be in effect. The added rate stability could aid DSI planning, increase load stability, and perhaps induce increased plant capital investment.

4.5.1 DSI Operations

Maintaining the IP-PF rate link through FY 2001 would reduce the uncertainty of electricity costs to the DSIs for the duration of their current Power Sales Contracts. This is important because, for the DSIs, electricity is a major cost of production. The IP-PF rate link by itself would not affect plant investment or operating decisions for the most efficient plants, or the plants that are least efficient and for which increased IP rate stability alone would not prevent shutdowns. However, for some plants, the IP-PF rate link may encourage investment in plant modernization because of greater assurance of investment recovery. If the duration of the IP-PF rate link were 5 years, the uncertainty in IP rate levels would be somewhat greater. Fewer, if any, plants would modernize on the basis of increased rate stability for a 5-year period.

The contract modification alternative could result in equal or slightly increased DSI loads over those that would occur if an IP-PF rate link policy were adopted. Increased loads could be due to greater investment in modernization, or fewer closures, as a result of lower perceived uncertainty in IP rate levels associated with a contractual arrangement as compared to a policy statement.

4.5.2. Resource Operations and Development

To the small extent the IP-PF rate link may increase DSI loads, or decrease them by encouraging conservation, there would be minor impacts on operation of power generating resources. Alternatives which provide less or more planning certainty to the DSIs are expected to affect resource operations to a somewhat lesser or greater degree, respectively.

4.5.3 Regional Socioeconomic Impacts

Overall, the IP-PF rate link is expected to have a beneficial stabilizing effect on the rates of other BPA customers. One other potential impact is the effect, either beneficial or adverse, of forecasting error on wholesale rates to other customers. The degree of forecasting error would depend on how closely the rate link approximates the factors affecting M and V over time.

To the extent BPA could reaffirm, modify, or rescind the IP-PF rate link arrangement any adverse impacts on BPA's customers may be mitigated. Because an IP-PF rate link policy could be modified, if needed, through a 7(i) process, it would be less difficult to change the IP-PF link than if the

contract modification alternative were adopted. Implementation through contract modification would provide less flexibility for BPA to mitigate any potential adverse impacts of the rate link to the DSIs or other customers.

With the alternative of implementing the IP-PF rate link through modification of Power Sales Contracts, BPA revenue stability could be even greater than under BPA's proposal, assuming the contractual arrangement results in stabilizing or increasing DSI loads. To the extent the proposed IP-PF rate link increases DSI operating levels, DSI employment levels might be higher. However, there is no basis for predicting substantive effects on total regional employment (see sections 4.3.3.2, 4.4.4.2, and 4.6.3.2).

Impacts to wholesale rates from policy implementation of the IP-PF rate link alternatives are likely to result in insignificant impacts to retail consumers of electricity. There is some risk of retail rate impacts resulting through FY 2001 via contract modification. This is because of the reduced flexibility associated with contractual implementation to respond to any adverse rate effects.

4.6 ENVIRONMENTAL CONSEQUENCES OF COMBINATIONS OF VARIABLE RATES AND CON/MOD PROGRAMS

To analyze cumulative effects of a Variable rate and a Con/Mod program, three combinations of Variable rates and Con/Mod incentive levels were modeled: the revenue protection alternative Variable rate with 3 mills/kWh Con/Mod incentive; the proposed Variable rate with 5 mills/kWh Con/Mod incentive; and the load maintenance alternative Variable rate with a 10 mills/kWh Con/Mod incentive. The model imposed the respective Variable rate on all the smelters. However, if implemented, it is expected that a Variable rate and a Con/Mod program will each be available optionally to each aluminum smelter. A smelter would be able to select one or another or both.

4.6.1 Aluminum Smelter Operations

Table 51 presents for the combinations modeled average probabilities of operating, summarized from Tables 14 through 23, for each of the region's aluminum smelters.

A Con/Mod program does not act as a disincentive to any smelter since participation is optional. The only influence it would have on plant closure decisions or the decision to accept a Variable rate would be if the program mitigated an adverse economic impact of a Variable rate on a smelter. A Con/Mod program, even if incentives as high as 10 mills/kWh were offered, would not generally mitigate the adverse impacts of the revenue protection alternative since the incentive would only be paid for energy savings at a smelter, a small part of their total load. However, Table 51 does indicate that a 3 mills/kWh incentive to Intalco would roughly balance out the effects of the revenue protection rate. This is probably due to Intalco's unique position as the region's lowest cost smelter. All the other smelters would have lower probabilities of operating under the combination of 3 mills/kWh Con/Mod incentive and the revenue protection alternative.

Table 51

PERCENT OF GAMES OPEN - COMBINATIONS 1/

	<u>Alcoa</u> <u>Vancouver</u>		<u>Alcoa</u> <u>Wenatchee</u>		<u>Columbia Falls</u>		<u>Intalco</u>		<u>Kaiser</u> <u>Mead</u>		<u>Kaiser</u> <u>Tacoma</u>		<u>Commonwealth</u>		<u>The Dalles</u>		<u>Reynolds</u> <u>Longview</u>		<u>Reynolds</u> <u>Troutdale</u>	
	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>	<u>65¢</u>	<u>70¢</u>
No Action (Incentive Rate)																				
FY 1987 - 1991	34	57	56	87	55	85	83	94	35	59	46	76	49	75	53	83	46	77	22	44
FY 1992 - 1996	30	64	60	84	60	82	81	94	32	64	54	78	50	74	57	81	54	78	19	44
FY 1997 - 2000	26	61	60	84	57	82	80	92	27	63	52	78	48	73	55	79	51	78	15	42
Combinations:																				
<u>Revenue/3 Mills</u>																				
FY 1987 - 1991	33	55	53	82	52	79	85	95	32	57	41	68	48	71	50	77	42	68	18	42
FY 1992 - 1996	29	59	60	83	57	80	81	95	28	62	46	72	47	70	53	78	48	72	19	31
FY 1997 - 2000	26	57	59	84	53	82	81	93	24	60	43	73	43	70	51	77	46	73	14	37
<u>Proposal/5 Mills</u>																				
FY 1987 - 1991	33	57	56	88	56	90	85	96	34	58	45	74	48	74	51	88	47	75	24	45
FY 1992 - 1996	30	64	61	86	61	87	71	95	28	63	52	76	47	74	56	86	54	76	21	44
FY 1997 - 2000	30	63	61	86	62	88	81	94	26	64	49	76	47	75	55	86	51	76	18	44
<u>Load/10 Mills</u>																				
FY 1987 - 1991	40	69	75	95	74	96	94	96	40	70	56	81	55	92	64	95	56	90	26	90
FY 1992 - 1996	46	80	78	93	76	94	90	94	42	76	61	84	63	90	69	93	61	88	29	88
FY 1997 - 2000	45	79	74	90	74	91	88	91	42	76	57	82	60	87	67	90	57	87	26	87

1/ At long-run aluminum prices of 65¢/lb. and 70¢/lb. as indicated.

When a Con/Mod program is offered with a Variable rate that may be beneficial or close to neutral to smelters in general, then there is likely to be some cumulative effect. At a long-run aluminum price of 70¢/lb., the combination of the proposed Variable rate with a 5 mills/kWh Con/Mod incentive improves probabilities of operating for some smelters over the no action alternative and over the proposed Variable rate alone (for example, compare Columbia Falls and The Dalles in Tables 33 and 43). Other smelters are helped to a lesser degree by this combination.

The combination of a 10 mills/kWh Con/Mod incentive with the load maintenance Variable rate is projected to benefit all the smelters in comparison with the no action alternative. High cost/low efficiency plants are particularly helped.

Aluminum smelter employment (see Table 54, section 4.6.3.2) at a long-run aluminum price of 70¢/lb. is improved by roughly 10 to 15 percent for the load maintenance alternative with a 10 mills/kWh incentive, and by much smaller percentages for the proposed Variable rate with a 5 mills/kWh incentive. The revenue protection rate with a 3 mills/kWh incentive result in less smelter employment.

Appendices C and D show projected aluminum smelter pollutant discharges computed directly from the model output for the combinations of Con/Mod incentives and Variable rates modeled.

4.6.2 Resource Operation and Development

Changes in aluminum smelter and total loads as a consequence of the combinations of rate alternatives and Con/Mod incentives are shown in Table 52.

Table 52

PROJECTED AVERAGE ALUMINUM SMELTER AND TOTAL LOADS:
VARIABLE RATE-CON/MOD COMBINATIONS AT 70¢/LB. ALUMINUM PRICE
(Ave. Annual MW)

	<u>No Action</u>	<u>Revenue with 3 mills/kWh</u>	<u>Proposal with 5 mills/kWh</u>	<u>Load with 10 mills/kWh</u>
<u>Smelter Loads:</u>				
FY 1987-1991	1,960	1,885	1,990	2,209
FY 1992-1996	1,806	1,779	1,875	2,117
FY 1997-2000	1,840	1,777	1,872	2,050
<u>Total Loads:</u>				
FY 1987-1991	21,360	21,391	21,436	21,550
FY 1992-1996	22,045	22,239	22,249	22,371
FY 1997-2000	23,351	23,515	23,497	23,587

Changes in smelter loads comport with the changes discussed in the previous section for probabilities of smelter operation. Total loads are highest for the load maintenance with 10 mills/kWh combination, but offer no other trends or consistent order. BPA currently has resources available to serve these higher loads in the near-term, but inducement of higher loads may accelerate need for new resources or conservation in the future.

Changes in emissions, discharges, and other environmental impacts of coal, nuclear, and combustion turbine generating resources computed from the model results for the combinations are provided in Appendix E.

4.6.3 Regional Socioeconomic Impacts

4.6.3.1 Rate Impacts

Rate impacts of the combinations do not appear to be significant. Table 53 shows PF, IP Standard, and NR rates projected for FY 1988, FY 1990, FY 1995, and FY 2000. Average aluminum smelter revenue per kilowatthour paid to BPA under each alternative for the years in which the Variable rate would be in effect is also shown. Average aluminum smelter revenue returned to BPA under the revenue protection Variable rate with 3 mills/kWh Con/Mod is projected to be 6.3 mills/kWh and 1.5 mills/kWh higher than under the no action alternative for FY 1990 and FY 1995, respectively. Average aluminum smelter revenues to BPA under the other combinations analyzed, however, more closely approximate those under the no action case. PF rates in FY 1990 are reduced with any combination because smelters are projected to operate more and therefore purchase more energy from BPA. The increased revenues more than offset the costs of providing the Con/Mod payments. Furthermore, PF, IP Standard, and NR rate levels projected under each of the combinations generally do not vary substantially from those under the no action case. These results suggest no significant wholesale or retail rate impacts under any of the combinations.

4.6.3.2 Employment Impacts

Projected employment impacts under each of the combinations analyzed are presented in Table 54. Regional employment for any of the combinations does not vary significantly from the no action case, especially when viewed in percentage terms. For instance, the difference of 805 employees relative to the no action case for FY 1992-1996 under the load maintenance Variable rate with 10 mills/kWh Con/Mod constitutes a positive difference of approximately 0.02 percent in total regional employment.

Table 53

PROJECTED POWER RATES BY CUSTOMER CLASS:
 NO ACTION CASE AND COMBINATIONS 1/2/
 (1985 Dollars; 70¢/Lb. Aluminum)

Year/Customer Class	No Action Case (mills/kWh)	Variation From No Action Alternative		
		Revenue with 3 Mills Con/Mod (mills/kWh)	Proposal with 5 Mills Con/Mod (mills/kWh)	Load with 10 Mills Con/Mod (mills/kWh)
<u>FY 1988:</u>				
Priority Firm	17.4	-0.6	-0.2	-0.2
Industrial Firm				
Standard <u>2/</u>	19.5	0.0	0.0	0.0
Average Aluminum				
DSI Revenue <u>3/</u>	18.8	+7.8	+2.1	0.0
New Resource Firm	20.3	-0.6	-0.3	-0.2
<u>FY 1990:</u>				
Priority Firm	19.9	-1.6	-0.4	-0.3
Industrial Firm				
Standard <u>2/</u>	18.5	-0.3	-0.2	-0.1
Average Aluminum				
DSI Revenue <u>3/</u>	17.9	+6.3	+1.0	-1.3
New Resource Firm	23.0	-1.8	-0.5	-0.4
<u>FY 1995:</u>				
Priority Firm	19.6	-0.3	-0.2	+0.1
Industrial Firm				
Standard <u>2/</u>	18.0	-0.7	-0.2	+0.2
Average Aluminum				
DSI Revenue <u>3/</u>	17.7	+1.5	+0.1	-0.8
New Resource Firm	28.4	-0.4	-0.2	+0.1
<u>FY 2000:</u>				
Priority Firm	19.6	+0.3	0.0	-0.1
Industrial Firm				
Standard <u>2/</u>	17.9	+0.2	0.0	-0.1
New Resource Firm	34.0	+0.3	-0.1	-0.6

- 1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.
- 2/ This analysis assumes that nonaluminum DSIs would continue to be served at the IP Standard rate if the Variable rate option and/or Con/Mod option are implemented.
- 3/ Average aluminum DSI revenue differs from IP Standard rate under no action because of the effects of the Incentive rate; average aluminum DSI revenue under combination alternatives varies from IP Standard rate because of Con/Mod payments received by some plants and the Variable rate.

Table 54

PROJECTED AVERAGE REGIONAL EMPLOYMENT
FOR A LONG-RUN ALUMINUM PRICE OF 70¢/LB.
NO ACTION CASE AND COMBINATION ALTERNATIVES

<u>Period/Sector</u>	<u>No Action Case</u>	<u>Variation From No Action Alternative</u>		
		<u>Revenue</u>	<u>Proposed</u>	<u>DSI Load</u>
		<u>Protection</u>	<u>Var. Rate</u>	<u>Maintenance</u>
		<u>With 3 Mills</u>	<u>With 5 Mills</u>	<u>With 10 Mills</u>
		<u>Con/Mod</u>	<u>Con/Mod</u>	<u>Con/Mod</u>
<u>FY 1987 - 1991:</u>				
Aluminum	5,091	-233	+47	+623
Other Employment	3,659,942	+528	+170	+118
Total Employment	3,665,033	+295	+217	+741
<u>FY 1992 - 1996:</u>				
Aluminum	4,749	-93	+162	+819
Other Employment	3,975,633	+354	+119	-14
Total Employment	3,980,382	+261	+281	+805
<u>FY 1997 - 2000:</u>				
Aluminum	4,808	-170	+94	+590
Other Employment	4,294,563	-198	+36	+41
Total Employment	4,299,371	-368	+130	+631

4.6.4 Sensitivity of the Analysis of Combinations to a Low Long-Run Aluminum Price

A second model run was made to test the effects from the combinations of Variable rate alternatives and alternative Con/Mod incentive levels at an assumed long-run expected aluminum price of 65¢/lb.

Similar overall trends for the lower aluminum price in the probability of smelter operation exist as for the higher aluminum price, but certain smelters, particularly the higher cost plants, do not respond as well to the load maintenance with 10 mills/kWh incentive combination.

Smelter loads and total generation at the lower aluminum price are substantially lower than at 70¢/lb. as expected (compare Tables 52 and 55), but show similar relationships among alternatives to those occurring for 70¢/lb.

Effects of the combinations analyzed on rates to other customer classes, in comparison with the no action alternative for a long-run aluminum price of 65¢/lb. are shown in Table 56. As under the 70¢/lb. scenario, impacts of the combinations on wholesale and retail rates in the 65¢/lb. scenario appear to be insignificant (compare Tables 53 and 56).

Table 55

PROJECTED AVERAGE ALUMINUM SMELTER AND TOTAL LOADS
FOR COMBINATIONS AT 65¢/LB.
(Ave. Annual MW)

	<u>No Action</u>	<u>Revenue with 3 mills/kWh</u>	<u>Proposal with 5 mills/kWh</u>	<u>Load with 10 mills/kWh</u>
<u>Smelter Loads:</u>				
FY 1987-1991	1,326	1,270	1,338	1,593
FY 1992-1996	1,221	1,175	1,229	1,515
FY 1997-2000	1,195	1,124	1,209	1,474
<u>Total Loads:</u>				
FY 1987-1991	21,038	21,034	21,055	21,202
FY 1992-1996	21,840	21,857	21,855	21,997
FY 1997-2000	23,011	22,999	22,998	23,172

Employment for the 65¢/lb. long-run aluminum price analysis of the combinations is shown in Table 57. Smelter employment is much lower in no action and with the combinations at the lower aluminum price. Nonaluminum smelter employment under the lower aluminum price scenario appears to be generally about the same for all combinations. The effect of the combinations on total regional employment under the 65¢/lb. aluminum price scenario appears to be insignificant in percentage terms.

4.6.5 Effects of Adding the IP-PF Rate Link to the Variable Rate -
Con/Mod Combinations

In the event the Variable rate and the Con/Mod program are both implemented, also implementing the IP-PF link may augment slightly the impacts reported in sections 4.6.1, 4.6.2, and 4.6.3.

4.7 IMPACTS OF BPA ACTIONS OUTSIDE THE PNW

In addition to the impacts of the alternatives considered by BPA on the regional smelters, the other regional energy consumer, the communities in which the smelters are located, and the regional economy as a whole, there are a number of potential impacts that would be felt outside the PNW. These impacts can be divided into three general categories: impacts on local economies in other regions, impacts on the aluminum industry generally, and impacts on the U.S. economy as a whole.

Table 56

PROJECTED POWER RATES BY CUSTOMER CLASS:
 NO ACTION CASE AND COMBINATIONS 1/
 (1985 Dollars; 65¢/Lb. Aluminum)

Year/Customer Class	No Action Case (mills/kWh)	Variation From No Action Alternative		
		Revenue	Proposal	Load with
		with 3 mills	with 5 mills	10 mills
		Con/Mod	Con/Mod	Con/Mod
		(mills/kWh)	(mills/kWh)	(mills/kWh)
FY 1988:				
Priority Firm	17.7	-0.5	-0.2	-0.1
Industrial Firm				
Standard 2/ Average Aluminum	19.4	0.0	0.0	0.0
DSI Revenue 3/ New Resource Firm	18.8	+8.1	+2.1	0.0
	20.7	-0.5	-0.3	-0.2
FY 1990:				
Priority Firm	20.4	-1.4	-0.4	-0.1
Industrial Firm				
Standard 2/ Average Aluminum	18.8	-0.4	-0.1	+0.1
DSI Revenue 3/ New Resource Firm	18.0	+6.6	+1.3	-1.1
	23.6	-1.5	-0.4	-0.1
FY 1995:				
Priority Firm	19.4	-0.4	-0.1	+0.2
Industrial Firm				
Standard 2/ Average Aluminum	17.7	-0.3	-0.1	+0.2
DSI Revenue 3/ New Resource Firm	17.7	+0.7	-0.4	-1.5
	27.5	-0.3	+0.1	+0.5
FY 2000:				
Priority Firm	19.1	0.0	-0.1	0.0
Industrial Firm				
Standard 3/ New Resource Firm	17.4	0.0	-0.1	-0.1
	32.6	-0.4	-0.7	-0.2

- 1/ Estimates of absolute rate levels should be viewed with caution. The purpose of this table is to show rate level differences among alternatives.
- 2/ This analysis assumes that nonaluminum DSIs would continue to be served at the IP Standard rate if the Variable rate option and/or Con/Mod option are implemented.
- 3/ Average aluminum DSI revenue differs from IP Standard rate under no action because of the effects of the Incentive rate; average aluminum DSI revenue under combination alternatives varies from IP Standard rate because of Con/Mod payments received by some plants and the Variable rate.

Table 57

PROJECTED AVERAGE REGIONAL EMPLOYMENT
FOR A LONG-RUN ALUMINUM PRICE OF 65¢/LB.
NO ACTION CASE AND COMBINATIONS

		Variation From No Action Alternative		
		Revenue Protection With 3 Mills Con/Mod	Proposed Var. Rate With 5 Mills Con/Mod	DSI Load Maintenance With 10 Mills Con/Mod
<u>Period/Sector</u>	<u>No Action Case</u>			
<u>FY 1987 - 1991:</u>				
Aluminum	3,390	-148	+30	+688
Other Employment	3,659,752	+488	+156	+44
Total Employment	3,663,142	+340	+186	+732
<u>FY 1992 - 1996:</u>				
Aluminum	3,190	-131	+10	+769
Other Employment	3,975,740	+188	-18	-129
Total Employment	3,978,930	+57	-8	+640
<u>FY 1997 - 2000:</u>				
Aluminum	3,095	-187	+42	+747
Other Employment	4,294,865	-38	+1023	-28
Total Employment	4,297,960	-225	+1065	+719

4.7.1 Impacts on Local Economies in Other Regions

Assuming the overall demand for primary aluminum is not changed by BPA actions, the long-run impacts of BPA actions on the production of metal at regional smelters will result in offsetting impacts on production at smelters outside the PNW. That is, BPA actions which result in greater PNW production will also result in less production elsewhere, and vice-versa. In the near term, the impacts on production at PNW smelters will result in either offsetting changes in production elsewhere or changes in the market price of aluminum (or both). It is primarily the changes in production elsewhere that cause impacts on local economies in other regions.

The magnitude and incidence of impacts on local economies outside the PNW are impossible to predict, but would depend on a number of factors. These include whether the initial impacts on PNW smelters' production from BPA actions were due to changes in capacity (e.g., plant closures) or operating rate (i.e., actual output as a function of capacity); whether the impacts were concentrated on a few smelters or companies, or were spread across all smelters; and the relative magnitudes of the initial impacts.

Generally speaking, initial impacts on PNW smelters that are large in magnitude such as might occur if both the load maintenance Variable rate and a 10 mill/kWh incentive were implemented, that result in significant changes in PNW smelter capacity, and/or have identifiable significant impacts on specific companies would be likely to result in significant impacts on specific local economies elsewhere. Initial impacts on PNW smelters that are smaller, that are diffused across all smelters and companies, or are the result of changes in operating rate only, are more likely to result in imperceptibly small impacts spread across many different local economies elsewhere.

In those cases in which initial impacts of BPA actions on PNW smelters would result in significant secondary impacts on local economies in other regions, these secondary impacts likely would be concentrated either in communities and surrounding regions in which higher-cost smelters owned by the companies which operate in the PNW are located, or in communities and surrounding regions in which other high-cost smelters are located. These communities most likely would be in the Southeastern U.S., the Gulf Coast region, or the Ohio Valley (see Tables 58 and 59). In general, the cost component that exhibits the widest variation among domestic smelters is power costs. The data in Table 59 show that with current power rates the PNW region has slightly lower average costs of power than all but the Northeast region. However, the additional expense of transporting primary aluminum ingot to major eastern markets (estimated at about 3¢/lb.) plus the relative energy and labor inefficiency of some of the older PNW smelters largely offsets this power cost advantage. The Variable rate is designed to return the IP Standard rate (i.e., 22.8 mills kWh) over the proposed 10-year period, thus it does not provide an interregional cost advantage over the long-term. The Variable rate would make the PNW plants more competitive during periods of low aluminum prices, giving them a short-term advantage over other regions during those periods.

On the other hand, the Con/Mod program is intended to improve the efficiency of regional smelters. A 10 percent power use efficiency improvement from this program will effectively put the PNW on a par with the Ohio Valley, and below the average costs of the Southeast and Gulf Coast even after allowance is made for the regional transportation cost disadvantage. On a short-term, cyclical basis, production levels would likely swing more often and more extensively in these higher cost regions as a result of the Variable rate and the Con/Mod program.

The impacts on specific communities would be similar to those identified as potential impacts on the PNW economy and specific PNW communities. That is, fluctuations in operating rates at smelters elsewhere would result in fluctuations in aluminum industry employment, which in turn would have impacts on employment in other industries, particularly service and other nonmanufacturing industries. Permanent closures in smelting capacity elsewhere would result in some permanent job losses and, depending on local labor market conditions and proximity to other labor markets, possibly some out-migration.

Table 58

U.S. PRIMARY ALUMINUM CAPACITY AND POWER RATES 1/PNW Region

<u>Smelter</u>	<u>Capacity</u> <u>2/</u>
Alcoa, Vancouver, WA	110
Alcoa, Wenatchee, WA	205
Columbia Falls, MT	163
Commonwealth, Goldendale, WA	168
Intalco, Bellingham, WA	254
Kaiser, Mead, WA	200
Kaiser, Tacoma, WA	73
Martin Marietta, The Dalles, OR	82 <u>3/</u>
Reynolds, Longview, WA	191
Reynolds, Troutdale, OR	118
Total Capacity	1,564
Weighted Ave. Power Rate (mills/kWh)	22.8 <u>4/</u>

Ohio Valley Region

<u>Smelter</u>	<u>Capacity</u>
Alcan, Sebree KY	163
Alcoa, Warrick, IN	270
Kaiser, Ravenswood, WV	148
Nat. Southwire, Hawesville, KY	165
Noranda, New Madrid, MO	204
Ormet, Hannibal, OH	245
Total Capacity	1,195
Weighted Ave. Power Rate (mills/kWh)	24.1

S.E. Region

<u>Smelter</u>	<u>Capacity</u>
Alcoa, Alcoa, TN	200
Alcoa, Badin, NC	115
Reynolds, Listerhill, AL	183 <u>3/</u>
Alumax, Mt. Holly, SC	181
Conalco, New Johnsonville, TN	132
Total Capacity	811
Weighted Ave. Power Rate (mills/kWh)	28.0

Gulf Coast Region

<u>Smelter</u>	<u>Capacity</u>
Alcoa, Rockdale, TX	310
Kaiser, Chalmette, LA	260 <u>3/</u>
Reynolds, Arkadelphia, AR	62 <u>3/</u>
Reynolds, Jones Mills, AR	113 <u>3/</u>
Total Capacity	745
Weighted Ave. Power Cost (mills/kWh)	26.3

N.E. Region

<u>Smelter</u>	<u>Capacity</u>
Alcoa, Massena, NY	205
Reynolds, Massena, NY	115
Alumax, Frederick, MD	160
Total Capacity	480
Weighted Ave. Power Cost (mills/kWh)	18.5

1/ BPA estimates

2/ In thousands, metric tons per year

3/ Smelter closed and/or written down

4/ Does not reflect self-owned power at lower cost for part of Alcoa, Wenatchee

Table 59

U.S. PRIMARY ALUMINUM POWER COSTS 1/

<u>Region</u>	<u>Capacity</u> (000 MTPY <u>2/</u>)	<u>Weighted Average</u> <u>Power Rate</u> (mills/kWh)	<u>Power</u> <u>Costs</u> <u>3/</u> (¢/lb.)	<u>Adjusted Power</u> <u>Costs</u> <u>4/</u> (¢/lb.)
PNW	1,564	22.8	18.2	16.4
Ohio Valley	1,195	24.1	19.3	
Gulf Coast	745	26.3	21.0	
Southeast	811	28.0	22.4	
Northeast	480	18.5	14.8	

1/ BPA estimates.2/ Metric tons per year.3/ Assumes 8.0 kWh/lb. of aluminum produced for power use efficiency.4/ Assumes 10 percent improvement in power use efficiency under Con/Mod program.4.7.2 Impacts on the Aluminum Industry

Potential impacts on the industry as a whole essentially involve impacts on the market price. It has been suggested that the Variable rate, by lowering the production costs of regional smelters during periods of depressed prices, will tend to keep production levels up at the very time when cuts should be made to bring supply and demand into balance. In some cases, BPA expects supply adjustments (production curtailments) to be shifted to other producing regions, as discussed in section 4.7.1 above. If other supply adjustments were not forthcoming, however, a rough estimate of the short-term impact of additional supply is approximately 1-2¢/lb. reduction in price for aluminum for each 100,000 tons of additional production. This estimate is based on discussions with a number of aluminum industry analysts conducted by BPA in 1984. The actual level of this impact would depend on the level of prices and inventories, and would likely decay over a 1 to 2-year period.

Another potential impact of the Variable rate and Con/Mod program relates to retaliation by other producing regions in the form of competing variable rate and production incentive programs, thereby diluting the effects of the programs in the PNW region. Power rate negotiations are being conducted in various locations around the world as energy surpluses develop and regions compete for energy-intensive industry. In the extreme case, if all aluminum smelters had the price of their electricity linked to the price of aluminum, then the cost structure of the industry would rise and fall with the price.

Since electricity costs are approximately one-third of the variable costs, this cost structure shift would be limited to one-third the rate of price movements. On the other hand, it has been argued by BPA's aluminum smelter customers that the presence of the Variable rate and reduction of the variable cost curve will tend to provide a disincentive to the entrance of new capacity, which will tend to produce upward pressure on prices over the long-term.

4.7.3 Impacts on the U.S. Economy as a Whole

Potential impacts of the Variable Rate and Con/Mod program with respect to the U.S. economy as a whole relate to international trade balances. Generally speaking, increasing the efficiency and lowering costs of PNW smelters through modernization and the Variable rate will improve the competitive position of the U.S. aluminum industry as a whole vis-a-vis world markets. All else being equal, this will tend to reduce the demand for imported aluminum and increase U.S. exports, thus improving trade balance. The actual magnitude of this impact is difficult, if not impossible, to determine at this time, given existing analytical models and techniques. This is due to uncertainty concerning changes in relative strength of the dollar; changes in world prices for fossil fuels, and the resulting production costs of aluminum smelters in other areas; and changes in trade and/or economic development policy with respect to aluminum smelting in other countries.

4.8 DIRECT AND INDIRECT EFFECTS OF THE PROPOSED OPTIONS AND THE ALTERNATIVES

This discussion defines which of the environmental effects of the alternative Variable rates, alternative Con/Mod incentive levels, and the IP-PF link alternatives are direct effects and which are indirect.

4.8.1 Direct Effects

The long-term direct environmental effects of the no action alternative and the revenue protection Variable rate alternative would include a reduction from the current level of air emissions, water pollutants, and aluminum DSI employment resulting from expected smelter closures. The direct effects of the remaining Variable rate and the Con/Mod alternatives and direct cumulative effects of their combinations would be to increase operating levels above the current level at those plants which continue to operate. The degree to which aluminum employment and pollutant levels exceed those under the no action alternative or the revenue protection rate is directly dependent on the impact of each alternative on aluminum smelter operating levels. Taking actions which increase aluminum smelter load on average may also increase the operational impacts of generating resources with consequent changes in air pollution, water quality, and tradeoffs between use of water in the hydrosystem for different purposes, although the existence of this direct impact is also related to other factors such as the ability to market energy to others in the absence of such increased smelter loads.

4.8.2 Indirect Effects

The indirect environmental effects are defined as growth inducing effects and other effects related to induced changes in the patterns of land use, population density, or growth rate, and related effects on air and water and other natural systems. Since the smelters to which the Variable rate or Con/Mod would apply are already existing, the indirect environmental effects are less than if there were new plant construction. The number of employees at some smelters would be expected to decrease, absent any action. Implementation of any of the Con/Mod incentives or Variable rate alternatives (except the revenue protection rate), would result in at least some level of expected smelter employment higher than under no action. Total regionwide employment, however, will be little affected.

Some smelters may continue to operate under some of the alternatives whereas in the absence of any action, they might have closed down. Without any action there could be negative indirect effects as workers and their families left the area of plant closure. There could also be positive physical effects such as diminished air and water pollution.

Indirect effects on land use patterns would be associated with the extent to which the plant site is modified for future use. If operations at a Northwest aluminum plant were no longer economic, plants could be temporarily shut down to wait a more attractive economic environment; plants could be permanently closed and dismantled; or the sites could be made available for an alternate use such as commercial, residential, or agricultural development. Different use of the plant sites in the future might require soil decontamination, depending on the level of fluorides, cyanide, or other harmful materials in the soil. Potliner and other wastes may have to be removed from the sites for disposal. In any event, closed plants would probably remain undisturbed for several years before being sold for scrap and before sites would be cleared for alternative use (see Appendix A, p. 4.75).

The Con/Mod alternatives and the no action and revenue protection alternative could result in load reductions which could mean that the effects of future resource development impacts could be deferred.

4.9 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Since the potential actions do not result in building any new aluminum smelters or any new generation or transmission facilities to serve the existing smelters, there is not a high probability of unavoidable adverse environmental effects. Certain plants could conceivably expand their production capacity if they can do so within their current Power Sales Contracts. The Con/Mod alternatives may enhance this possibility. However, expansion would occur on current plant sites with minimal additional disruption of land. It is not likely, however, that plant expansion would occur under most of the potential actions.

While higher production levels could result in greater levels of air emissions and water pollutants, prior approval from environmental agencies would be needed if generation of pollutants were to exceed currently permitted levels.

4.10 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The 10 aluminum plants in the region were constructed between 1940 and 1970. The existing use of local environments has been and continues to be for operation of nine aluminum smelters. This commitment effectively removed portions of the plant sites from contributing to the natural productivity of the region. Major facilities at most of the aluminum plant sites occupy a fraction of the dedicated sites; hence, the effect of land dedication on regional productivity is minimal. The surrounding environment is relatively unaffected by these facilities (see Appendix A, p. 4.74).

Future plans for the aluminum plant sites generally are for continued use as areas dedicated primarily to aluminum smelting operations, but economic and other factors have resulted in closure of one plant and may result in closure of others at some time in the future. Potential actions contemplated by BPA in this EIS are generally intended to forestall such additional smelter closures.

4.11 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The Northwest aluminum plants were sited many years ago. The associated resource commitments due to plant construction have already been made. Some additional commitment of resources may be made as a consequence of plant modernization, increased smelter production or plant expansion (see Appendix A, p. 4.75). Plant expansion is not regarded as likely under most of the potential actions.

Some additional fossil and nuclear fuel may be used to generate additional energy to serve increased average smelter loads. However, most of the load increase will be borne by hydroelectric energy, which is renewable.

4.11.1 Raw Materials

Several raw materials are consumed in the production of aluminum and are essentially irretrievable. Aluminum is a highly recyclable material, however, and part of the aluminum produced will probably be recycled. A general range of consumption of raw material is shown in Table 60.

4.11.2 Energy

Electrical energy is used in large amounts to produce aluminum. Hydroelectric power is renewable through the global water cycle. Fossil fuel or nuclear-generated power is nonrenewable since the fuel is consumed. The aluminum plants also use fossil fuels directly, primarily natural gas, with some oil and propane. To some degree, these latter fuels can be substituted for each other, so specific quantities of each may vary with price and availability. Table 61 lists electric and fossil fuel energy requirements.

Table 60

RAW MATERIAL REQUIREMENTS FOR ALUMINUM PRODUCTION 1/

Material	Typical Value (lb./lb. of Al produced)
Alumina (Al_2O_3)	1.9
Cryolite (Na_3AlF_6)	0.03 - 0.05
Aluminum fluoride (AlF_3) <u>2/</u>	0.03 - 0.05
Fluorspar (CaF_2) <u>2/</u>	0.003
Anode	
Petroleum coke	0.46 - 0.49
Pitch binder	0.12 - 0.17
Cathode (carbon)	0.02

1/ From Appendix A, p. 4.75.

2/ Either calcium fluoride or aluminum fluoride is added to the cryolite bath to reduce the bath melting point.

Table 61

ENERGY USE 1/

Plant	Electrical Consumption <u>2/</u> (MWHr/yr)	Fossil Fuels <u>2/ 3/</u> (Therms/yr)
Vancouver	2.1×10^6	8.8×10^7
Longview	No data	1.1×10^6
Troutdale	No data	No data
The Dalles <u>4/</u>	1.6×10^6	2.4×10^6
Goldendale	1.9×10^6	2.3×10^6
Wenatchee	3.2×10^6	1.1×10^7
Tacoma	1.2×10^6	1.5×10^6
Ferndale	3.8×10^6	1.0×10^7
Mead	3.8×10^6	1.2×10^6
Columbia Falls	3.2×10^6	1.2×10^7

1/ From Appendix A, p. 4.76.

2/ At capacity operation.

3/ Includes natural gas, propane, and oil.

4/ Energy use when the plant is operated at capacity.

4.11.3 Natural Ecosystems

One of the greatest resources utilized by the siting of aluminum plants is land and the disruption of the natural plant and animal communities that occupied it.

4.11.4 Construction Materials

One potential irretrievable commitment of resources is that of materials used in plant construction or modification to effect Con/Mod under a program. Concrete, reinforcement steel, and other structural materials are examples.

4.11.5 Human Resources

One potential irretrievable commitment of human resources is that used in plant engineering and construction or modification to effect Con/Mod under a program.

4.12 THE SIGNIFICANCE OF THE DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

This section discusses the direct and indirect environmental consequences and their significance to the human environment. The potential actions, except for the revenue protection alternative are generally expected to maintain smelter production, including pollution levels and employment levels, closer to the current levels relative to the no action case. With adoption of the revenue protection Variable rate or in the absence of any action, more plants may close, resulting in decreased pollution and employment levels.

4.12.1 Significance of Direct Environmental Consequences

The impact on pollution levels of each of the potential actions, save the revenue protection alternative, is (to varying degrees) to maintain levels closer to the current levels than would occur under no action. It is not likely that pollution levels at plants would be increased. Furthermore, it is possible one or more plants will close or remain closed regardless of what actions are taken.

Changes in operation of thermal and hydroelectric resources are expected to be minor because of compensating actions BPA would take to market to others any power made available as a result of reduced DSI loads. Changes in operation of hydroelectric resources as a result of action by BPA, or no action, may affect the Columbia River ecosystem and particularly migratory fish, but the effects appear to be minor and neither clearly beneficial nor adverse.

4.12.2 Significance of Indirect Environmental Consequences

The impact on urban quality (community impact) of most of the potential actions is to generally maintain a future level of smelter operation closer to

the current level. In the absence of action by BPA or with the revenue protection Variable rate, the impact on at least some communities is likely to be adverse.

Since the proposed actions will not cause any new smelter, generating resource, or transmission facilities to be built, there is no identifiable impact on historic or cultural resources.

4.13 MITIGATING MEASURES

The proposed Variable rate and IP-PF rate link both reduce the risk to BPA of underrecovery of revenue and therefore serve to protect the other ratepayers from any revenue shortfall. The Con/Mod program, by improving the efficiency of plants, may ensure their existence beyond what it would have been. This continued existence may have a future resource impact. However, the fact that the smelter has participated in a conservation program also may serve to mitigate future resource needs.

All of the aluminum plants are required to comply with Federal and State laws and regulations for protection of the environment. The plant effluents and ambient concentrations of pollutants are monitored and reported to State agencies.

Air pollution control equipment has been installed in the plants to comply with regulatory requirements. Facilities for storage of spent potliners have been improved at several of the plants to prevent cyanide-containing leachate from reaching soil or groundwater. For example, the Tacoma and Mead plants store potliner wastes indoors. Impacts to plants and animals near some of the plants were reported in earlier years, however, reductions in plant effluents appear to have mitigated all of those impacts (see Appendix A p. 4.74).

Any changes in hydroelectric resource operation that might occur as the result of changes in aluminum smelter load will be limited by the constraints concerning aspects of river operation such as flood control, navigation, recreation, and water budget. Additionally, BPA, the U.S. Corps of Engineers, and the Northwest Power Planning Council continue to pursue effective spill, bypass, and transportation programs to facilitate passage of downstream migrating smolts.

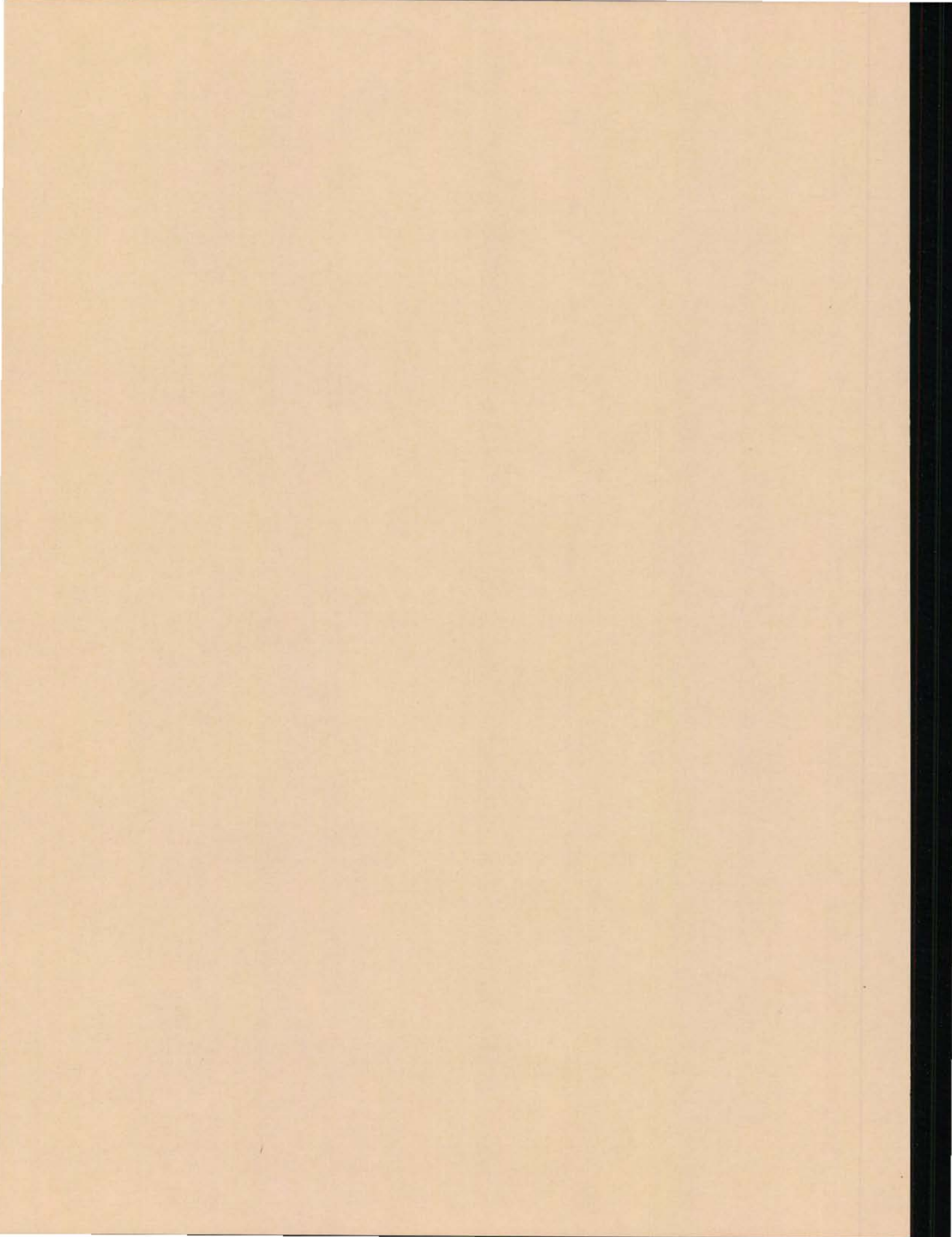
The need for additional BPA mitigation actions has not been identified.

4.14 OTHER ENVIRONMENTAL CONSIDERATIONS

In addition to their responsibilities under the National Environmental Policy Act, Federal agencies such as BPA are required to carry out the provisions of several other Federal environmental laws and regulations to the extent that they apply to the proposed actions under consideration. For the most part, the proposed actions described in this EIS do not require any particular response with regard to the resources covered by these laws. These laws are more concerned with the Federal development-oriented, site-specific proposals

directly affecting the physical environment rather than the rate and Con/Mod issues and interpretations addressed in this EIS. The proposed actions do not involve any direct Federal development and BPA believes that the actions are consistent with all State and local plans or planning activities. A requirement BPA believes must be addressed specifically is Intergovernmental Review and Consultation (Executive Order 12372). BPA has circulated the draft EIS to satisfy the review and consultation requirements in accordance with that executive order.

COMMENTS AND RESPONSES



Chapter 5

COMMENTS AND RESPONSES

The comment letters received or summaries of oral telephone comments are shown on the left-side pages and responses are on the right. The comments and their responses are coded in the margin for ease of identification. The number to the left of the hyphen is the number the letter was assigned when received; the numbers to the right identify separate comments within each letter.

<u>Comment Letter No.</u>	<u>Commentor</u>
1	Wilson Meyer, private citizen
2	Ray Matthew and Mr. Jim Comini, Wasco County Commissioners
3	Sue Heath, State of Montana Clearinghouse Manager
4	Jeffrey Booren, Executive Director, Mid-Columbia Child and Family Center
5	Sid Gould, private citizen
6	Dan Downend, The Dalles High School
7	Walter Hoffman, Hoffman and Son, Inc.
8	Dolores Streeter, State of Oregon Clearinghouse Coordinator
9	Otis Swisher, private citizen
10	Walter Hoffman, Electri-Planners, Inc.
11	Gary Brackett, Tacoma-Pierce County Chamber of Commerce
12	Max Miller, Jr., Counsel for Association of Public Agency Customers
13	E. Zahn, private citizen
14	E. E. Coates, City of Tacoma Department of Utilities
15	Mark Crisson, Direct Service Industries, Inc.
16	Robert Henny, US Corps of Engineers, North Pacific Division
17	John Woodworth, USDOI, Bureau of Reclamation, Pacific Northwest Region
18	Paul Kaufman, Attorney for Public Power Council
19	Thomas Green, State of Idaho Historic Preservation Office
20	Robert Burd, US Environmental Protection Agency, Region 10

CONFERENCE AND TELEPHONE CALL REPORT

Date 1/23/86

No.	Date
SJ-DSI-DEIS-01	1/23/86

TO: DSI Options Study follow-on comment

FROM: Lynn Baker, ALP

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature

cc: ☒ A. Morrell - SJ
☒ Official Record - APP
 (Variable Rate)
☒ Reference Room - ALP
☐
☐
☐

SIDE CALLER OR CONFEREES

SUMMARY OF DISCUSSION

Mr. Wilson Meyer
 3755 Skyline Rd.
 The Dalles, OR 97138

Mr. Meyer opposes BPA assistance in any form to the aluminum plants at The Dalles and Goldendale, because he perceives negative environmental impacts from those plants.

He said cyanide is showing up in the water in The Dalles. Wells at The Dalles have been found to have cyanide in them from top to bottom. He also is concerned about cyanide in the piles of slag outside the plants. Mr. Meyer has notified the EPA of these concerns. His view is that the aluminum companies should clean up the mess they've made and not come back.

Other environmental issues of concern to Mr. Meyer include:

1-2 -- air pollution: An air inversion in 1984 trapped pollutants from the Goldendale plant, damaging local cherry crops. (Damaged the stems at a critical point in their development; reduced crop size.)

1-3 -- impact on fish runs. Flouride contamination in the Columbia near John Day dam from the Goldendale plant and The Dalles plant makes fish lose their way to their spawning grounds. He notes that the fishing is improving now that The Dalles plant is closed.

1-4 Mr. Meyers notes that Comalco now owns the Goldendale plant, and is a new company in the U.S. aluminum market. He suggests the other Northwest aluminum companies would be glad to see the Goldendale and The Dalles plants permanently closed; reduces competition.

DSC-9

PUBLIC INVOLVEMENT	
No.	Date
DSIV-31	JAN 29 1986
Referred to:	
K. Johnson	
Action Taken:	
☐ Ans.	☐ No Reply

Comment
No.

Response

1-1

BPA was aware of the cyanide problem associated with the plant of The Dalles at the time the draft EIS was being prepared (see 4. 4.7 of Appendix A). Since that time more information has been developed, and the U.S. Environmental Protection Agency, the Oregon Department of Environmental Quality, and the Martin-Marietta Corporation have been working toward a solution to the problem. The cyanide bearing wastes have been moved from their former locations to a new, double-lined storage pad to prevent further leaking of cyanide and other pollutants into ground and surface waters. Residual contamination of water and soil remains. Ditches containing contaminated surface water have been diverted so that water flows back onto the plant site. Groundwater monitoring wells are being used to define the extent of groundwater contamination. Thus far, cyanide has been found in groundwater off the plant site to the north, but not towards the main part of The Dalles. An agreement for clean-up of the site is expected to take another 12 to 24 months to resolve under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. (Personal communication with Larry Patterson, Oregon Department of Environmental Quality, March 14, 1986.)

Issues concerning liability for these environmental problems and their clean-up may also be a substantial hurdle in efforts to reopen The Dalles smelter. (Brett Wilcox, Public Hearing Re: Proposed Variable Power Rate, The Dalles, Oregon, February 3, 1986.)

1-2

BPA has contacted persons knowledgeable about the smelters at The Dalles and Goldendale at both the Washington Department of Ecology (WDOE) and the Oregon Department of Environmental Quality. These agencies had no evidence of damage to cherry crops in the area in 1984 or in other recent years. WDOE had evidence of damage to a peach crop at an orchard in Washington located near the bridge that crosses from Biggs Junction about 7 miles west of the Goldendale plant. WDOE was notified of the problem in September 1984; the damage apparently occurred during July 1984. The crop had been diagnosed as having soft suture, an injury associated with fluoride. The orchard owner was subsequently compensated by the plant. WDOE was unaware of the atmospheric conditions at the time of the damage, but knew the plant was operating poorly from an environmental standpoint during this time. The plant had received off-specification coke which is used in the Soderberg electrodes. It caused trouble with the electrodes which caused excessive emissions and the problem took a long time to rectify. The plant exceeded its permitted levels of pollutant emissions at times during this period.

Comment
No.

Response

1-3

BPA is aware of the concern about fluoride discharged from the Goldendale plant delaying fish passage at John Day Dam, as evidenced in studies by Damkaer and Dey (see Appendix A, second paragraph on p. 4.45 and second and third references listed on p. 4.78). The latter of these studies indicated that the problem at John Day seemed to have been alleviated, at least temporarily, as a result of using a lined waste disposal pond beginning in January 1983. The WDOE has required monitoring wells to detect leaks from this pond, should they occur, and has also required a survey of other plant site groundwater that could find its way to the river. The plant must now measure pollutant levels in the river, and they have been below the 0.2 parts per million found by Damkaer and Dey to be at or below the fluoride threshold sensitivity for chinook (personal communication with Ted Mix, WDOE March 7, 1986). This problem currently seems to be under regulatory control.

A similar problem has not been documented at The Dalles. Research has shown undelayed fish passage at The Dalles Dam. The relative locations of the aluminum plant discharges and the fish passageways at The Dalles Dam are different than upstream at John Day Dam, and the effects may be different.

Behavior studies of chinook and coho salmon do demonstrate an adverse effect of fluoride on fish migration.

1-4

This assertion may or may not be true. Closure of one or more Northwest aluminum plants could also cause the power rate for the remaining plants to go up.



WASCO COUNTY

Wasco County Court
5th & Washington
The Dalles, Oregon 97058

ENVIRONMENT	
No.	Date
ST-DSJ-DEIS-CL	2/3/86

William L. Hulse, *County Judge*
Raymond P. Matthew, *County Commissioner*
Jim Comini, *County Commissioner*

January 29, 1986

Mr. Peter T. Johnson
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

After reviewing the proposal of Bonneville Power concerning the DSI Variable Rates, we, the Members of the Wasco County Court (Board of County Commissioners), have passed a Resolution.

We support the concept and hope you will act favorably on the proposal.

Yours very truly,

WASCO COUNTY COURT

Ray Matthew
COUNTY COMMISSIONER

Jim Comini
COUNTY COMMISSIONER

cc: Frank Fisher
Commonwealth Aluminum

Comment
No.

Response

2

This comment has been noted.



GEORGE TURMAN
LIEUTENANT GOVERNOR

State of Montana
Office of The Lieutenant Governor
Helena 59620
(406)444-3111

No.	Date
SJ-DSI-DEIS-03	2/3/86

January 29, 1986

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

RE: Draft Environmental Impact Statement - Direct Service Industry Options
Montana State IGR Clearinghouse SAI No. MT860127-380-X

Dear Mr. Morrell:

The above-captioned document has been received in the Clearinghouse. In order to provide notification to parties that may be interested in review and/or comment on the proposal, it will be listed in the next Intergovernmental Review Bulletin issued from this office.

Any inquiries or comments regarding the proposal will be directed to your office. Please provide copies of the enclosed suggested review form to potential reviewers - those you feel should be invited to comment, as well as to any who may request the opportunity to do so. We have asked that comments be returned to your office by February 21, 1986 as requested, and that copies be sent to the Clearinghouse for our files.

The Clearinghouse intends to take no further action on this proposal.

Sincerely,

A handwritten signature in cursive script that reads "Sue Heath".

SUE HEATH
Clearinghouse Manager

Enclosure

Comment
No.

Response

3

No response required.

ENVIRONMENT	
No.	Date
SJ-DSI-DEIS-04 2/3/86	

Mid-Columbia Child & Family Center, Inc.
3221 W. 10TH ST.
P.O. Box 1050
The Dalles, OR 97058
PHONE (503) 298-5104

January 28, 1986

Peter Johnson
Bonneville Power Administration
1002 N.E. Holladay
Portland, OR 97208-3621

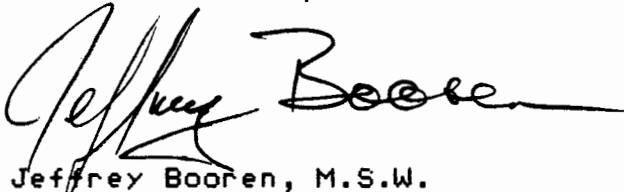
Dear Mr. Johnson:

I have written you on several previous occasions regarding my support for variable rates from BPA for the aluminum industry. As I stated in previous communications, the aluminum industry is vital to the interests of the Northwest both in terms of jobs and in terms of utilization of surplus power. Without the aluminum industry rates for other customers would be greatly increased, further adding to the economic hardships already experienced by our community.

As an Administrator in a mental health facility, we are now beginning to see the ramifications of high unemployment on the well being of our area families. Our agency has been operating at 115% of capacity for the past six months, due to the stresses placed upon our community. I might add that we are also seeing a major jump in the area of child abuse, often associated with the stress due to economic conditions.

I urge your strong consideration for the variable rates as one part of the economic picture for the Pacific Northwest.

Sincerely Yours,



Jeffrey Booren, M.S.W.
Executive Director

JB/jw

cc: Congressman Bob Smith
Senator Bob Packwood
Senator Mark Hatfield
Governor Vic Atiyeh
Representative Wayne Fawbush
Senator Ken Jernstedt
Fl.

Comment
No.

Response

4

This comment has been noted.

U.S. DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION
CONFERENCE AND TELEPHONE CALL REPORT

No.	Date
SS-DSI-DEIS-OS	2/6/86

Date 1/29/86

TO: Sid Gould
 ↑
FROM: Seattle, WA

cc: ☐ K. Johnson

OS

PUBLIC INVOLVEMENT	
No.	Date
DSI-42	JAN 31
Referred to:	
K. Johnson	
Action Taken:	
☐ Yes ☐ No ☐ Pending	

Include all telephone calls and conferences of importance bearing upon policies, customer or public relations, but excluding those purely technical in nature.

TSIDE CALLER OR CONFeree

SUMMARY OF DISCUSSION

Stated that he saw our Ad in the Seattle newspaper on 1/28 and felt that taking less money from the Aluminum plants really is a bad idea. He talked to 14 people in his neighborhood and they all felt the same way.

5-1 | 1. Aluminum plants shouldn't even be in service

5-2 | 2. Aluminum waste is bad
 : bad for environment

3. It kills animals : whales

4. "Get rid of Aluminum plants"

Comment
No.

Response

5-1

The aluminum plants in the Northwest were established between 1940 and 1970. Production of aluminum from some of the plants was an important part of the World War II effort and, today, is an important national commodity. In addition, service to the DSIs provides BPA with roughly one-third of its revenues and a substantial part of its operating reserves, which helps to keep rates to other customers lower. The aluminum smelters have valid power contracts with BPA until June 30, 2001. Unilateral discontinuation of service to the aluminum plants is not an option available to BPA and was not a topic of the EIS. However, the proposals and alternatives analyzed in the EIS can influence the viability of different plants to varying degrees. These impacts are discussed in the Chapter 4 of the EIS.

5-2

Waste from aluminum plants (or improper disposal of aluminum products for that matter) is harmful to the environment. The EIS describes adverse effects of the aluminum smelters served by BPA. Because of regulatory controls, these smelters, as a general rule, do not result in levels of environmental impact that are viewed as excessive by most people or by those who regulate the smelters. There are some residual adverse effects of past practices, such as solid waste disposal, which would remain whether the plants were closed now or not. There is no evidence that any of the smelters operating under current regulatory control and with current pollution control equipment and practices are killing animals or that they have any effects on whales.



The Dalles High School

2421 Wright St.
The Dalles, OR 97058
January 31, 1986

Peter Johnson
Bonneville Power
1002 N.E. Holladay
Portland, OR 97208-3621

Dear Mr. Johnson:

I support the variable rate the BPA has proposed for the Aluminum Industry. We urge you to give the Aluminum Industry every consideration because they are so important to the economy of the Northwest and The Dalles, both as an employer and a consumer of raw materials, supplies and electricity. I feel very strongly that the Aluminum Industry is vital to American interests, both in defense and economically.

Very sincerely yours,

A handwritten signature in dark ink, appearing to read "Dan Downend", is written over a horizontal line.

Dan Downend

Comment
No.

Response

6

This comment has been noted.



ENGINEERING
CONSTRUCTION
MAINTENANCE

HOFFMAN & SON, INC. ELECTRIC
CALIFORNIA CONTRACTORS LICENSE NO. 191821
MAIN OFFICE: 1100 GAVIOTA AVENUE, LONG BEACH, CALIFORNIA 90801 • (213) 591-0571
P. O. BOX 300

INVOICE	
No.	Date
SJ-DSI DEIS-07 2/12/86	

January 30, 1986

Department of Energy
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 92708

Attention: Peter T. Johnson, Administrator

Re: SJ-L1

Dear Mr. Johnson,

Thank you for my copy of the Draft EIS on DSI options. I appreciate being included among those who are interested in and concerned for the future of the Pacific Northwest Aluminum Industry.

My concern involves more than just the PNW Aluminum Industry, and the Socioeconomic impact plant closings have on local communities, as serious as that is. I believe that it is incumbent upon those in authority to have an even broader vision of the environment impacted. What does it mean to the United States of America if we abdicate our position as a major producer of Aluminum?

We are all witnesses to the depressing erosion of this country's industrial base. Steel manufacturing declining; automobile manufacturing losing steadily; agriculture threatened; High tech. and information industries being challenged; and Japan is even moving to "join" in our aircraft manufacturing.

Some of these may have been unavoidable, not amenable to governmental aid, even a type of painful "progress". But this is not so with the PNW Aluminum Industry. This time this country, Our Government, the B.P.A. can do something constructive to save an Industry, to relieve a negative socioeconomic impact on local communities in the PNW, and I submit, on the entire U.S.A. The simple expedient of a favorable rate adjustment for the DSI can halt, in this case at least, our accelerating slide toward becoming a have not, debtor nation. (Consider 1985's record negative balance of payments).

I earnestly urge you to adopt a VARIABLE RATE, or combination Variable Rate and Con/Mod Program.

Yours truly,

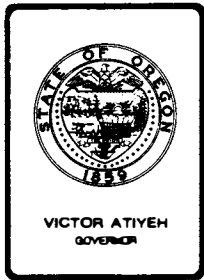

Walter A. Hoffman, P.E.

150

Comment
No.

Response

7 This comment has been noted.



Executive Department

155 COTTAGE STREET NE., SALEM, OREGON 97310

No.	Date
SJ-DSI-DEIS-08	2/18/86

February 11, 1986

Anthony R. Morrell
Environmental Section
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

SUBJECT: Direct Service Industry Proposals
PNRS # OR851231-127-4

Thank you for submitting your draft Environmental Impact Statement for State of Oregon review and comment.

Your draft was referred to the appropriate state agencies for review. The Governor's Office offered the enclosed comments, which should be addressed in preparation of the final Environmental Impact Statement.

We will expect to receive copies of the final statement as required by Council of Environmental Quality Guidelines.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter

Dolores Streeter
Clearinghouse Coordinator

DS:bm
Enclosure



OREGON INTERGOVERNMENTAL PROJECT REVIEW

RECEIVED

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N. E.
Salem, Oregon 97310

DEPARTMENT OF ENERGY

Statewide

Phone (503)378-3732 or Toll Free in Oregon 1-800-422-3600

STATE AGENCY REVIEW

Project Number: **OR 851231-127-1** Return Date: **FEB 07 1986**

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the return date.

ENVIRONMENTAL IMPACT REVIEW
DRAFT STATEMENT

- () This project has no significant environmental impact.
- () The environmental impact is adequately described.
- () We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.
- () No comment.

Remarks

We will be commenting through the PUC rate making process - through the Dept. of Energy agency on a BPA working group. But conceptually we agree

Agency

Governor's Office

By

Pat Anderson

IPR #5

Comment
No.

Response

8

This comment has been noted.

February 14, 1986

No	Date
SJ-DSI-DEIS-09	2/15/86

Anthony K. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

re: Draft EIS on DSI options

9-1

I object to the shortening of the comment time to 22 days. You have been working on the proposals for months. Why the sudden hurry to resolve the issue in a less-than-prescribed or required time? It may not be your intent, but you are in effect saying "Public, all we need is an off-the-cuff response from you, not one based on a careful study of the proposals and their implications." I believe that the proposals will affect us for 20 years, and deserve a greater response period than 22 days.

9-2

None of the "Models" used has had a "Model for fisheries" (Pg. 48). In the "Environmental Consequences (Pg. 50) there is no mention of fisheries. In the "Unavoidable Adverse Environmental Effects" (Pgs. 81 and following) there is nothing about fisheries, or even the water requirements for fisheries. In "Mitigating Measures" 4.7.7 (Pg. 85) Fisheries are not mentioned.

I object to the omission of fisheries from this EIS.

It is my studied conclusion that this EIS feels that the present, and future, situation on Columbia River fisheries is taken care of satisfactorily by present Federal/State/Local requirements and their present applications by BPA and the smelters/dams/cities, etc.

I further conclude that you feel that these requirements and present applications do not need improving; or, WORSE, that they CANNOT be improved.

9-3

I strongly disagree! And, I feel that NOW is the time for input to make improvements in those regulations and their application on behalf of fisheries.

Potential improvements, necessary improvements, are almost legion: up-stream passage, down-stream passage, timing of water flows, nitrogen kills, just name a few.

A "set aside" of water for fisheries has been begun, but must be improved so that 20 years from now degradation of the fishery will have been halted and improved fisheries will have been realized.

To maintain "status quo" for 20 years is not acceptable. Undoubtedly the Oregon Department of Fish/Wildlife has improvements, changes, and implementations they would like to see on behalf of fisheries. They should be done NOW.

Comment
No.

Response

- 9-1 The shortened comment period on the draft EIS was approved by the U.S. Environmental Protection Agency in accordance with Section 1506.10(d) of the Council on Environmental Quality regulations for implementing the National Environmental Policy Act. This shortened review period was perceived at the time to be necessary to complete a separate rate hearing process and allow implementation of the Variable rate upon expiration of the current incentive rate on June 30, 1986.
- 9-2 This is correct; the Decision Analysis Model (model) does not contain a module for estimating possible impacts to fish. However, as discussed in the draft and final EIS, several features made the model the better tool for analysis. The most important was that the model provides an overall picture of the Northwest's aluminum smelter and utility economics and operations, and useful output such as regionwide employment figures (draft EIS, p. 46).
- A discussion on fish was provided in chapter 4, Environmental Consequences, of the draft EIS for the no action alternative (draft EIS, pp. 55 and 56). The proposed actions and their alternatives were then compared to the resource operations and development discussion of the no action alternative (draft EIS, pp. 63, 64, 72, 75, and 77).
- BPA would continue hydroelectric resource operation within the constraints established by the U.S. Corps of Engineers, the Bureau of Reclamation, and the Northwest Power Planning Council.
- 9-3 BPA agrees that improvements need to be made and takes seriously its responsibilities under the Northwest Power Act to mitigate and enhance Northwest fisheries. Improvements such as fish screens, fish ladders, trap and haul programs, research, etc., are being carried out through BPA's Fish and Wildlife Program. The no action alternative and the proposals and their alternatives addressed in this EIS are consistent with BPA's enhancement and mitigation efforts.

Anthony R. Morrell, Environmental Manager
BPA, Portland, Oregon

9-4

Cumulative Effects of the alternatives are pertinent to the decision which is being made. I found no reference to this aspect of the problem in any part of this EIS.

Lastly, this document clearly hints at the unwise, unwanted, and unnecessary decision to stay with a NO ACTION ALTERNATIVE.

9-5

At the same time, this document has chosen arbitrarily, and before-hand, a NO ACTION ALTERNATIVE AS FAR AS FISHERIES ARE CONCERNED.

This decision, NO ACTION ALTERNATIVE AS FAR AS FISHERIES ARE CONCERNED, is unwise, unwanted, and unnecessary; and it should not be allowed to stand!

Sincerely yours,



Otis D. Swisher
PO Box 1582
Medford, Oregon 97501-0120

copies to:

CDFW

Senators Hatfield/Packwood

Representatives Smith, Weaver, AuCoin, Wyden

Comment
No.

Response

9-4

The cumulative effects of the no action alternative and the proposals and their alternatives were addressed and compared in the draft EIS in section 2.5, Environmental Consequences Summary and in section 4.6. Specifically, Table 3 in Chapter 2 compares the proposals and their alternatives to the no action alternative, as well as combinations of the proposals/alternatives. The final analysis of cumulative effects of the proposals and alternatives is contained in the same parts of the final EIS.

9-5

BPA has indicated both in the draft EIS and the Variable rate and Con/Mod public involvement processes that the Variable rate and the Con/Mod program are its proposed actions -- not the no action alternative. CEQ regulations (1502.14) require that Federal agencies explore and objectively evaluate any proposed action(s) and any reasonable alternatives which includes a no action alternative.

BPA's purposes for preparing this EIS were to maintain the DSI load in order to facilitate resource operational planning and to stabilize BPA's revenues. Discussion in Chapter 4, Environmental Consequences, address the impacts of selecting the no action alternative.



ELECTRI-PLANNERS, INC.

211 EAST COLUMBINE AVENUE / SANTA ANA / CALIFORNIA 92707 / TEL. (714) 540-4944

ENVIRONMENT	
No.	Date
ST-DSI-DEFS-10	2/20/86

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 92708

Re: SJ-L1

Attn: Peter T. Johnson, Administrator

Dear Mr. Johnson,

Thank you for my copy of the Draft EIS on DSI options. I appreciate being included among those who are interested in and concerned for the future of the Pacific Northwest Aluminum Industry.

My concern involves more than just the PNW Aluminum Industry, and the Socioeconomic impact plant closings have on local communities, as serious as that is. I believe that it is incumbent upon those in authority to have an even broader vision of the environment impacted. What does it mean to The United States of America if we abdicate our position as a major producer of aluminum?

We are all witnesses to the depressing erosion of this country's industrial base. Steel manufacturing declining; automobile manufacturing losing steadily; agriculture threatened; High tech. and information industries being challenged; and Japan is even moving to "join" in our aircraft manufacturing.

Some of these may have been unavoidable, not amenable to governmental aid, even a type of painful "progress". But this is not so with the PNW Aluminum Industry. This time this country, Our Government, the B.P.A. can do something constructive to save an Industry, to relieve a negative socioeconomic impact on local communities in the PNW, and I submit, on the entire U.S.A. The simple expedient of a favorable rate adjustment for the DSI can halt, in this case at least, our accelerating slide toward becoming a have not, debtor nation. (Consider 1985's record negative balance of payments).

I earnestly urge you to adopt a **Variable Rate**, or combination Variable Rate and Con/Mod Program.

Yours Truly,


Walter A. Hoffman, P.E.

Comment
No.

Response

10

This comment has been noted.



TACOMA-PIERCE COUNTY CHAMBER OF COMMERCE

ENVIRONMENT	
No.	Date
SJ-DSL-DEIS-11	2/20/86

February 13, 1986

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

RE: Draft EIS Direct Service Industry Options

Dear Mr. Morrell:

Thank you for the opportunity to comment on this draft EIS. Tacomans recognize the importance of the direct service industries, especially aluminum, to the Northwest economy. And, we appreciate the contributions of Kaiser to our local economy.

11-1 The Tacoma community has suffered a higher unemployment rate for more than a decade. Our burdens pre-dated the woes of the timber industry. Therefore, we are sensitive to any job loss, even from a plant that represents only a fraction of our total employment base. The draft EIS notes how additional unemployment here might overburden the mitigating resources. This observation is taken too lightly in view of federal trends to reducing the monies to local governments for these very types of mitigating resources.

11-2 The purpose of the options, assuring BPA of a financially secure resource, should also consider employment displacements and economic losses of other industries if the electric rate must be raised to maintain BPA's revenue base after a loss of direct service industries. These inputs on the local community, coupled with national trends and international pressures, can cause structural changes in local economies.

735 SE HELENS, POST OFFICE BOX 1933, TACOMA, WA 98401
PHONE: 206-627-2175



Comment
No.

Response

- 11-1 Appendix A of the draft EIS discusses the impact to public services and social organization (pp. 4.53 and 4.54). As noted in the appendix, Tacoma and Pierce County have demonstrated intent and ability to assist displaced workers and their families. It is also noted that the availability of these adequate resources is heavily dependent upon the broader economic and social climate of the area at the time. This statement reflects, indirectly, the trend mentioned. However, the fact that the Kaiser smelter accounts for less than 1 percent of all wage and salary jobs in Pierce County and because of large tax bases and diversity of service recipients in both Tacoma and Pierce counties, significant structural or service-level effects still are not anticipated.
- 11-2 Section 3.2.3 describes other Pacific Northwest industries with emphasis on the importance of electric power rates on their economic health. For most non-DSI Pacific Northwest industries, electric power rates are a less significant factor in their operations than for the DSIS. Other factors, principally relating to the strength of the markets for their respective products, are typically much more important than electricity prices to operations of non-DSI industries. Changes in wholesale electric power rates as a result of any of the options, alternatives, or combinations analyzed in the final EIS are projected to be small. Therefore significant changes in employment or other economic effects outside the aluminum industry or directly related to the aluminum industry are not expected. This is shown by the small employment impacts projected on a regional basis by the model. (See sections 4.2.3, 4.2.4.3, 4.3.3, 4.3.4, 4.4.4, 4.4.5, 4.6.3, and 4.6.4 of the final EIS. Section 4.7 discusses effects on other aluminum producing areas in the United States.)

11-3

A reference on the problems of generally rising rates, potentially caused by the quitting of direct service industries from the BPA system is: "Impact of Electric Rates on Tacoma's Economic Development Phase I Final Report." A copy is enclosed for your convenience.

After all, we all understand the unemployment rate is only a (small)%, unless you are unemployed; then it become 100%.

Sincerely,



Gary D. Brackett, Manager
Business/Industry Council

GDB/dr

Comment
No.

Response

11-3

The report provided has been reviewed by BPA staff and was considered in preparation of the final EIS. See section 3.2.3, Non-DSI Consumer Sectors.

LAW OFFICES
GARVEY, SCHUBERT, ADAMS & BARER
A PARTNERSHIP OF PROFESSIONAL CORPORATIONS

SUITE 2650
1211 S.W. FIFTH AVENUE
PORTLAND, OREGON 97204
(503) 228-3939

TELEX: 32-1037 (LEX SEA)
CABLE: LEX-SEATTLE

TELECOPIER
(503) 226-0259

PLEASE REPLY TO PORTLAND OFFICE

February 20, 1986

SEATTLE

BROCK ADAMS
JOHN R. ALLISON
JOHN W. ATTEY
STANLEY H. BARER
BOBBE J. BRIDGE
BRUCE M. BROOKS
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DAVID R. WEST
FRANK C. WOODRUFF

OF COUNSEL

GREGORY R. DALLAIRE
BRUCE D. ERICKSON
A. DANIEL D'NEAL

WASHINGTON, D.C.

DANIEL J. ABDUN-NABI
BROCK ADAMS
HAROLD G. BAILEY, JR.
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PORTLAND

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MAX M. MILLER, JR.
PAMELA GRACE RAPP

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ANTHONY GARY
CYNTHIA L. MITCHELL
BRUCE A. ROBERTSON

Hand Delivered

Mr. Anthony R. Morrell
Environmental Manager
Environment Office
Bonneville Power Administration
1002 N.E. Holladay - 7th Floor
Portland, OR 97232

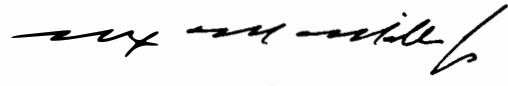
Re: Comments Regarding The Draft EIS On
The Direct Service Industry Options

Dear Mr. Morrell:

Please find enclosed the comments of the Association of Public
Agency Customers (APAC) regarding the Draft EIS on the Direct
Service Industry Options.

Sincerely,

GARVEY, SCHUBERT, ADAMS & BARER
A Partnership of Professional Corporations

By 
Max M. Miller, Jr.
Counsel for the Association
of Public Agency Customers

MMM:tr
Enclosure

COMMENTS OF THE ASSOCIATION OF
PUBLIC AGENCY CUSTOMERS REGARDING THE
DRAFT EIS ON THE DIRECT SERVICE INDUSTRY OPTIONS

I. Introduction

The Association of Public Agency Customers (APAC) is a consortium of large industrial consumers of electric power purchased from the preference customers of the Bonneville Power Administration (BPA). APAC's primary concern regarding the Draft Environmental Impact Statement on the Direct Service Industry Options is that it is wholly inadequate for use by the Administrator as a tool for evaluating (1) whether or not to adopt a variable industrial power rate, or (2) what form a variable rate should take. Therefore, these comments focus on the variable rate portion of the EIS.

APAC's recommendations for changing BPA's initially proposed variable rate are contained in its testimony submitted in the variable rate case, BPA No. VI-86. We will not repeat our proposal here. The purpose of our modifications, however, is to create a variable rate schedule that: (1) will perform the function BPA wants it to perform if actual loads, resources, opportunity costs of power, and aluminum prices are within the ranges assumed by BPA in preparation of its initial proposal; but (2) will protect BPA's other regional customers from significant adverse impact, if actual experience is different from BPA's forecasts. In other words, APAC proposes the incorporation of risk mitigation factors, including a revenue accounting mechanism like that referenced in the Draft EIS at 17.

II. Discussion

12-1 The Draft EIS is inadequate to evaluate the value of such risk mitigation factors because it is not designed to evaluate the actual risk of adopting a ten-year variable rate. The Draft simply assumes that actual experience will fall within the narrow range of BPA's forecasts. APAC does not have an overwhelming concern that if BPA's forecasts of its own loads and resources, aluminum prices, and the opportunity cost of power delivered to the DSIs are accurate, the variable rate will result in acute harm to its members. APAC has strong concern, however, that if these notoriously unpredictable variables do not track BPA's forecasts, APAC's members and the region may be greatly harmed. In order to evaluate this risk of substantial harm, the Draft EIS must incorporate at least the following three major changes.

12-2 First, APAC proposes that in order for the EIS to be useful, it must analyze the impact on the affected environment that would occur if, for example, the variable rate resulted in a \$250 million shortfall in the first 3 years and \$450 million shortfall in the first 5 years, when compared to what BPA would have received if the same load had been served at the IP Standard rate. This result is within the range of possible outcomes and should be studied. It would have significant impact on BPA's other customers and their consumers because BPA proposes to allocate any revenue underrecovery resulting from the variable rate to other customers.

Comment No.	Response
12-1	For the final EIS, an additional aluminum price scenario has been analyzed to assess the impacts of the proposals and alternatives if future aluminum prices are low.
12-2	The actual over- or underrecovery in any given year is a function of a number of factors, none of which can be viewed in isolation from the others, i.e., cost and load. It is the combination of these factors that result in over- or underrecoveries. In some cases a deviation in one may offset the deviation in another and thus BPA's revenues are sufficient to meet its financial obligation. The precise scenario suggested has not been analyzed for the final EIS. Many factors determine BPA's revenues and costs. BPA establishes its rates on a prospective basis, i.e., it forecasts loads, including DSI loads, and costs for a future period and establishes its rates to recover the correct share of its costs from each rate class, in accordance with the Pacific Northwest Power Act. With a Variable rate for the aluminum smelter DSIs, the rate form becomes just one more factor to account for in the rate-setting process. Over- or underrecovery occurs when loads and/or costs deviate from those used to determine the rates. These deviations may relate to the forecasts of preference customer loads, BPA's efforts in secondary markets (both surplus firm and nonfirm), or many other factors besides those relating to the aluminum smelters. The Decision Analysis Model deals with over- or underrecovery in a similar way. For a given year in a given game, it sets rates at the start of that year for various customer classes based on internally forecasted data. At the end of the year, due to the randomness in the model, it is likely that there would be higher or lower costs or loads than when the rates were fixed, leading to an "over- or underrecovery." These amounts are held in an account in the model, and totalled. When the value of this account exceeds a certain value (500 million), the surplus revenues collected are allocated to different rate pools and a downward rate adjustment is made for the following year. If the value in this account ever becomes negative, rates are increased for the next 1 to 2 years by an amount that would bring the account back to zero if there were no other over- or underrecoveries.

12-3 Second, in order to evaluate the environmental impact of such an occurrence, the EIS should include an industry-by-industry impact analysis for every energy-intensive industry served by public (as well as private) utility customers of BPA. The Draft EIS' "analysis" of other industries is both inadequate and inaccurate. The analysis that runs from the bottom of page 65 through page 66 of the Draft is based exclusively on one page of the Final 1983 Wholesale Power Rate EIS. Even if one were to assume that the 1983 EIS was accurate at the time it was produced, the effect of electricity prices on these industries has changed since 1983. The Draft does not rely heavily upon the 1983 Wholesale Power Rate EIS for its analysis of the DSIs. BPA should not rely upon that document for other industries either.

12-4 A specific example of the inaccuracy which results from such reliance is the statement that "[t]he costs of power purchased from BPA for these consumers account for a relatively small portion of total electricity costs." Draft at 65. BPA need only look at its 1985 rate case Industrial Margin Study to see that it is common for public utilities to charge the BPA priority firm rate plus a markup to their retail industrial customers. In these instances, BPA's rate is the primary variable in determining the retail rate charged to industrial consumers.

12-5 Another statement in the EIS is particularly disturbing: "[o]ther measures [that may be taken by large energy-intensive industries in response to major rate increases] could include installation of fuel switching capabilities or installing onsite generation." Draft at 66. In other words, in an EIS

Comment No.	Response
12-3	Further consideration of impacts on other industries has been given. See section 3 of the final EIS.
12-4	Further discussion of major consumer sectors has been given. See section 3.2.3 of the final EIS. A reference to the <u>Industrial Margin Study</u> has been included in section 3.2.3, along with a statement that BPA power costs accounted for most of the electricity costs paid by industries included in that study. Section 4.2.3 of the final EIS states that BPA power costs account for only a portion of the rates paid by non-DSI consumers. The characterization in the draft EIS of BPA power costs as "a relatively small portion of total electricity costs" does not appear in the final EIS. The final EIS does emphasize that for most non-DSI industries, as well as most commercial and agricultural consumers, electricity costs account for a small portion of total operating costs and that other factors (e.g., product markets) are more influential determinants of economic health. See sections 3.2.3 and 4.2.3, of final EIS.
12-5	See section 3.2.3 of the final EIS for further discussion. The discussion of measures which industries can take in response to electricity price increases appears in the draft EIS and the final EIS to provide information on how industries in general and particularly those industries that are sensitive to electricity prices, may respond during periods of increasing rates. The discussion does not, and was not intended to, foretell massive rate increases to non-DSI consumers as a result of actions which BPA is considering in this EIS. In fact, a paramount consideration with respect to the Variable rate, Con/Mod or the IP-PF rate link will be to assure that the region's non-DSI customers will be made better off or, at worst, held harmless by any action taken by the Administrator. Far from being a tacit admission of "potential loss of priority firm load and associated revenue resulting from an effort to preserve DSI load and associated revenue," the analyses presented in both the draft and final EIS identify no significant adverse rate impacts to BPA's non-DSI customer utilities or their consumers. See sections 4.2.3, 4.3.3, 4.4.4 and 4.6.3 of final EIS. The final EIS does address the general adverse rate impacts associated with loss of DSI plants, particularly under the no action alternative. See section 4.2.3 of final EIS. In addition, section 3.2.3 of the final EIS cites potential adverse impacts from DSI aluminum plant shutdowns on non-DSI industries who supply materials to aluminum smelters. Such non-DSI industries could be adversely affected by loss of a major product market.

12-5

to evaluate the impact of a rate measure designed to retain DSI load in order to generate BPA revenue, BPA suggests as mitigation to a potential harmful impact of this measure that other consumers of BPA's energy should remove their load from BPA-served utilities. BPA tacitly admits, but fails to quantify, the potential loss of priority firm load and associated revenue resulting from an effort to preserve DSI load and associated revenue.

12-6

Third, after BPA performs a meaningful analysis of the impacts of a potential large-scale revenue deficiency resulting from implementation of a variable rate, BPA should model a variable rate with a revenue accounting mechanism like that referenced in the Draft at 17. Once BPA recognizes that implementation of the proposed variable rate has the potential of having much greater environmental impact than that considered in the Draft, and specifically that it has the potential to result in severe impact on other BPA customers and their consumers, a variable rate with a revenue accounting mechanism becomes an alternative that has a high likelihood of minimizing the risk of those impacts. As such, it should be modeled.

III. Conclusion

12-7

In summary, the Draft EIS is an inadequate tool for the Administrator or anyone else to use to evaluate the variable rate proposal. First, the Draft EIS ignores the only real risk of the proposed rate -- the risk that due to some combination of lower than expected aluminum prices, higher than expected resource costs, and higher than proposed opportunity costs, BPA

Comment
No.

Response

12-6

The DSI Decision Analysis Model is already fairly complex. Adding another level in order to model a "revenue accounting mechanism" has been determined to not be feasible. The final EIS now more thoroughly addresses the impact of a revenue accounting mechanism as an alternative within the Variable rate option (see sections 2.2.4 and 4.2.3.4 of the final EIS).

12-7

The EIS is only one of the tools the Administrator uses in making his decisions. Information from the Variable rate hearings, Con/Mod program meetings, public review of both proposals, and any studies undertaken by BPA and others also serve as decision tools.

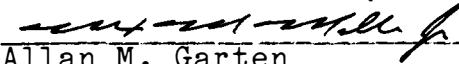
Based upon comments BPA has received on the draft EIS, the Variable rate proposal, and the Con/Mod program, modifications and additions have been made to the Decision Analysis Model. Impacts to other energy-intensive industries served by BPA's public utility and investor-owned utility customers also have been analyzed (see answers to comments 12-1 through 12-6 and 11-2). These modifications, additions, and analyses have made the final EIS a better decision tool for the Administrator.

12-8 will significantly underrecover the revenue that it could receive if it retained the IP Standard rate. Second, the Draft EIS ignores the real impact that this revenue underrecovery could have on BPA's other customers and particularly other high load factor industrial consumers. Third, partially as a result of the Draft EIS' failure to identify and evaluate the real risk of the proposed variable rate, BPA decided not to model the alternative it identifies as a revenue accounting mechanism alternative. Nor does it evaluate any other alternatives with meaningful risk mitigation measures included such as take-or-pay provisions, a shorter term for the variable rate, or a variable rate with a steeper upper slope than that proposed. Unless the Draft EIS is rewritten to overcome these deficiencies, it should not be relied upon by the Administrator for any decision making with regard to the proposed variable rate.

Dated February 20, 1986.

Respectfully submitted,

GARVEY, SCHUBERT, ADAMS & BARER
A Partnership of Professional
Corporations

By 
Allan M. Garten
Max M. Miller, Jr.

Counsel for the Association of
Public Agency Customers

Comment
No.

Response

12-8

The alternative of a "take-or-pay" provision and a shorter term have been discussed in the final EIS (see sections 2.2.4 and 4.3.3). The revenue protection Variable rate alternative analyzed contains a steeper upper slope. Merely changing the proposed Variable rate by making the upper slope greater would not result in environmental impacts substantively different from those of the proposal unless the slope were made so steep that it acted as a disincentive to operate more at higher aluminum prices.

JS-DSI-DEUS-13 2/20/86

OS

PUBLIC INVOLVEMENT	
No.	Date
DSIV-139	FEB 19 1986
Referred to:	
K. Johnson	
Action Taken:	
☐ Ans. ☐ No Reply	

The Director of the Bonneville Power Administration
Portland, Oregon

The need for wisdom is most evident in this puzzling presentation of notions in regard to stable rates for domestic customers, a primary purpose, as in conflict with aiding the Pacific Northwest aluminum industry, which is not an appropriate function.

And added to these notions is the unwitting development of surplus power which development is not repaid.

13-1 It seems too much like glorified welfare to consider a need for jobs-as the communities with surplus labor have only themselves to blame. If there is no incentive for Planned Parenthood--then welfare for excess job seekers is a better alternative than for the BPA to believe that it has an obligation to aid one industry unless it aids all industry which is in trouble because of foreign competition or environmental pollution which necessitates plant modernization. There is objection to the notion that surplus power will be needed for growth. Growth is too one-sided. Man is the worst predator, and the ecosystems suffer. The public lands are already mainly degraded or destroyed as wildlife habitat-as the logging, mineral development, and grazing for instance make public lands not for multiple use as man is the sole user in the long run. Growth is not the goal. The need for dams has been exaggerated. The need for nuclear plants is a problem not only if there is surplus power as there is also the problem of nuclear waste disposal. So why not restore the land to natural state; close the surplus aluminum plants, and tell these communities that if there is surplus population, then there is a need for responsible social planning including responsible parenting instead of the baby crop being used as the factor of influence.

13-2

13-3 There is a problem in the variability of surplus power which may mean that fisheries could be impacted if hydropower is the source of power. It seems wrong that there are still projects under construction tho. The power marketing obligations have been extended beyond acceptability - environmentally and economically-with the idea that reimbursement is due if energy saved through efficiency improvements.

13-4

Thank you for wiser and less activity, E. Zahn,
295 Fleet Drive, Port Ludlow, WA 98365 2-15-86

Comment
No.

Response

13-1

As stated in the draft EIS, the purpose and need for BPA's proposed actions is to facilitate BPA's resource operational planning and BPA's revenues (p. 1). Additionally, the implementation of a Variable rate or a Con/Mod program is not intended to forestall closure of plants that are not economic over the medium to long-term (p. 11).

BPA is currently studying how a Con/Mod program for other industries in the region might be developed, since it recognizes that most energy-intensive industries, as well as BPA, could benefit from conservation/modernization.

13-2

Part of BPA's mission is to market and transmit energy in an environmentally-sound fashion; it is not to educate the population on "responsible social planning." The purpose of the EIS was to evaluate BPA's proposed actions (see answer to comment 9-5). To analyze closure of all the smelters and restoration of those plant sites to a natural state was not in the scope of the EIS nor would it be an action that this Federal agency could undertake unilaterally. However, the impacts associated with closure of the smelters have been addressed in Appendix A of the EIS.

13-3

In the draft EIS, section 2.5, Environmental Consequences Summary, and Table 3 showed the potential impacts on operation of the Federal Columbia River Power System. Variations in amount of spill or sales of surplus power can be expected depending upon which actions or combinations of actions BPA implements. However, those variations are relatively small and would be within established operational constraints.

In addition, section 4.2.2 of the draft EIS, Resource Operations and Development, discusses how BPA could use freed up power for nonfirm or firm sales, dependent upon certain conditions, and how spill could be affected, thereby impacting fish, either beneficially or adversely (pp. 54-56). Generally, the loss of aluminum smelter load would be beneficial to fish. If loads are maintained or possibly increased through implementation of the Variable rate or Con/Mod program, impacts to fish would not be substantially less or greater than currently occurring.

13-4

BPA is attempting to solve several problems: the unstable aluminum DSI load; uncertainty with regard to BPA's resource planning and operation; increasing regional rates; continuing scheduled U.S. Treasury payments; and establishing a rate relationship between the rate charged the DSIs and the rate charged BPA's public agency and cooperative customers. In addition to the Variable rate, the Con/Mod program and its incentives would help solve BPA's resource operation and planning and unsteady load problems, and would enable BPA to

Comment
No.

Response

continue scheduled U.S. Treasury payments. Conservation incentives are being offered because it has not been demonstrated that DSIs would voluntarily conserve or modernize on their own, particularly in light of their current economic condition. See also the response to comment 18-10.

DIVISIONS

Light
Water
Belt Line



City of Tacoma
WASHINGTON
DEPARTMENT OF PUBLIC UTILITIES

ENVIRONMENTAL	
NO ST-DSI-DEIS-14	Date 2/21/86
Please address reply to: City of Tacoma Department of Public Utilities P.O. Box 11007 Tacoma, Washington 98411 (206) 383-2471	

February 19, 1986

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

RE: BPA File No: SJ-L1

Enclosed are the City of Tacoma, Department of Public Utilities' comments on the Draft Environmental Impact Statement for Direct Service Industry Options. We appreciate the opportunity to review and comment, and commend BPA's effort at customer involvement on an issue which has a broad regional impact. We hope that these comments provide some insight into what is obviously a multidimensional issue.

Yours very truly,

E. E. Coates
Acting Director of Utilities

Enc.

CITY OF TACOMA

DEPARTMENT OF PUBLIC UTILITIES

Comments On

Draft Environmental Impact Statement

DIRECT SERVICE INDUSTRY OPTIONS

The City of Tacoma, Department of Public Utilities, Light Division has reviewed the Draft Environmental Impact Statement for the Direct Service Industry Options and appreciates the opportunity to comment. We have participated in the development of comments provided by the Public Power Council on various aspects of this entire issue and we strongly support those positions. We felt however, that there were several areas of specific concern which we wanted to emphasize under separate cover.

Variable Rate:

14-1 The Tacoma Light Division is sensitive to the need to balance the various and often times conflicting goals vis-a-vis the regional DSI aluminum smelting companies. We are particularly sensitive to the local socio-economic impacts because of the presence of one of those smelters in the Greater Tacoma Metropolitan Area. Nonetheless, we feel strongly that first and foremost, the Bonneville Power Administration (BPA) must act within its charter as mandated by the Pacific Northwest Electric Power Planning and Conservation Act of 1980. It would seem that several of the alternatives offered in the EIS are more consistent with that goal than others. Another issue, not addressed directly in your draft discussion, are the negative socioeconomic impacts on other non-DSI industrial customers in the Pacific Northwest, especially those industries served by Public Utilities who purchase some or all of their power from BPA at the PF rate.

14-2 Specifically, we support your recognition of the fact that any potential variable rate design must have as a clearly recognized goal, ultimate collection of the IP standard rate on average over the designated time frame. We strongly feel that the EIS understates the potential rate impact of the proposed variable rate. To the extent that undercollection of IP revenues under this proposal would have to be offset by additional revenue, which could only be derived from BPA's other customers through higher rates, you have neglected to calculate or even mention the negative socioeconomic impacts on these other customer groups.

14-3 We believe that if those impacts are indeed quantified, that some form of truing up or balancing account is a necessity. There is a major degree of difference in revenue shortfalls which occur as a result of imperfect knowledge as opposed to those which occur through intentional rate design, in the hopes that revenue will increase

Comment
No.

Response

- 14-1 The Pacific Northwest Power Act mandates several activities for BPA. One is establishing, reviewing, and revising rates for the sale of energy in accordance with sound business principles and costs associated with the acquisition, conservation, and transmission of electric power (section 7(a)(1)). Another is to acquire resources through conservation and implement conservation measures consistent with the Regional Planning Council's Energy Plan; this includes technical and financial assistance to customers to encourage maximum cost-effective voluntary conservation (section 6(a)(1) and 6(a)(1)(B)). The proposed actions and their alternatives are consistent with BPA's mandates as well as potential solutions to the problems faced by BPA (draft and final EISs, pp. 1 and 2). Furthermore, the Council on Environmental Quality regulations for implementing the National Environmental Policy Act directs agencies to consider in an EIS "reasonable alternatives not within jurisdiction of the lead agency" (section 1502.14(c)).
- 14-2 This issue is considered further in the final EIS (see section 3.2.3).
- 14-3 Socioeconomic impacts as a result of rate impacts on non-DSI customers are more fully addressed in the final EIS (see section 3.2.3).
- 14-4 The effects of a "truing-up" mechanism and other potential means of mitigating potential revenue shortfalls are discussed in Chapter 4 of the final EIS.

14-4

somewhere down the line. To that end, we would strongly endorse the establishment of some sort of balancing account for those companies which choose to take advantage of the variable rate, if and when it is finally implemented. This would allow BPA to pursue the various goals established for this rate, that is, revenue maximization, stable loads, and compliance with the rate directives contained in Section 7 of the Pacific Northwest Power Act. In the event, that aluminum prices strengthened considerably, excess revenues would be refunded to the companies in some manner. In the event that the price of aluminum did not reach levels where all of the DSI aluminum smelters were able to operate profitably, a certain deficit would be incurred by the company or class. If for whatever reason, those companies were unable to repay that debt, the region's other customers would still be repaid by the delay of resource acquisitions. It should be noted, that resource acquisition delay should be quantified in order to establish some maximum that a balancing account might not exceed. We strongly agree with BPA's contention that any DSI Option finally agreed upon, should not provide long term subsidy to a class or group of customers.

Conservation/Modernization

14-5

We would support the BPA goal of funding levels of DSI conservation/modernization to cost-effective levels but we would also urge or insist that this program be available to all direct and indirect customers of BPA. The keys here are cost effectiveness and equity. To the degree any program is not cost effective, all classes of customers sustain the negative socioeconomic impacts of higher rates. Equity considerations must be taken into account, when only certain customer groups are offered financial incentives, cost effective or not. All major customers should be offered the opportunity to implement conservation measures or modernize with the tradeoff of guaranteed conservation benefits available to BPA when needed.

IP-PF Rate Link

14-6

We must raise some question concerning the asserted benefits of predictability of rates for DSI's with the establishment of a rate link. Recent rate instability has been more a function of intraregional causes rather than any interclass matter. There are however benefits real and imagined in a linked rate proposal including the not insubstantial benefit of removal of a major source of controversy during future rate proceedings. We would propose that any formula proposed or adopted be subject to revisions. We would suggest that this occur after a reasonable number of years to be determined, but in no event longer than 7 years. It is unlikely that the value of margin (M) and value of reserves (V) would retain a constant relationship to each other for longer than 7 years, yet the 7 years would provide the DSI customers predictability vis-a-vis the PF rate over a reasonable planning horizon.

Comment
No.

Response

14-5

The incentive and funding levels proposed for DSI conservation/modernization are cost-effective according to BPA's economic analyses completed to date, using the Decision Analysis Model. The analysis shows no significant economic impacts on other customer classes.

The DSI Con/Mod program proposal is the result of a lengthy DSI Options Study completed by BPA in June 1985. The purpose of the study was to identify initiatives that BPA could pursue to ameliorate the economic downturns facing the region's aluminum industry. BPA is particularly interested in encouraging the aluminum companies to make additional capital investments to upgrade the plants through energy efficiency improvements. Because of the large share (25 to 30 percent) of BPA's total power sales revenues provided by the region's aluminum industry, BPA wishes to see plant operations stabilized.

BPA is currently studying how criteria might be developed to expand a conservation/modernization initiative to other industries in the region.

14-6

In the draft EIS, as well as the final (see sections 2.4 and 4.5), an IP-PF rate link alternative of 5-year duration was discussed and analyzed. A 7-year alternative is not very different from the 5-year alternative and potential impacts, both adverse and beneficial, are encompassed in range of impact for the alternatives discussed in the EIS.

Direct Service Industries, Inc.

910 LLOYD CENTER TOWER □ 825 N.E. MULTNOMAH STREET □ PORTLAND, OREGON 97232-2150 □ (503) 233-4445

ENVIRONMENT	
No.	Date
SI-DSI - DEIS - 15	2/24/86

February 21, 1986

HAND DELIVERED

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621 - SJ
Portland, Oregon 97218

RE: Comments of the Direct Service Industries on the
Draft Environmental Impact Statement,
Direct Service Industry Options.

Dear Mr. Morrell:

We appreciate the opportunity to comment on the Draft Environmental Impact Statement (EIS). Generally, the Draft EIS does a fine job, but we do have a few comments on its assessment of the environmental impacts of Staff's proposed Variable Rate in the VI-86 proceeding.

15-1 First, in their testimony, the DSIs have demonstrated that the five year rolling pivot point adjustment in Staff's proposed Variable Rate makes this Variable Rate unacceptable. VI-86-E-DS-02, pp. 7-12. Basically, the five year rolling pivot point adjustment creates a risk that power rates will be so substantially higher in five years that smelters, which would otherwise operate at the IP Standard/Incentive rate, would be forced to close. Unless this risk is eliminated from Staff's proposed Variable Rate, any benefits to BPA and the region from this alternative are illusory -- just as any benefits from the Revenue Protection Alternative are illusory. The Revenue Protection Alternative will not be accepted by regional smelters because average electricity prices under this alternative exceed average prices under either the IP Standard rate or the IP Standard/Incentive rate combination. Draft EIS, p. 61.

15-2
15-3 The Draft EIS does not make this point because the rolling five year pivot point adjustment was not modeled in the DAM (Tr. 328) and, even if it were, the single aluminum price forecast used in the DAM, because it is an optimistic forecast, would not cause this adjustment to be made in a manner that would test this risk.

15-4 Second, in its Variable Rate Design Study, Staff made certain smelter closure assumptions for its proposed Variable Rate. These same closure assumptions were used in the Draft EIS.

Comment
No.

Response

- 15-1 For the analysis in the final EIS, the 5-year rolling pivot point adjustment was modeled. Long-term decisionmaking by the aluminum companies is now also modeled. For analysis purposes in the EIS, BPA generally supposes all the smelters operate under the proposed Variable rate, and draws its conclusions regarding that scenario from the model. If the variable rate being modeled were not acceptable to a smelter, the long-term decisionmaking portion of the model should indicate so by reporting a low probability of operating for the smelter.
- 15-2 BPA does not contend that the DSIs would accept the revenue protection alternative in either the draft or final EIS.
- 15-3 See the response to comment 15-1 above. Analyses have also been done for the final EIS based on a low aluminum price forecast (see sections 4.2.4, 4.3.4, 4.4.5, and 4.6.4).
- 15-4 The final EIS relies on exogenous plant closures only in terms of deciding which plants to close within the model to analyze impacts if two plants closed in the no action alternative (see sections 4.2.5 and 4.3.6). Since the model used for the final EIS incorporated long-term decisionmaking, more reliance was placed on the model to determine the relative impacts among alternatives or their combinations, and exogenous information was not used. See also the responses to comments 15-1 and 18-9.

Anthony R. Morrell
February 21, 1986
Page 2

15-4

Based upon the detailed analysis in our testimony (using more precise models than the DAM used in the Draft EIS, Draft EIS, p. 48), we conclude that Staff's closure assumptions are overly optimistic. Thus, the benefits from reduced closures, i.e., greater BPA revenues and greater regional employment, that Staff's proposed Variable Rate seems to offer may be overstated. Our analysis establishes that these benefits cannot be captured unless the Variable Rate design more closely resembles the Load Maintenance Alternative.

15-5

Third, the discussion of Resource Operations and Development fails to recognize that the out of region sale of all the power not consumed by the aluminum smelters would be ~~determined~~ detrimental to the region even if sold at an equivalent rate. The DSI load provides operating reserves for BPA by granting load curtailment rights that would otherwise be provided by the construction and operation of additional resources.

15-6

Finally, the conclusion that retail rates would possibly increase if the No Action alternative were adopted understates the rate impacts that will occur with the closure of a significant number of the Northwest smelters. The socioeconomic impact of higher retail rates to the region should be addressed in this EIS.

15-7

I hope these few comments are helpful and, again, applaud your fine job.

Very truly yours,



Mark Crisson
Executive Director

6:7:187

Comment
No.

Response

15-5	The value of DSI reserves is discussed further in the final EIS in section 4.2.2.
15-6	This comment apparently refers to the summary table, Table 3, in Chapter 2.5 of the draft EIS where a "possible increase" in retail rates was indicated for the no action alternative. The effect of the no action alternative on rates was described more fully on p. 56 of the draft EIS and in sections 4.2.3 and 4.2.4 of the final EIS. The term "possible" was used in the table because the existence and amount of any increase depends on the amount of energy resulting from plant closures that BPA could market elsewhere and the price BPA would receive; both are uncertain.
15-7	Socioeconomic effects of retail rate changes resulting from wholesale rate changes have been addressed in section 3.2.3 of the final EIS. The impacts of the proposal and alternatives on wholesale rates have been further addressed in sections 4.2.3, 4.3.3, 4.4.4, and 4.6.3 of the final EIS.



DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

ENV
No.
55-DEI-DEIS-16 2/20/86

REPLY TO
ATTENTION OF:

February 20, 1986

Planning Division

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

16-1 Your draft environmental impact statement, "Direct Service Industry Options," January 1986, has been reviewed. Our only comment on this document is on the discussion on page 3, paragraph 7, concerning the availability of "advanced energy" by provisional drafting of reservoirs. At this time the Corps of Engineers is reviewing the policy of provisional drafting of our reservoirs for serving advance energy. Therefore, we suggest that the referenced paragraph be revised to reflect that this operational procedure is being reviewed and a change may have an impact on the availability of providing non-firm energy for the first quartile.

We appreciate the opportunity to review and comment on the environmental impact statement.

Sincerely,

Robert L. Henry
Asst. Chief, Planning Division

Comment
No.

Response

16-1

The referenced paragraph has been revised.



United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043 - 550 WEST FORT STREET
BOISE, IDAHO 83724

ENVIRONMENTAL	
No.	Date
SJ-DSI-DEIS-17 2/24/86	

IN REPLY
REFER TO: PN 150
120.1

FEB 20 1986

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

The draft environmental impact statement on Bonneville Power Administration's Direct Service Industry Options has been reviewed by appropriate personnel within the Bureau, and we have no objections to the content. Please let us know if we can be of further assistance in the review process.

Sincerely yours,

Regional Environmental Officer

cc: Commissioner, Bureau of Reclamation, Washington, D.C.
Attention: 150 (for information)

Comment
No.

Response

17 No response required.



DOCUMENT	
NO	Date
SJ-DSI-DEIS-18 2/25/86	

February 21, 1986

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
Post Office Box 3621-SJ
Portland, Oregon 97208

RE: Direct Service Industry Options Draft DEIS

Dear Mr. Morrell:

The Public Power Council (PPC) submits the following comments on the Draft DSI Options Study Environmental Impact Statement (DEIS). PPC comments on the DEIS on areas that affect the DEIS in general. PPC also comments on specific portions of the analysis as they pertain to two of the options studied in the DEIS--the Variable rate option and the ConMod option.

18-1 PPC reserves the right to comment further on the Variable rate option portions of the DEIS at appropriate stages of the VI-86 rate process. All such comments should be incorporated as part of the DEIS public involvement process. Further, the DSI Options Study DEIS should analyze any issues raised, and any changes to the options adopted or proposed, during the VI-86 and ConMod program development process.

Congress enacted NEPA to aid agencies in their decisionmaking. NEPA requires the preparation of an EIS to enable agencies to make informed decisions and to provide for full public disclosure of all information necessary to make an informed decision. Trout Unlimited v. Morton, 509 F.2d 1276, 1283 (9th Cir. 1974); Columbia Basin Land Protection Ass'n. v. Schlesinger, 643 F.2d 585 (9th Cir. 1981).

A. General Comments

1. BPA's Goal In The DSI Options Study DEIS Must Be To Improve BPA's Revenue Stability And Financial Viability In A Lawful Manner.

Page 1

Comment
No.

Response

18-1

Additional alternatives suggested for the Variable rate and Con/Mod program or issues raised during their respective public involvement processes are believed to be encompassed in the options and alternatives addressed in this final EIS.

In Chapter 1, the "Purpose of and Need for Action" the DEIS states that:

BPA desires to stabilize the DSI load in order to facilitate resource operational planning and to stabilize BPA's revenue. Stable revenues would enhance BPA's ability to make the necessary payments to the U.S. Treasury and would stabilize rates to BPA's customers.

18-2

PPC agrees that the purpose and need for the DSI Options study should be the improvement of BPA's revenue stability and financial viability consistent with attainment of § 7(c) rate directives. The driving force of the DSI Options can not merely be the improved financial viability of either an individual DSI or the DSIs as a customer group.

a. Failure To Consider The Criteria Required By The Regional Act.

BPA's goal however can only be to improve BPA's revenue stability in a lawful manner. Both the Variable rate option and the ConMod option must be implemented according to the requirements of the Regional Act.

18-3

In the discussions of the goals of the Variable rate (DEIS, p. 11) the goals of the ConMod program (DEIS, p. 18) the DEIS failed to consider the legality of either of these two options even though the Regional Act limits, to a large extent, the environment in which BPA operates. PPC questions whether the Regional Act authorizes BPA to either fund modernization or to design a Variable rate which does not comport with the requirements of § 7 of the Regional Act. PPC also raised this issue in the VI-86 hearing and in the ConMod program development process.

b. Level Of Specificity Required

18-4

The problems identified by BPA as requiring the DSI Options study directly and indirectly affect all of BPA's customer groups and the region as a whole. Similarly, the options identified by BPA as potential solutions to those problems will affect all of BPA's customer groups and the region as a whole.

To make an informed decision on which option(s) will best attain the broader goal of improving BPA's revenue stability and financial viability, the Administrator must have information on the impacts of each of the DSI options

Comment No.	Response
18-2	This comment has been noted.
18-3	BPA legal analyses have concluded that, properly designed and implemented, a variable rate for aluminum smelters, a conservation and modernization program for aluminum smelters, and an IP-PF rate link would be legal. Furthermore, this point is moot from the standpoint of the EIS since section 1502.14(c) of the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act directs agencies to "include reasonable alternatives not within the jurisdiction of the lead agency" in an EIS.
18-4	A description of electricity rate affects on non-DSI consumer groups has been added for the final EIS (see section 3.2.3, Non-DSI Consumer Sector).

on BPA and the region's DSI and non-DSI "sectors". Moreover, the DSI Options DEIS should provide any information on the impacts of each option on the DSI and non-DSI "sectors" in the same level of detail and specificity.

18-4

PPC believes that the analysis of impacts of the options studied in the DEIS is inadequate because, although the DEIS specifically analyzes DSI communities it does not provide for similarly detailed analysis of non-DSI communities. By failing to analyze non-DSI communities and instead treating the non-DSI sector as an undifferentiated whole, the DEIS only tells half the story of the regional impact of the options.

c. The Proposed Actions Need Not Be Designed To Ensure The Viability Of All Smelters.

18-5

The proposed actions analyzed in the DEIS appear to be designed to ensure the survival of all DSI aluminum smelters. PPC believes that it may not be possible to ensure survival of all smelters and design a lawful Variable rate or ConMod program.

2. The DEIS Should Discuss The Impacts Of The Options On The Worldwide Aluminum Market.

18-6

PPC supports BPA's analysis of the options considered in the DEIS on a smelter specific basis and discussion of the results of that analysis on a smelter specific basis. Failure to analyze such impacts ignores significant differences among the DSIs which could affect the Administrator's choice of options. Aggregating the results of an impact analysis would violate the intent of NEPA and diffuse the public involvement necessary for a regional consensus.

18-7

The DEIS's failure to consider the impacts of the options on the worldwide aluminum market raises this same concern. For example, closure of Pacific Northwest smelter could improve the market for the remaining smelters and provide the needed market incentive to modernize. This possibility can not be easily dismissed.

18-8

Each option will have a different impact on each DSI, and on the worldwide aluminum market. The DEIS must disclose these impacts to the public and inform the Administrator of these impacts. Aggregating the results of any impact analysis diffuses public involvement. It is important for the public to have knowledge of how the impacts of each option are distributed among the DSIs.

Comment No.	Response
18-5	This comment has been noted.
18-6	This comment has been noted.
18-7	Further consideration of impacts on the aluminum industry as a whole has been given. See section 4.7 of the final EIS.
18-8	This comment has been noted.

3. The DEIS Inadequately Considers The Impacts Of Exogenous Variables On Smelter Operations.

The DEIS inadequately analyzes the role of exogenous variables on smelter operations in two ways.

a. The DEIS Relies On Inadequate Support Documentation When Considering Exogenous Variables.

First, where exogenous variables are analyzed the sources used are not entirely appropriate. For example, the DEIS uses newspaper articles to substantiate conclusions regarding smelter financing options. See DEIS, p. 51.

In this example, the exogenous variables include the financing market, the financial condition of the corporate owner of the smelter, and the world market for aluminum (see discussion above). Newspaper articles are at best secondary sources for this information.

Primary sources should be used such as finance studies--to determine whether or not outside financing is available to refurbish the corporation's plants both in the Pacific Northwest and the rest of the country, and examination of the corporation's accounts and books. BPA must be able to assure the professional integrity of both the discussion in the DEIS and the information used to support those discussions. See 40 C.F.R. § 1502.24.

b. The DEIS Inadequately Discusses Some Exogenous Variables.

Second, the DEIS does not adequately discuss the impact of the adoption of an individual option on the smelter's corporate owner's operation decisions. For example, the DEIS inadequately discusses whether BPA adoption of a Variable rate will lead to a corporate owner's decision to modernize without a ConMod program.

BPA's Variable rate, should it be adopted, will accomplish indirectly some modernization goals. With the Variable rate, the risk of smelting is shifted away from the corporate owners to the region, making investments in regional smelters more attractive. Thus, the corporate owners may elect to modernize in the absence of a BPA ConMod program.

The DEIS apparently assumes that some combination of the Variable rate and the ConMod program is necessary to stimulate full operation of all Pacific Northwest smelters. This assumption must be tested in the DEIS on a smelter by smelter basis.

Comment
No.

Response

- 18-9 The model as used in the final EIS incorporates new logic to better account for long-term closure decisions by the smelters. Therefore, increased reliance on the model output is made for the final EIS, and less reliance is placed on exogenous information. Nevertheless, the probabilistic nature of the model produces a result in which no smelter ever closes completely since it subsumes all games for a year including those in which the random elements of the model combine favorably to make even the least economic smelter operate, and reports an average for each year. To better isolate the potential effects if plants actually did close in the no action case, sensitivity analyses were performed with the model in which two plants were held closed. Exogenous information was used to decide which two plants to close (see section 4.2.5), but, in terms of impacts or rates and regional employment, the particular choice of plant closures is secondary - only the size of the load that disappears is pertinent. The discussions of these sensitivity analyses are contained in sections 4.2.5 and 4.3.6.
- 18-10 The results of the model indicate that no additional smelters invest in modernization under the Variable rate alternative relative to the no action alternative. In both cases, three lower cost smelters--Alcoa, Wenatchee; Kaiser, Tacoma; and Reynolds, Longview--invest in modernization. When Con/Mod credits are added to the Variable rate (5 mills/kWh saved with BPA's proposed Variable rate), five additional smelters invest in modernization. Therefore, it can be concluded that the Variable rate alone does not accomplish the goal of modernization. However, the combination of Variable rate and Con/Mod is quite effective in inducing modernization and keeping smelters operating at a relatively high operating rate.
- 18-11 This assumption was not and is not made in the EIS.

4. The DSI Options DEIS Should Project A Range Of Baselines For Discussing Options And Impacts.

18-12 The DSI Options DEIS uses a No Action alternative that assumes a single long term aluminum price for the term of the DSI Options Study. This analysis is inadequate. BPA should analyze a No Action alternative with the baseline currently used in the DEIS, and, baselines with ranges of aluminum prices.

18-13 These No Action alternative baselines should then be compared with each of the options analyzed in the DEIS to provide the Administrator with a worst case analysis. Where information necessary for an informed decision is unavailable, the CEQ regulations contemplate a worst case analysis. Although forecasts are available to BPA, and are used in the DEIS, forecasts can be wrong. Only with these additional baselines can BPA accomplish a reasonable assessment of risk.

5. The DEIS Analysis Of The Variable Rate Option Doesn't Reflect The Ten Year Term Of The Proposed Variable Rate.

18-14 The DEIS analyzes both the ConMod option and the Variable rate option over the thirty year term of the DSI Options Study. The Variable rate proposed by BPA in the VI-86 process is for a ten year term. The longer term used in the DEIS analysis could skew any conclusions drawn from the DEIS and is therefore inappropriate.

B. Specific Comments

1. Variable Rate Option

a. In The DEIS BPA Must Use Reliable Data.

18-15 All data used in the DEIS should be generally available to the public without limitation. The data used in the
18-16 DEIS however, must be reliable and verifiable.

18-17 Smelter operation cost data must, for example, be accurate and verifiable. If these data, which form the basis of the conclusions regarding option viability, are less than accurate, any decisions reached in a Record of Decision following completion of the EIS process will be subject to challenge.

Comment No.	Response
18-12	The final EIS includes an analysis based on a low aluminum price scenario (see sections 4.2.4, 4.3.4, 4.4.5, and 4.6.4).
18-13	The inclusion of an analysis based on a low aluminum price scenario in the final EIS provides additional information to the Administrator. BPA believes sufficient information is available in the final EIS for informed decisionmaking, and that a "worst case" analysis is unnecessary, even if one could be defined.
18-14	The draft EIS analyzes impacts over a period of FY 1987 - 2000. Model runs were carried out over a longer period of time, but only the results for this period were used. While the proposed Variable rate lasts only 10 years, it would have residual effects for some time thereafter in terms of the state of the Northwest aluminum industry and in terms of BPA's electric rates. The Con/Mod program could, of course, effect long-term gains in aluminum plant efficiency over current levels, and therefore could well have effects beyond 10 years. The termination date of the analysis was based on the expiration date of the DSI contracts. BPA believes the term over which the analyses for the EIS was limited was appropriate.
18-15	All data used for preparing the draft EIS and the final EIS is available to the public for review. See the responses to comments 18-16 and 18-17.
18-16	BPA uses the best smelter operation cost data available to it. Cost data used for the EIS were derived from two reports, <u>Primary Aluminum Production Costs in the Pacific Northwest, July 1984</u> by John Moberly Associates, and <u>Alumina Costs and Supply Arrangements in the Pacific Northwest, May 1985</u> by Resource Strategies, Inc., both prepared for BPA, as well as BPA's own estimates and analyses. The smelter costs have been the subject of much review, comment, and public input during the 1983 and 1985 rate cases and the DSI Options Study. The Public Power Council actively participated in these processes. Antitrust laws preclude the aluminum companies from publicly revealing their costs, and, even if they were provided to BPA, antitrust would preclude BPA from using them in a public forum. In addition, a consultant has reviewed BPA's smelter cost data and it has been found that any inaccuracies are insufficient to alter the conclusions in this EIS (see section 4.1).
18-17	BPA uses the best smelter operation cost data available to it. However, it does not have access to records of the aluminum companies and, therefore, must use estimates rather than actual figures. See also response to comment 18-16.

b. BPA Inadequately Analyzed The "Truing Up" Device.

18-18 The DEIS limits discussion of the "truing up" device required by § 7(c) to a single paragraph. DEIS, p. 17. This discussion is entirely inadequate. See discussion above.

c. The Discussion Of The No Action Alternative Is Inadequate.

18-19 The DEIS inadequately models the Incentive rate portion of the No Action alternative. The model used for the DEIS reduces the DSI's power rate 0.5 mills/kWh for every 1¢/lb. reduction in aluminum. By adopting this straight line method, the model fails to accurately represent BPA's obligations under the Incentive rate by ignoring alternate designs which, for example, lower the DSI rate by various amounts for each month of the incentive offer to maximize revenues.

18-20 The DEIS inadequately models the Surplus Firm power and Nonfirm energy markets in the Southwest. For example, the DEIS does not consider BPA's Firm Displacement rate concept or the recently proposed Surplus Firm power sale/capacity-energy exchange with Southern California Edison.

d. The Discussion Of The Impacts Of The Variable Rate Inadequately Considers The Impacts Of Increased Operation.

18-21 The DEIS inadequately discusses the environmental and resource construction impacts of operation levels above those forecasted up to contract demand. Although the DEIS
18-22 considers the impacts of projected operation levels it does not adequately address the worst case. The DEIS assumes
18-23 that plant closure will occur even with the Variable rate. This assumption fails to take into account the range of exogenous variables operating in the smelter's corporate owner's decisionmaking process.

2. The ConMod Option

18-24 The DEIS analyzes a range of ConMod option alternatives ranging from 3 - 5 mills/kWh. The DEIS fails to analyze the reasonable alternative of BPA sponsoring a ConMod pilot program or a program targeted to a few smelters. In the ConMod program development process PPC urged BPA to offer the program initially as a pilot program with eligibility

Comment
No.

Response

18-18

This issue has been considered further in the final EIS. (See sections 2.2.4 and 4.3.3.3.)

18-19

The PPC is correct that the model used for the draft EIS, the DSI Decision Analysis Model, does not conduct the test BPA uses in determining whether to implement an Incentive rate. The procedures for implementing an Incentive rate are currently set forth in the General Rate Schedule Provisions (GRSPs) of the 1985 Wholesale Rate Schedules. To implement an Incentive rate, BPA must demonstrate that its total revenues increase due to granting the DSIs a rate reduction. (1985 GRSPs, pages 45-46) The PPC misrepresents the revenue demonstration by its reference to an Incentive rate that maximizes revenues. The major factors that influence the offering of an Incentive rate are the price of aluminum (and correspondingly the load responsiveness of the DSIs to lower rates given these aluminum prices) and the price BPA can obtain for that same energy in alternative markets (i.e., the PSW markets). The price BPA can obtain in alternative markets is influenced by 1) water conditions, 2) the capacity of the PNW-PSW Intertie, and 3) PSW decremental costs. BPA had not attempted to model, for the draft EIS, the alternative market considerations in offering an Incentive rate. Nor had BPA tested in the model whether the level of the Incentive rate increases BPA's revenues.

BPA has noted in the draft EIS and the final EIS that the model simplifies the operations of the "real world", and therefore only approximations are possible (final EIS, section 4.1) The conclusions and results of the model are useful for comparison among the options, "but the absolute values should be viewed with caution." It is true that the Incentive rate is modeled similarly to the lower portion of the Variable rate. That is, when aluminum prices fall below 61¢/lb. the rate declines 0.5 mills/kWh. However, the model does not use a "straight line method" suggested by the PPC. Instead, the model assigns a probability that the Incentive rate will be implemented when aluminum prices fall below the 61¢/lb. threshold. BPA believes that assigning this probability, although not as precise as the revenue test, captures the "uncertainty" that the Incentive rate will trigger. In effect, it simulates the likelihood that low aluminum prices alone will not result in the Incentive rate being implemented.

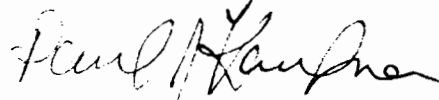
Conducting an Incentive rate test is a very time consuming process. Currently, it takes BPA at least 6 weeks to conduct this test. The DSI Decision Analysis Model is already fairly complex, and adding another level to this complexity (the Incentive rate test) has been determined to not be feasible.

18-24

for the funds based upon a bidding process of competing sponsor-designed projects. Other notions raised in the ConMod process included targeting the conservation program to the most inefficient smelters.

A pilot program could keep expenditures at a minimum while testing state and local participation ability, contract demand and proprietary information issues, and the ability of companies to generate capital funding. The pilot program would also allow BPA to test smelter's corporate owner's response to the Variable rate. See discussion above re: exogenous variables.

Sincerely,

A handwritten signature in cursive script, appearing to read "Paul J. Kaufman".

Paul J. Kaufman
Staff Attorney

PP:2:13

Comment
No.

Response

- Nor is it certain that adding an Incentive rate test would appreciably change the outcome of the model. That is, although it may change the absolute levels generated by the model, it most likely would not change the relative changes between options.
- 18-20 The commenter is correct that the draft EIS does not explicitly consider BPA's Firm Displacement rate concept or the recently proposed Southern California Edison sale. The appropriate question is whether or not consideration of these and other more detailed specifications of the Southwest market would significantly change the results of the model. The FD rate is still under consideration in a 7(i) process. The FD rate is another tool to enhance BPA's ability to market its surplus power. It is not clear that FD considerations in the model would increase the market for surplus power. BPA feels these results would not change significantly.
- 18-21 To address operating impacts at levels above forecasted demand and up to contract demand would be purely speculative for this EIS and not relevant to the issues at hand. The existing DSI Power Sales Contracts define contract demand for each DSI. Those DSIs with contract demand in excess of their needs at capacity have a right to increase their loads (e.g., by a plant expansion) independent of any of the actions addressed in this EIS. The Con/Mod program is designed to reduce energy consumption by the smelters rather than increase it. The Variable rate in itself is not likely to induce smelter expansions. There is already a world-wide surplus of aluminum smelter capacity.
- 18-22 Section 1502.22(b) of the Council on Environmental Quality regulations for implementing the National Environmental Policy Act describes the conditions when a "worst case analysis" is to be used in an EIS. These conditions include: (1) if "... the information is essential to a reasoned choice among alternatives and is not known and the overall costs of obtaining it are exorbitant or (2) if the information relevant to adverse impacts is important to the decision and the means to obtain it are not known . . . the agency shall weigh the need for the action against the risk and severity of possible adverse impacts were the action to proceed in the face of uncertainty. If the agency proceeds, it shall include a worst case analysis" BPA does not believe these conditions are met for the DSI Options EIS.
- 18-23 See the response to comment 18-19.
- 18-24 Further discussion and analysis of reasonable conservation and modernization alternatives have been given. See section 2.3 of the final EIS.

IDAHO STATE HISTORICAL SOCIETY
610 NORTH JULIA DAVIS DRIVE BOISE, 83702



ENVIRONMENT	
No.	Date
SJ-DSI-DEIS-19 2/25/86	

February 20, 1986

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have received a copy of the draft environmental impact statement on BPA's Direct Service Industry Options.

Our office has determined that this issue will have no impact on cultural resources.

Thank you for your consideration.

Sincerely,

Thomas J. Green
State Archaeologist
State Historic Preservation Office

TJG/bnd

Comment
No.

Response

19-1

This comment has been noted.



U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101
FEB 21 1986

ENVIRONMENT	
No.	Date
SJ-DSI-DEIS-20	2/26/86

REPLY TO
ATTN OF M/S 443

Anthony Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act, we have reviewed the Direct Service Industry Options (DSI) Draft Environmental Impact Statement (DEIS). The DEIS evaluates the effects of four options/alternatives for reducing load fluctuations and revenue uncertainty from electric service to 10 aluminum smelters and other direct service industrial customers. The following comments are offered:

Air and Water Impacts

20-1 Air quality impacts of the proposal would result from aluminum smelter closures or continuance/expansion depending on the option selected. The Final EIS should discuss whether changes to increment consumption under the Clean Air Act would increase or decrease other industrial opportunities in airsheds where the smelters are located.

20-2 The Final EIS should concisely describe all the environmental tradeoffs among the options and the implementation steps which would lead to a selected option.

20-3 In the Conservation/Modification (Con/Mod) option the DEIS identified forces which would tend to increase production and improve efficiency of aluminum smelters (Page 68). Would changes in air and water pollution from increased production be offset by improvements in efficiency?

Socioeconomic Impacts

20-4 It is not clear in the environmental consequences chapter who would benefit and not benefit economically from the proposed rate revisions. For example, the employment impacts from the rate proposals are local, however total employment in the region will not be affected (Table 3). Would averting concentrated unemployment in smelter towns cause unemployment elsewhere in the region due to employment constraining electric rate increases for non-DSI customers? General consumers, agriculture, forest industries and energy intensive fabricating industries served by public utility districts could be marginally worse off if aluminum smelters were to gain.

Comment No.	Response
20-1	Effects on other industrial development through interaction of smelter closures, continued operations, and expansions with Prevention of Significant Deterioration Rules are described in section 4.2.1 of the final EIS.
20-2	The final EIS discusses BPA's decisionmaking process for each of the options analyzed. See section 1.4 of the final EIS.
20-3	The EIS considers the Con/Mod in a programmatic sense. BPA is aware of some conservation or modernization measures some smelters are likely to undertake (see pp. 19 and 68 of the draft EIS and sections 2.3 and 4.4.1 of the final EIS), but the full range of measures the smelters might do under the program cannot be defined at this time. Changes in air or water pollution from increased production induced by a Con/Mod program would not necessarily be offset by improvements in efficiency since there is no direct correlation between plant efficiency and discharges of air or water pollutants. The Con/Mod program could result in several scenarios which are described in section 4.4.1 of the final EIS.
20-4	Employment and rate effects are considered further in the final EIS (see section 3.2.3, Non-DSI Consumer Sectors, and sections 4.2.3, 4.3.3.2, 4.4.4.2, and 4.6.3.2). Results from the Decision Analysis Model suggest that effects on regional employment of any option or combination of options would be small. Total employment levels projected for the no action and the various Variable rate and Con/Mod alternatives vary by less than one-tenth of one percent, well within acceptable forecasting error. To the extent that the Variable rate and/or Con/Mod program prevents smelter closures, electric rates to other regional customers should be reduced from what they would be without such programs, at least during the period of regional power surplus. These lower power rates will tend to have a beneficial, although probably small, impact on employment elsewhere in the region.

20-5 | Since the scope of the DEIS was limited to the Pacific Northwest, economic impacts outside of the region were not addressed. For example, assuming that the demand for aluminum stays the same, the provision of economic advantages to this region could close aluminum smelters outside the region. The Final EIS should provide an extra-regional perspective.

20-6 | Most of the economic incentives for conservation currently in place increase electric rates as consumption increases. The economic incentive proposal in the Con/Mod program would offset conservation with a decrease in power rates. The Final EIS should explain why other economic incentives were not examined to encourage conservation.

20-7 | The loss of aluminum smelter loads would tend to produce power surpluses in the region. The Final EIS should discuss any secondary impact disincentives for energy conservation especially with the current period of oil price declines.

20-8 | Based on our review we have rated DEIS and proposal EC-2 (Environmental Concerns-Insufficient Information). We are primarily concerned that all beneficial and adverse economic impacts of the proposed rate revisions be fully evaluated in the EIS.

Thank you for the opportunity to review this DEIS. If you have any questions concerning our review, please contact Wayne Elson of our EIS and Energy Review Section at (FTS) 399-1463.

Sincerely,



Robert S. Burd
Director, Water Division

Comment No.	Response
20-5	Impacts outside the region are addressed in the final EIS (see section 4.7).
20-6	The purposes of the Con/Mod program have been elaborated, and the Variable rate has been clarified as to how it will provide DSIs with more certainty (see sections 2.2 and 2.3 in the final EIS). However, the EIS does not look at other types of incentives since the Con/Mod program is similar to our other conservation programs. That is, the Con/Mod program is payment for the acquisition of load reduction on a planning basis secured through a contract, not a decrease in rates.
20-7	Secondary impact disincentives to conserve as a result of increased surplus would not occur due to smelter closures have been addressed (see section 4.2.5 of the final EIS.)
20-8	Further consideration of this issue has been given. See section 3.2.3 and Chapter 4 of the final EIS.

LIST OF PREPARERS

Chapter 6

LIST OF PREPARERS OF THE ENVIRONMENTAL IMPACT STATEMENT

Project Director

Seiffert, Randy D.

Environmental Engineer - Office of Power and Resources Management

Qualification: Experience with air quality standards and regulations (1972-1976); preparation of BPA environmental documents (1976-1985)

Responsibility: Overall coordination of EIS, technical review, preparation of chapters 1 through 5.

Major Authors

Blumhardt, Orville J.

Public Utility Specialist - Rate Evaluation Section, Division of Rates

Qualification: Eight years experience including market research, use of econometric models, and use of data processing; marginal cost studies and environmental analysis with BPA (1981-present).

Responsibility: Preparation of IP-PF rate link alternative discussion and environmental impacts of rate link, and socioeconomic impacts of rates, discussion on non-DSI consumer sectors, technical review, responded to comments.

Margeson, Jacilyn R.

Public Utility Specialist - Wholesale Rate Section, Division of Rates

Qualification: Work experience has included development of BPA's wholesale rates, especially for regional industries, preparation of documents supporting BPA wholesale rate adjustments, development of Variable rate option in DSI Options Study (1981-present).

Responsibility: Prepared Variable rate alternatives discussion, technical review, contributed to Variable rate impact analysis, responded to comments.

Palmatier, Sheryl E.

Supervisory Public Utility Specialist - Rate Evaluation Section, Division of Rates

Qualification: Work experience has included research on recreation, fish, renewable energy sources and low income households; preparation of environmental documents for BPA (1981-present).

Responsibility: Preparation of direct and indirect impacts and discussion on non-DSI consumer sectors, technical review.

Rothman, Robert S.

Environmental Specialist - Division of Commercial and Industrial Programs

Qualification: Work experience has included preparation of environmental documents and field analyses such as habitat evaluations, hydrology assessments, and water and air quality studies.

Responsibility: Preparation of Con/Mod impacts and regulatory controls for aluminum plants, technical review.

Spies, Paul A.

Industry Economist - Industrial Forecasting Section, Division of Power Forecasting

Qualification: River Basin development planning (1979-80); load forecasting work at BPA (1981-present).

Responsibility: Prepared computer runs from Decision Analysis Model, analysis of impacts on aluminum industry, responded to comments, technical review.

Technical Contributors/Editorial Reviewers

Fox, Roy B.

Environmental Coordinator - Office of Power and Resources Management

Qualification: Environmental/economic analysis of BPA power marketing actions, fish and wildlife program, and conservation acquisition programs (1980-present).

Responsibility: Technical review.

Hollister, Diane

Industry Economist - Office of Power and Resources Management

Qualification: Work on environmental documents for BPA (1984 and 1985).

Responsibility: Prepared analysis of environmental impacts from employment, production and various energy-generated resources.

Kingsbury, Pamela A.

Public Utility Specialist - Office of Power and Resources Management

Qualification: Environmental consulting (1977-1980); power scheduling and work on environmental documents for BPA (1981-present).

Responsibility: Prepared river operations impact analysis, technical review.

Moorman, Geoffrey B.

Supervisory Industry Economist, Economic and Industrial Forecasting Branch

Qualification: Preparation of Environmental Documents (1969-1976); Load Forecasting (1971-1972, 1980-1986); Aluminum Industry Analysis (1982-1986).

Responsibility: Supervised analysis using the Decision Analysis Model, analysis of impacts on aluminum industry, responded to comments, technical review.

Price, Shirley P.

Public Utility Specialist - Office of Power and Resources Management

Qualification: Work on environmental documents for BPA (1982-present).

Responsibility: Prepared chapters 5, 6 and 7, editorial review, assisted with coordination.

Sugiyama, Sam O.

Supervisory Industry Economist - Industrial Forecasting Section, Division of Power Forecasting

Qualification: Regional economic analysis (1972-1975); instructor of economics (1975-1978 and 1981-1984); analysis of electric-intensive manufacturing industries (1982-present).

Responsibility: Supervised computer runs and coding changes of the Decision Analysis Model.

Ulrich, Bruno

Public Utility Specialist - Rate Evaluation Section, Division of Rates

Qualification: Seven years community planning experience: analysis and development of economic development policies and programs, and preparation of environmental documents and local comprehensive plan elements; work on BPA environmental documents (1985-present).

Responsibility: Prepared analysis of environmental impacts from employment, production and various energy-generated resources.

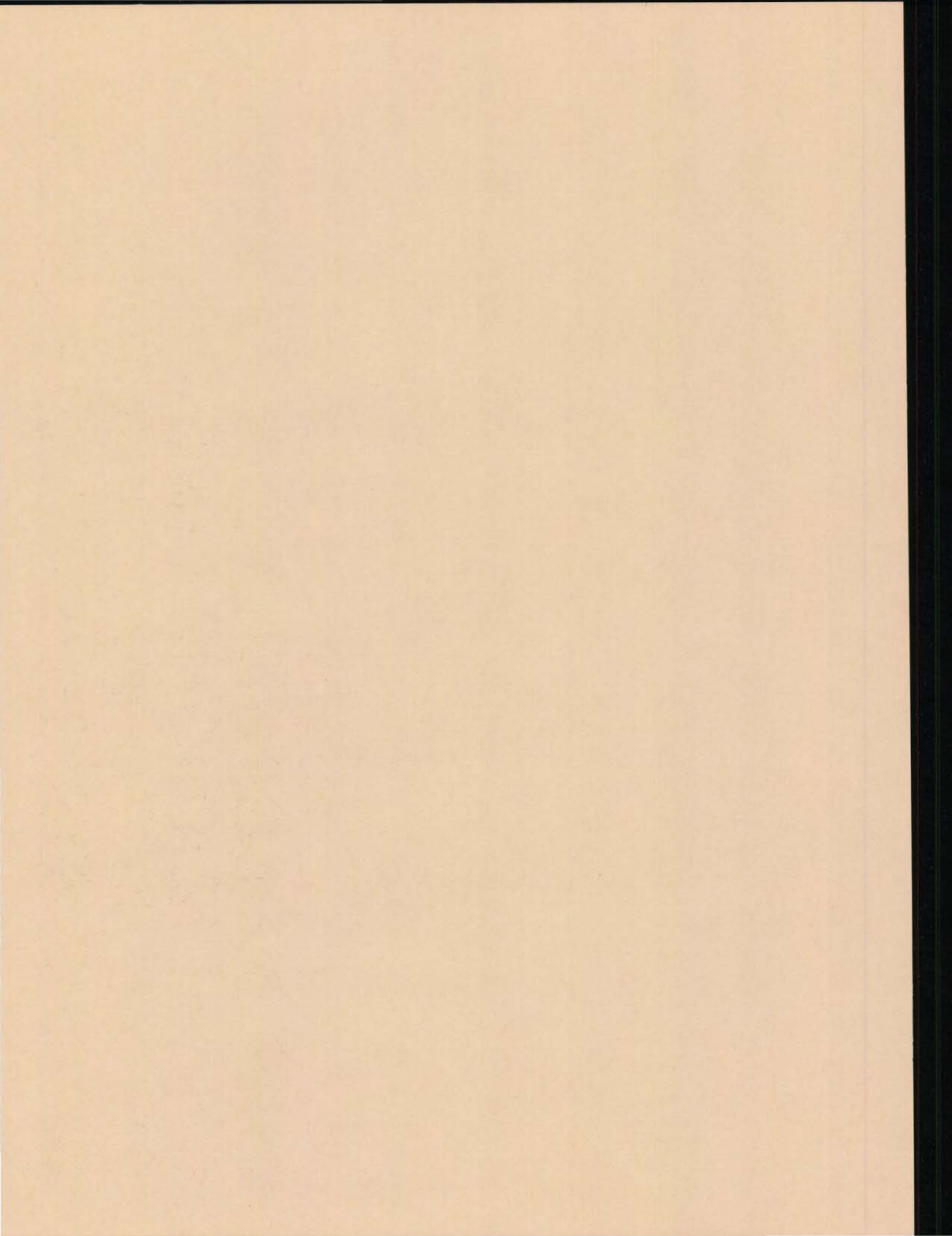
West, Peter G.

Industry Economist - Economic Forecasting Section, Division of Power Forecasting

Qualification: Regional impact analysis (1981-1982); alternative resource valuation and economic flows modeling; research on agricultural finance and soil conservation (1983-1984); employment and regional economic forecasting for BPA (1985-present).

Responsibility: Preparation of employment levels and impacts; technical review of income impacts.

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



Chapter 7

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

FEDERAL AGENCIES

Advisory Council on Historic Preservation, Golden, CO
Federal Regional Council, Region X, Seattle, WA
Tennessee Valley Authority, Chattanooga and Knoxville, TN
US Attorney's Office, Portland, OR
US Department of Health and Human Services, Seattle, WA
US Department of Justice, Land and Natural Resources, Washington, D.C.
US Environmental Protection Agency, Seattle, WA
US General Accounting Office, Portland, OR
US Social Security Administration, Kalispell, MT
USA Corps of Engineers, Cascade Locks and Portland, OR
USDA, Forest Service, Missoula, MT
USDA, Forest Service, Portland, OR
USDA, Office of Energy, Washington, D.C.
USDA, Rural Electrification Administration, Washington, D.C.
USDA, Soil Conservation Service, Portland, OR
USDOC, National Marine Fisheries Service, Olympia and Seattle, WA
USDOC, Ecology and Conservation Division, Washington, D.C.
USDOE, Federal Energy Regulatory Commission, Portland, OR
USDOE, Region X, Seattle, WA
USDOE, Richland Operations Office, Richland, WA
USDOE, Western Area Power Administration, Sacramento, CA and Golden, CO
USDOl, Office of Environmental Project Review, Washington, D.C.
USDOl, Office of the Secretary, Portland, OR
USDOl, Secretary of the Interior, Washington, D.C.
USDOl, Bureau of Mines, Washington, D.C.
USDOl, Bureau of Indian Affairs, Portland, OR
USDOl, Bureau of Land Management, Boise, ID; Billings, MT; Portland, OR; and Washington, D.C.
USDOl, Bureau of Reclamation, Boise, ID; Medford, OR; Grand Coulee, WA
USDOl, Fish and Wildlife Service, Boise, ID; Billings, MT; Olympia, WA; Washington, D.C; Portland, OR
USDOl, Interagency Archeological Services, San Francisco, CA
USHUD, Regional Office, Seattle, WA

CONGRESSIONALS

Subcommittee on General Oversight Management and the BPA, Washington, D.C.
Les Aucoin, Representative
Max S. Baucus, Senator
Don L. Bonker, Representative
Rod Chandler, Representative
Larry E. Craig, Representative
Norman D. Dicks, Representative
Daniel J. Evans, Senator
Thomas S. Foley, Representative

Slade Gorton, Senator
Mark Hatfield, Senator
Michael E. Lowery, Representative
Ronald C. Marlenee, Representative
James A. McClure, Senator
John Melcher, Senator
John Miller, Representative
Sid Morrison, Representative
Bob Packwood, Senator
Denny Smith, Representative
Robert Smith, Representative
Richard H. Stallings, Representative
Al Swift, Representative
Steven D. Symms, Senator
James H. Weaver, Representative
Pat Williams, Representative
Ron Wyden, Representative

STATE GOVERNORS

Governor of California, Sacramento
Governor of Idaho, Boise
Governor of Montana, Helena
Governor of Oregon, Salem
Governor of Washington, Olympia
Governor of Wyoming, Cheyenne

STATE OF CALIFORNIA

State Agencies

California Energy Commission, Sacramento
Energy Resource Conservation & Development, Sacramento

Local/County Agencies

County Supervisors Association of California, Sacramento
League of California Cities, Sacramento

STATE OF IDAHO

State Agencies

Department of Employment, Boise
Department of Fish and Game, Boise
Department of Lands, Boise
Department of Water Resources, Boise
Office of Energy, Boise
Office of the Governor, Boise
Idaho State Historic Preservation Officer, Boise
Idaho Public Utilities Commission, Boise

Local/County Agencies

Association of Idaho Cities, Boise
Caldwell Chamber of Commerce, Caldwell
City Council, Moscow
County of Boundary, Bonners Ferry
Idaho Association of Counties, Boise
Mayor, Bonners Ferry

STATE OF MONTANA

State Agencies

Office of Budget and Program Planning, Helena
Department of Environmental Quality, Helena
Department of Fish and Wildlife and Parks, Helena
Department of Natural Resources and Conservation, Helena
Department of Labor and Industry, Helena
Montana State Historic Preservation Officer, Helena
Secretary of State, Helena
Department of Commerce, Helena

Local/County Agencies

City of Columbia, Columbia Falls
Columbia Falls Chamber of Commerce, Columbia Falls
County of Flathead, Kalispell
Mineral County, Alberton
Missoula County Commissioners, Missoula
Montana Association of Counties, Helena
Montana League of Cities & Towns, Helena

STATE OF NEVADA

State Agencies

Colorado River Commission, Las Vegas
Office of Community Service, Carson City

Local/County Agencies

Nevada Association of Counties, Carson City
Nevada League of Cities, Carson City

STATE OF OREGON

State Agencies

Department of Agriculture, Salem
Department of Energy, Salem
Department of Environmental Quality, Portland
Department of Fish and Wildlife, Grants Pass
Department of Fish and Wildlife, Portland

Department of Water Resources, Salem
Division of Employment, Salem
Office of the Governor, Salem
Oregon Public Utilities Commission, Salem
Oregon State Historic Preservation Officer, Salem

Local/County Agencies

Bend Urban Area Planning Commission, Bend
City of Irrigon, Irrigon
City of Portland Planning Bureau, Portland
City of The Dalles, The Dalles
City of Troutdale, Troutdale
Coos Curry Council of Governments, Coos Bay
County of Deschutes, Bend
League of Oregon Cities, Salem
Linn County, Albany
Mayor, Milton-Freewater
Metropolitan Service District, Portland
Mid-Columbia Council of Governments, The Dalles
Mid-Columbia Economic Development District, The Dalles
NW Power Planning Council, Portland
Oregon Association of Counties, Salem
Portland City Energy Offices, Portland
Rogue Valley Council of Governments, Central Point
The Dalles Area Chamber of Commerce, The Dalles

STATE OF UTAH

State Agencies

State of Utah Energy Office, Salt Lake City

Local/County Agencies

Utah Association of Counties, Salt Lake City
Utah League of Cities and Towns, Salt Lake City

STATE OF WASHINGTON

State Agencies

Department of Ecology, Olympia
Department of Fisheries, Olympia
Department of Natural Resources, Olympia
Energy Office, Olympia
Office of the Governor, Olympia
Office of Community Development, Olympia
Utilities and Transportation Commission, Olympia
Washington State Historic Preservation Officer, Olympia

Local/County Agencies

Association of Washington Cities, Seattle
Association of Washington Cities, Olympia
City Council, Everett
City of Grandview, Grandview
City of Seattle, Seattle
City of Tacoma, Tacoma
County of Grays Harbor, Montesano
Grays Harbor Regional Planning Commission, Aberdeen
Greater Yakima Volunteer Bureau, Yakima
Port of Chelan County, Wenatchee
Regional Planning Council of Clark County, Vancouver
Spokane Area Economic Development Center, Spokane
Spokane Regional Planning Conference, Spokane
Spokane Regional Council, Spokane
Washington State Association of Counties, Olympia

WYOMING

State Agencies

Energy Office, Cheyenne
Public Service Commission, Cheyenne
State Planning Coordinator, Cheyenne

Local/County Agencies

Wyoming Association of Municipalities, Cheyenne
Wyoming County Commissioners Association, Cheyenne

BPA'S CUSTOMERS

Alcoa, Vancouver, WA
Aluminum Co. of America, Wenatchee, WA
Albany Research Center, Albany, OR
Alder Mutual Light Co., Eatonville, WA
Allen Charles, Salem, OR
Alumax Inc., San Mateo, CA
Aluminum Co. of America, Pittsburgh, PA
BC Hydro & Power Authority, Vancouver, BC
Benton County PUD #1, Kennewick, WA
Benton Rural Electric Assn., Prosser, WA
Blachly Lane County Coop, Eugene, OR
Bountiful City Light & Power, Bountiful, UT
Bureau of Public Utilities, Alameda, CA
Bureau of Reclamation, Ephrata, WA
Bureau of Reclamation, Yakima, WA
CP National Corp., Baker, OR
CP National, Concord, CA

Canby Utility Board, Canby, OR
Cascade Locks City Light, Cascade Locks, OR
Central Electric Coop, Inc., Redmond, OR
Central Lincoln PUD, Florence, OR
Central Lincoln PUD, Newport, OR
Centralia City Light Department, Centralia, WA
Chelan County PUD #1, Wenatchee, WA
Citizens Utilities Co., Wallace, ID
City of Albion, Albion, ID
City of Anaheim, Anaheim, CA
City of Ashland Water & Light, Ashland, OR
City of Bandon, Bandon, OR
City of Blaine, Blaine, WA
City of Burbank, Burbank, CA
City of Burley, Burley, ID
City of Chewelah, Chewelah, WA
City of Coulee Dam, Coulee Dam, WA
City of Declo, Declo, ID
City of Drain Light & Power, Drain, OR
City of Ellensburg, Ellensburg, WA
City of Forest Grove, Forest Grove, OR
City of Glendale, Glendale, CA
City of Healdsburg, Healdsburg, CA
City of Heyburn, Heyburn, ID
City of Idaho Falls, Idaho Falls, ID
City of Lodi, Lodi, CA
City of Lompoc, Lompoc, CA
City of McMinnville, McMinnville, OR
City of Minidoka, Minidoka, ID
City of Monmouth, Monmouth, OR
City of Pasadena, Pasadena, CA
City of Port Angeles, Port Angeles, WA
City of Richland, Richland, WA
City of Roseville, Roseville, CA
City of Rupert, Rupert, ID
City of Santa Clara, Santa Clara, CA
City of Soda Springs, Soda Springs, ID
City of Sumas, Sumas, WA
City of Ukiah, Ukiah, CA
City of Whatcom PUD, Ferndale, WA
Clallam County PUD #1, Port Angeles, WA
Clark County PUD, Vancouver, WA
Clatskanie PUD, Clatskanie, OR
Columbia Basin Electric Coop, Heppner, OR
Columbia Falls Aluminum Company, Columbia Falls, MT
Columbia Power Coop Assn., Monument, OR
Columbia River PUD, St. Helens, OR
Columbia Rural Electric Assn. Inc., Dayton, WA
Commonwealth Aluminum, Goldendale, WA
Consolidated Irrigation Dist. 19, Greenacres, WA
Consumer Power Inc., Philomath, OR

Coos-Curry Electric Coop., Port Orford, OR
 Cowlitz County PUD #1, Longview, WA
 Crown Zellerbach Corp., West Linn, OR
 DOE, Richland, WA
 Direct Services Industries, Inc., Portland, OR
 Douglas County PUD #1, East Wenatchee, WA
 Douglas Electric Coop, Inc., Roseburg, OR
 E End Mutual Electric Co. Ltd., Rupert, ID
 Elmhurst Mutal Power & Light Co., Tacoma, WA
 Emerald PUD, Pleasant Hill, OR
 Energy Management Department, Boise, ID
 Eugene Water and Electric Board, Eugene, OR
 Fall River Rural Electric Coop Inc., Ashton, ID
 Farmers Electric Co., Rupert, ID
 Ferry County PUD #1, Republic, WA
 Flathead Electric Coop Inc., Kalispell, MT
 Flathead Irrigation Project, St. Ignatious, MT
 Franklin County PUD, Pasco, WA
 Georgia Pacific Corp., Bellingham, WA
 Georgia Pacific Corp., Portland, OR
 Gilmore Steel Corp., Portland, OR
 Glacier Electric Coop Inc., Cut Bank, MT
 Grant County PUD, Ephrata, WA
 Grant County PUD, Moses Lake, WA
 Grays Harbor County PUD #1, Aberdeen, WA
 Gridley Municipal Utilities, Gridley, CA
 H. R. Richmond, San Diego, CA
 Hanna Mining Co., Cleveland, OH
 Hanna Nickel Smelting Co., Riddle, OR
 Hanna Nickel Smelting Company, Portland, OR
 Harney Electric Coop Inc., Burns, OR
 Hoodriver Electric Coop, Odell, OR
 Idaho Coop Utilities, Lewiston, ID
 Idaho Light & Power Coop Assn Inc., Grangeville, ID
 Idaho Power Company, Boise, ID
 Industrial Customers of NW Util, Tacoma, WA
 Inland Power & Light Co., Spokane, WA
 Intalco Aluminum Corp., Ferndale, WA
 Intercompany Pool, Spokane, WA
 Kaiser Aluminum & Chemical Corp., Oakland, CA
 Kaiser Aluminum & Chemical Corp., Spokane, WA
 Kaiser Aluminum & Chemical Corp., Tacoma, WA
 Kaiser Aluminum & Chemical Corp., Trentwood, WA
 Kaiser Aluminum and Chemical Corp., Vancouver, WA
 Kaiser Aluminum and Chemical Corp., Mead, WA
 Kittitas County PUD #1, Ellensburg, WA
 Klickitat County PUD, Goldendale, WA
 Kootenai Electric Coop Inc., Hayden Lake, ID
 Lakeview Light & Power Co., Tacoma, WA
 Lane Electric Coop Inc., Eugene, OR
 Lewis County PUD, Chehalis, WA

Lincoln Electric Coop Inc., Davenport, WA
 Lincoln Electric Coop, Eureka, MT
 Los Angeles Department of Water and Power, Los Angeles, CA
 Lost River Electric Coop Inc., Mackay, ID
 Lower Valley Power & Light Inc., Afton, WY
 Martin Marietta Corporation, Bethesda, MD
 Mason County PUD #3, Shelton, WA
 Mason County PUD, Belfair, WA
 McCleary Light & Power, McCleary, WA
 Midstate Electric Coop Inc., La Pine, OR
 Milton Freewater Light & Power, Milton Freewater, OR
 Missoula Electric Coop Inc., Missoula, MT
 Modern Electric Water Co., Spokane, WA
 Montana Light & Power, Libby, MT
 Montana Power Company, Butte, MT
 Northwest Public Power Association, Vancouver, WA
 Natural Resources Defense Council, San Francisco, CA
 Naval Radio Station T, Oso, WA
 Nespelem Valley Electric Coop Inc., Nespelem, WA
 Non Generating Public Utilities, Portland, OR
 Northern Lights Inc., Sandpoint, ID
 Northern Wasco County PUD, The Dalles, OR
 Ohop Mutual Light Co., Eatonville, WA
 Okanogan County Electric Coop Inc., Winthrop, WA
 Okanogan County PUD #1, Okanogan, WA
 Orcas Power & Light Co., Eastsound, WA
 Oregon Metalurgical Company, Albany, OR
 Pacific Carbide & Alloys Co., Portland, OR
 Pacific County PUD #2, Raymond, WA
 Pacific Gas & Electric Company, San Francisco, CA
 Pacific NW Utilities Conference, Portland, OR
 Pacific Northwest Generating Co., Portland, OR
 Pacific Power and Light Company, Portland, OR
 Parkland Light & Water Company, Tacoma, WA
 Pend Oreille County PUD #1, Newport, WA
 Peninsula Light Co., Gig Harbor, WA
 Pennwalt Corp., Portland, OR
 Pennwalt Corp., Tacoma, WA
 Port Townsend Paper Corporation, Bainbridge Island, WA
 Portland General Electric Company, Portland, OR
 Prairie Power Cooperative, Inc., Fairfield, ID
 Puget Sound Naval Shipyard, Bremerton, WA
 Puget Sound Power and Light Company, Bellevue, WA
 Raft River Rural Electric Coop., Malta, ID
 Ravalli County Electric Coop Inc., Corvallis, MT
 Resources Agency of California, Sacramento, CA
 Reynolds Metal Company, Troutdale, OR
 Reynolds Metals Co., Richmond, VA
 Reynolds Metals Co., Troutdale, OR
 Riverside Electric Co., Rupert, ID
 Rural Electric Co., Rupert, ID

Sacramento Municipal Utility District, Sacramento, CA
 Salem Electric, Salem, OR
 Salmon River Electric, Challis, ID
 Seattle City Light, Seattle, WA
 Skamania County PUD, Carson, WA
 Snohomish County PUD #1, Everett, WA
 South Side Electric Lines Inc., Declo, ID
 Southern California Edison Co., Rosemead, CA
 Springfield Utility Board, Springfield, OR
 Sub Base Bangor, Bremerton, WA
 Surprise Valley Electric Coop, Alturas, CA
 Tacoma City Light, Tacoma, WA
 Tanner Electric, North Bend, WA
 Tillamook Peoples Utility District, Tillamook, OR
 Town of Eatonville Power & Light, Eatonville, WA
 Town of Fircrest, Tacoma, WA
 Town of Milton, Milton, WA
 Town of Steilacoom, Steilacoom, WA
 Town of Waterville, Waterville, WA
 US Bureau of Reclamation, Boise, ID
 US Dept. of the Navy, San Bruno, CA
 USAF, Fairchild AFB, WA
 Umatilla County PUD, Milton-Freewater, OR
 Umatilla Electric Coop., Hermiston, OR
 Unity Light & Power Company, Burley, ID
 Utah Power and Light Company, Salt Lake City, UT
 Vera Irrigation District #15, Veradale, WA
 Vigilante Electric Coop Inc., Dillon, MT
 Village of Plummer, Plummer, ID
 Wahkiakum County PUD, Cathlamet, WA
 Wapato Irrigation Project, Wapato, WA
 Wasco Electric Coop, Inc., The Dalles, OR
 Washington PUD Association, Seattle, WA
 Washington Public Power Supply, Richland, WA
 Washington Water Power Company, Spokane, WA
 Wells Rural Electric Company, Wells, NV
 West Kootenay Power & Light Co., Trail, BC

UTILITIES

Association of Public Agencies Comm, Portland, OR
 Anaheim Public Utilities, Anaheim, CA
 Association of Public Agency Customers, Washington, D.C.
 BC Utilities Commission, Vancouver, BC
 Industrial Customers of NW Utilities, Portland, OR
 Langell Valley Irrigation District, Bonanza, OR
 Martin City County Water District, Martin, MT
 NW Power Pool Coordination Group, Portland, OR
 Northwest Natural Gas Company, Portland, OR
 Oil Heat Institute of Oregon, Portland, OR
 South Columbia Basin Irrigation District, Pasco, WA
 Tokyo Electric Power Company, Inc., Washington, D.C.
 Tualatin Valley Irrigation District, Forest Grove, OR

BUSINESSES/OTHERS

Alcan Aluminum Corporation, Washington, D.C.
Alcoa, Washougal, WA
Amax Magnesium Corporation, Salt Lake City, UT
Battelle Pacific Northwest Labs
Bechtel Power Corp.
Bogle & Gates, Seattle, WA
CH2M Hill, Bellevue, WA
CH2M Hill, Boise, ID
Ch2M Hill, Portland, OR
Chickering & Gregory, San Francisco, CA
Columbia Reclamation, Chehalis, WA
Commonwealth Aluminum, The Dalles, OR
Commonwealth Aluminum, White Salmon, WA
Cross Engineers, Inc., Tacoma, WA
Dezendorf, et al, Portland, OR
Electric Power Research Institute
Envirosphere Co.
Federal Reserve Bank of San Francisco, San Francisco, CA
Garvey, Schubert, Adams, & Barer, Portland, OR
Heller, Ehrman, White, & McAuliffe, Seattle, WA
Heller, Ehrman, White, & McAuliffe, Portland, WA
Hopkins, French, Crockett, & Springer, Idaho Falls, ID
Hugh A. Thompson Associates, Inc., Redmond, WA
J. Kenneth Kaseberg, Portland, OR
John Nuveen & Company, Seattle, WA
Kalispell Job Service, Kalispell, MT
Ladner Environmental
Lindsay, Hart, Neil, & Weigler, Boise, ID
Lindsay, Hart, Neil, & Weigler, Portland, OR
Longview Libre Company, Longview, WA
Montana State University, Bozeman, MT
Occidental Chemical Corp., Puyallup, WA
Passive Solar Services, Olympia, WA
Preston, Thorgrimson, Ellis, & Holman, Seattle, WA
Recreational Equipment Inc.
R. W. Beck & Associates, Seattle, WA
Seattle Times, Seattle, WA
Sohio, Niagara, NY
Spears, Lubersky, et al, Portland, OR
Stoll & Stoll, Portland, OR
Utility Data Institute
Wirth Associates

INTEREST GROUPS

American Association of Retired People, Prineville, OR
American Fisheries Society, Missoula, MT
Assn. Northwest Steelheaders, Battleground, WA
Center for Urban Affairs, Evanston, IL
Central Oregon Intergovernmental Council, Redmond, OR

Citizens for Environmental Quality, Asotin, WA
 Columbia River Conservation League, West Richland, WA
 Columbia River Fishermen's Protective Union, Astoria, OR
 Columbia River Inter-Tribal Fish Commission, Portland, OR
 Common Cause, Olympia, WA
 Democratic Women Club, Spokane, WA
 East Central Oregon Association of Counties, Pendleton, OR
 Energy Conservation Coalition, Lake Oswego, OR
 Environmental Affairs Commission, Seattle, WA
 Environmental Defense Fund, Berkeley, CA
 Environmental Defense Fund, Washington, D.C.
 Environmental Defense Fund, New York, NY
 Eugene Future Power Committee, Eugene, OR
 Flathead Citizens for Safe Energy, Whitefish, MT
 Flathead River Basin Study, Kalispell, MT
 Forelaws on Board, Boring, OR
 Friends of the Columbia River Gorge, Portland, OR
 Friends of the Earth, San Francisco, CA
 Friends of the Earth, Seattle, WA
 Friends of the Earth, Missoula, MT
 Gray Panthers of Portland, Portland, OR
 Greenpeace Foundation, Eugene, OR
 Idaho Environmental Council, Idaho Falls, ID
 International Brotherhood of Electrical Workers, Seattle, WA
 Jane Jefferson Democratic Club, Spokane, WA
 League of Oregon Cities, Salem, OR
 League of Women Voters, Seattle, WA
 League of Women Voters of Oregon, Salem, OR
 League of Women Voters, Missoula, MT
 League of Women Voters of Idaho, Boise, ID
 Legislative Action, Grande Ronde, OR
 Montana Association of Counties, Helena, MT
 National Audubon Society, Corvallis, OR
 Natural Resources Defense Council, San Francisco, CA
 North Cascades Conservation Council, Seattle, WA
 Northern Plains Resource Council, Billings, MT
 Northern Plains Resource Council, Helena, MT
 Northwest Conservation Act Coalition, Seattle, WA
 Northwest Environmental Defense Center, Portland, OR
 Northwest Fund for the Environment, Seattle, WA
 NW Pulp and Paper Association, Bellevue, WA
 Oregon and Washington Columbia River Gorge Committee, Stevenson, WA
 Oregon Ecum. Center for Environmental Action, Cottage Grove, OR
 Oregon Environmental Council, Portland, OR
 Oregon Fair Share, Portland, OR
 Oregon League of Environmental Voters, Portland, OR
 OSPiRG, Portland, OR
 Oregon Wildlife Federation, Roseburg, OR
 Pacific NW Waterways Association, Vancouver, WA
 Salem Audubon Society, Salem, OR

Sierra Club, Seattle, WA
 Sierra Club, Pocatello, ID
 Sierra Club, Missoula, MT
 Sierra Club, Portland, OR
 Sierra Club, Helena, MT
 Sierra Club, Bitterroot Mission Club, Missoula, MT
 Sierra Club, San Francisco, CA
 Sierra Club, Spangle, WA
 The Nature Conservancy, Portland, OR
 The Nature Conservancy, Seattle, WA
 The Salvation Army, Portland, OR
 The Union Coalition on Energy, E. Wenatchee, WA
 The Wilderness Society, Portland, OR
 Trout Unlimited Northwest, Olympia, WA
 Washington Environmental Council, Seattle, WA
 Wenatchee Aluminum Trades Council, E. Wenatchee, WA
 Western Environmental Trade Association, Columbia Falls, MT
 Western Montana Fish and Game Association, Missoula, MT
 Wildlife Society, Moscow, ID
 Wildlife Society, Kalispell, MT
 Wildlife Society, Lakeview, OR
 Wildlife Society, Port Angeles, WA
 1000 Friends of Oregon, Portland, OR

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 Nooksak Indian Tribe, Deming, WA
 Portland Inter-Tribal, Portland, OR

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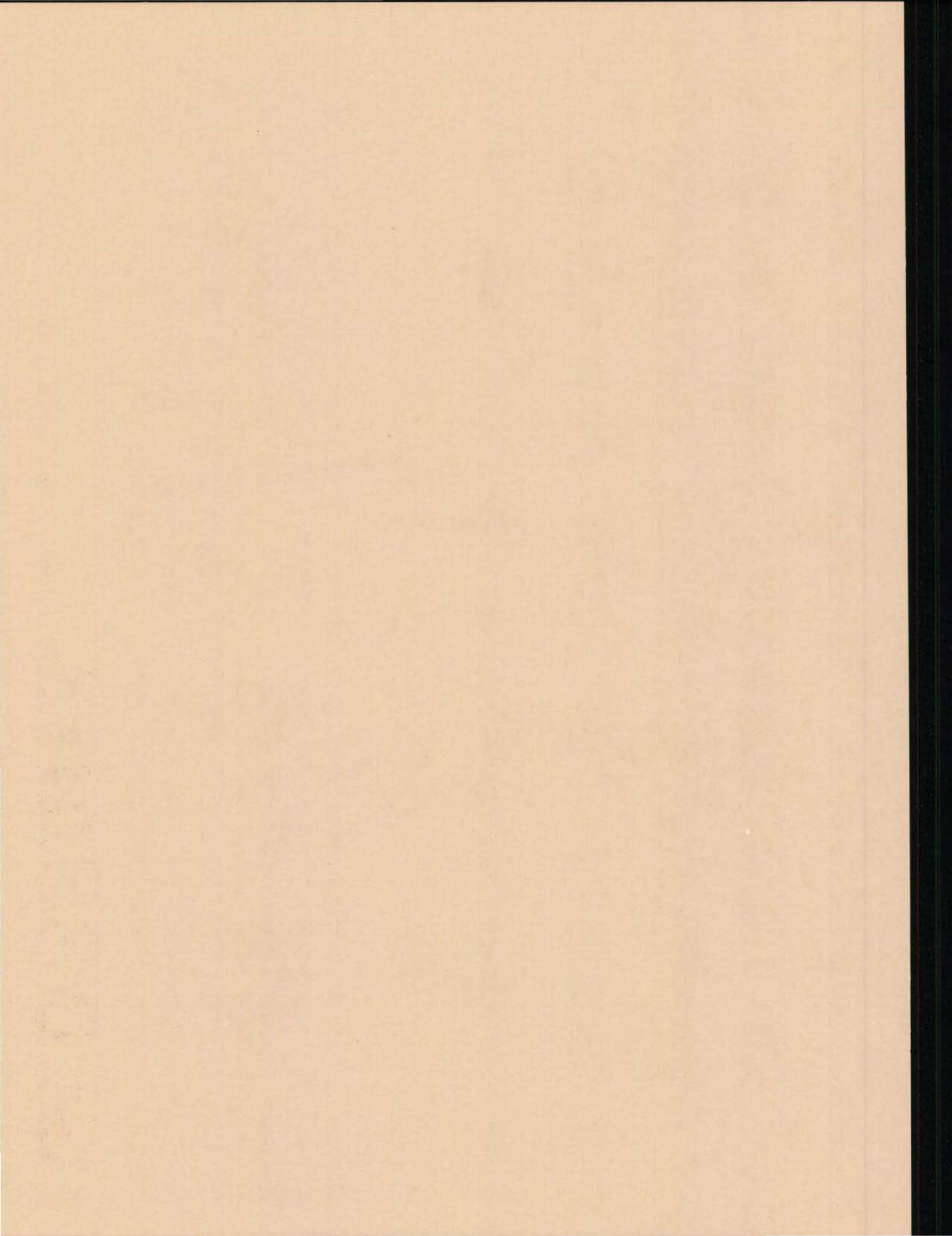
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GLOSSARY



GLOSSARY OF TERMS

Alumina Feed Systems. The devices and method used to supply alumina (Al_2O_3) to the reduction cells. State-of-the-art technology uses automated systems controlled by computer to add alumina to individual cells as needed based on the voltage across each cell.

Ambient Air Quality. The prevailing quality of the surrounding air in a given area in terms of the type and amounts of various air pollutants present.

Anadromous Fish. Species of fish (such as salmon) that are hatched in fresh water, mature in salt water, and return to fresh water to spawn.

Anode Preparation Facility. The part of an aluminum plant at which anodes are made. In a plant using Soderberg anodes, it consists mainly of crushers and mixers which process petroleum coke and coal tar pitch into a paste-like material which bakes and hardens in place at the pot. More paste is added as the anode is consumed in the reduction reaction. In a prebake plant, the paste is pressed around a steel stud and baked in a furnace to form a hard anode, several of which are installed on a reduction cell, and which are replaced periodically as they are consumed in the reduction process.

Anode. In an aluminum reduction cell (or pot), the upper carbonaceous electrode through which direct electric current is delivered to effect the electrolytic reduction of alumina (Al_2O_3) to aluminum metal (Al) and which is consumed as a source of carbon for the reaction.

Average System Cost. The fully allocated cost of a utility's generation and transmission system. Under the Regional Power Act, a utility may sell power to BPA at the utility's average system cost and purchase the same amount of power back from BPA at a lower rate based on the costs of the Federal Base System.

Baseload Generation. The minimum load in a power system over a given period of time.

Cathode. In an aluminum plant, the electrode which receives the direct electric current and which consists of the carbonaceous part of the reduction cell lining and the collector plate or bar.

Cell Lining. The carbonaceous material packed into an aluminum reduction cell to act as a cathode and firebrick or other refractory material to protect the steel shell and provide some insulation.

Contract Demand. The maximum amount of Industrial Firm Power a DSI could purchase under its BPA Power Sales Contract.

Dissolved Oxygen Content. The amount of oxygen dissolved in water, necessary for the life of fish and other aquatic animals.

Effluent. A discharge or emission of a liquid waste.

Horizontal Stud Soderberg. A type of aluminum production technology in which the anode material is added in a paste-like form and bakes in place at the reduction cell. Electricity is conducted to the anode through steel pins inserted horizontally into the anode through holes in the casing that retains the anode.

Industrial Firm Power. Power intended to have assured availability to a BPA industrial customer on a contract demand basis, but which allows certain rights of restriction on the part of BPA (see Section 1.3).

Load Factor. The ratio of the average load to the peakload during a specified period of time, expressed in percent.

New Resources Firm Power Rate. A rate based on costs of new resources added to meet load growth which is charged for serving load growth of regional investor-owned utilities and for serving any new large single loads (additions of over 10 average MW in any one year at any one facility) on public utility systems.

Nitrogen Supersaturation. A condition of water in which the concentration of dissolved nitrogen exceeds the saturation level of the water. Excess nitrogen can evolve bubbles of nitrogen in the circulatory systems of fish.

Nonfirm Energy. Energy which is subject to interruption or curtailment at any time by the supplier and hence, does not have the guaranteed, continuous availability of firm power.

Operating Demand. The maximum rate at which electric energy may be requested by a DSI over a designated period and delivered without penalty. Demand is expressed in kilowatts or megawatts, or in kilovolt-amperes or megavolt-amperes. Operating demand is set by each DSI and may be increased upon 90 days' notice or as otherwise scheduled in Exhibit C of the DSI's Power Sales Contract. Operating demand cannot exceed contract demand.

Pacific Northwest Power Act. Signed into law December 5, 1980, the Act provides for coordinated planning of the Pacific Northwest's energy future, through a Regional Planning Council with representation from Oregon, Idaho, Montana, and Washington.

Particulate Concentrations. Finely divided solid or liquid matter in the air or in a gaseous discharge. Some particulates are dust, smoke, fumes, mist, spray, and fog.

Peaking Energy. Energy from operation of generating facilities to meet maximum instantaneous electrical demands.

Potlines. A set of aluminum reduction cells (pots) which are connected electrically in series. A potline may contain 200 pots or more.

Power System Reserves. Extra generating capacity and/or ability to shed certain loads in order to protect service to firm loads when a failure occurs on the generating system or transmission system.

Prebake. A type of aluminum production technology in which the anode is formed and baked prior to its installation at a reduction cell, or "pot." See Anode Preparation Facility.

Preference Clause. The preferential use of Federal resources by public bodies and cooperatives, as accorded to such utilities in the Bonneville Project Act.

Preference Utilities. Cooperatives and public bodies which have preferential rights to Federally generated hydro power under the Bonneville Project Act.

Priority Firm Power. Sale of firm power to be used within the Pacific Northwest by public bodies, cooperatives, Federal agencies, and IOUs participating in the residential and small farm exchange under Section 5(c) of the Pacific Northwest Power Act.

Probabilistic Model. A form of mathematical model used to predict the most probable outcome in a realm of uncertainty by averaging the results of many calculations involving two or more variables. In each such calculation, each variable is selected randomly from within some defined range.

Quartile. The Direct Service Industries' operating demands are divided into quarters. The upper quartile is that quarter of the DSIs' load which BPA may restrict for any reason or which the DSIs may curtail for any reason.

Riparian. Of, pertaining to, situated, or dwelling on the bank of a river or other body of water.

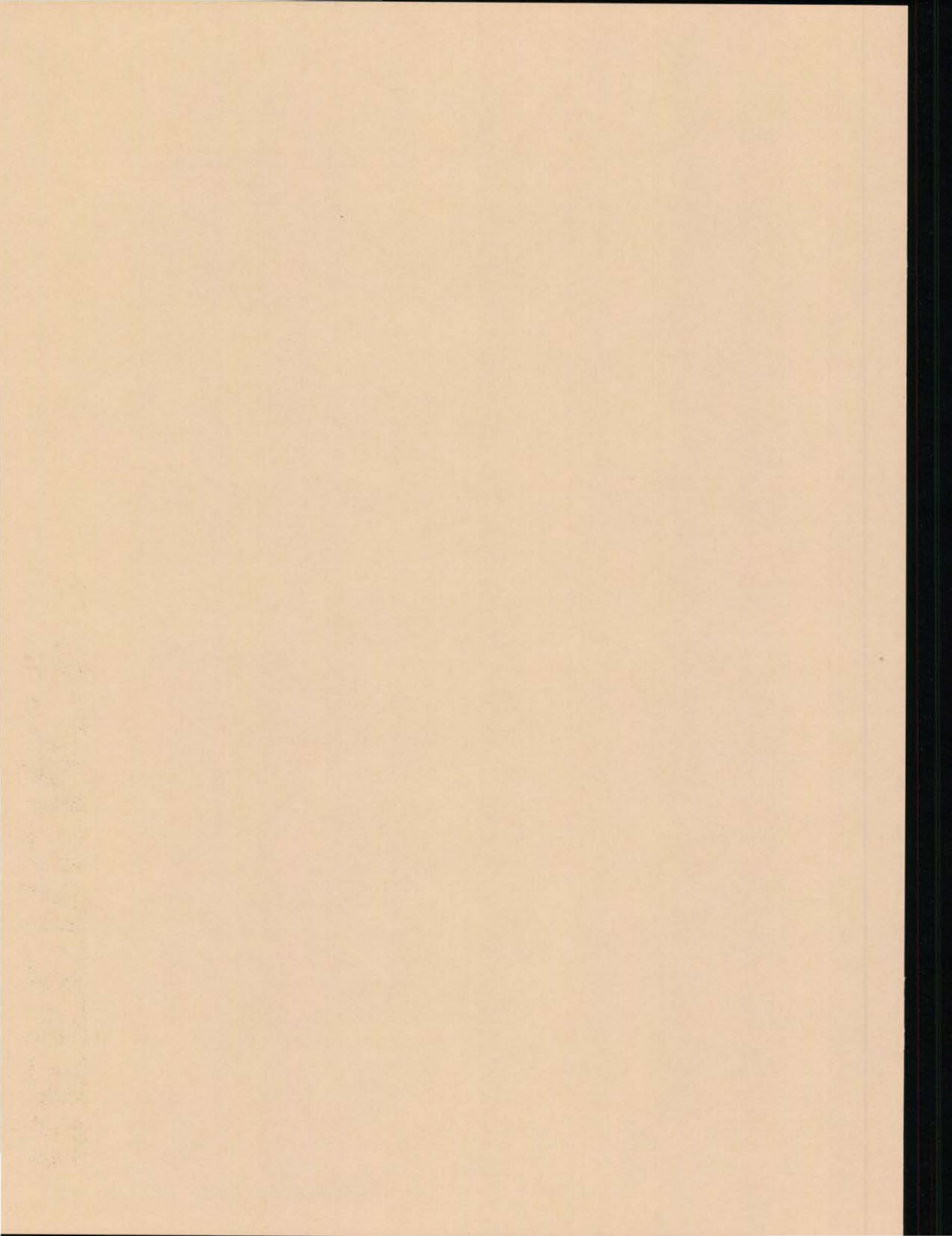
Salmonid. Fish belonging to the family of salmonidas, including salmon, trout, char, and allied freshwater and anadromous fishes.

Total Suspended Solids. A water pollution term referring to a measure of the quantity of all non-dissolved materials in a volume of water.

Vertical Stud Soderberg. A type of aluminum production technology in which anode material is added in a paste-like form and bakes in place at the reduction cell. Electricity is conducted to the anode through steel pins inserted vertically into the top of the anode.

Water Budget. A river operating constraint developed by the Northwest Power Planning Council in its Fish and Wildlife Program to provide certain volumes of water to achieve desired flows during April 15 to June 15 to increase the flow of water between dams on the Columbia River.

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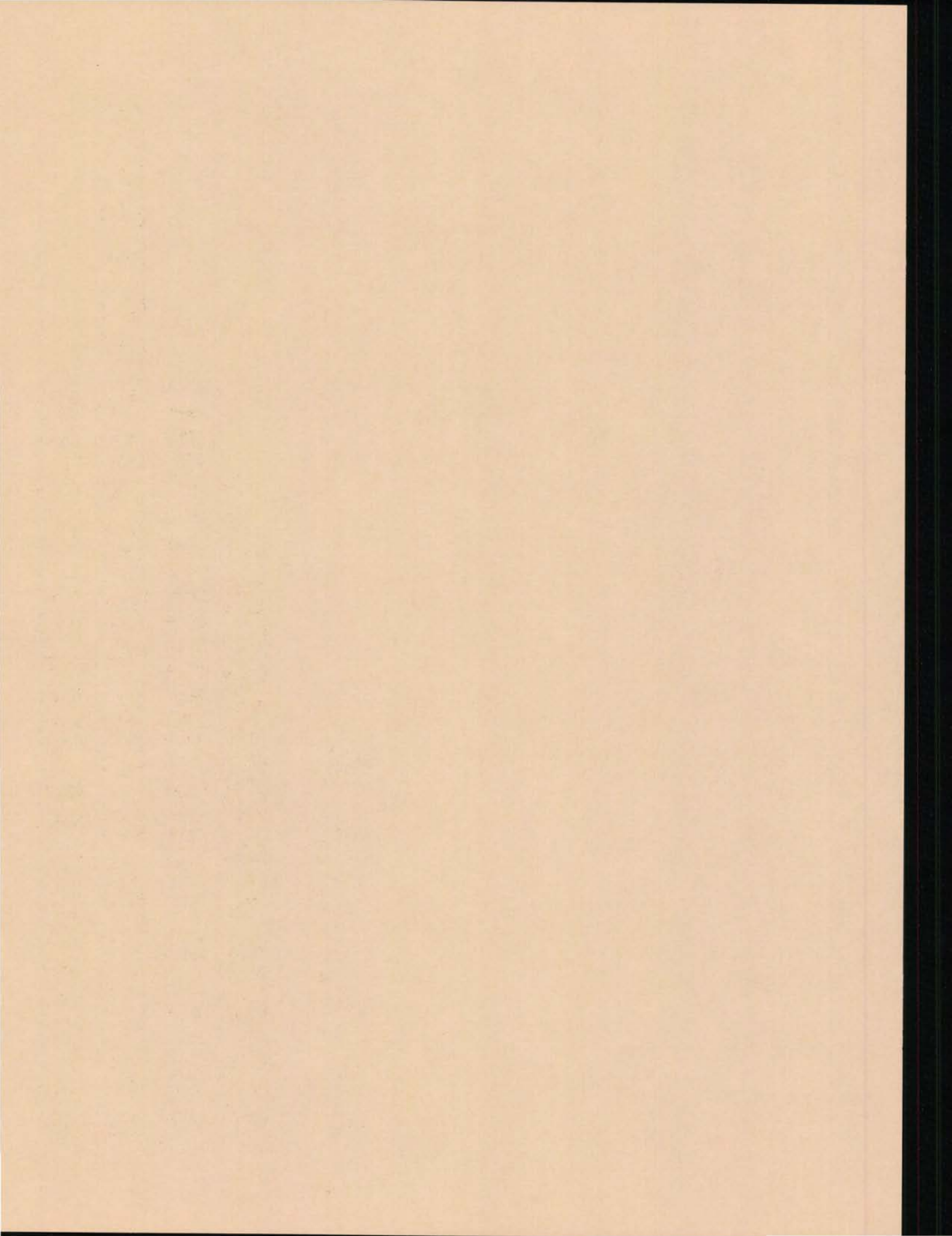


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APPENDIX A

AN ENVIRONMENTAL AND SOCIOECONOMIC ANALYSIS OF NORTHWESTERN ALUMINUM SMELTERS



Revised - Table 4.12
Atmospheric Emissions (ton/yr)

Plant	Plant Capacity TAP/day ^(a)	Particulates	Fluorides ^(b)	Hydrocarbons	SO _x ^(c)	CO
Vancouver ^(d)	338	678	185	30	1,276	7,023
Longview	575	1,575	263	No data	No data	No data
Troutdale ^(e)	356	877	162	No data	2,799	12,822
The Dalles	250	435	102	No data	503	15,926
Goldendale	482	595	161	No data	633	No data
Wenatchee ^(f)	630	1,368	495	401	2,737	No data
Tacoma	218	600	158	36	1,941	11,336
Ferndale	798	620	117	9	5,082	37,205
Mead	636	1,544	685	No data	404	24,132
Columbia Falls	437	837	456	625	1,850	No data

(a) TAP/day = tons aluminum produced per day.

(b) Includes particulate and gaseous fluorides.

(c) Washington regulates based on sulfur content in coke - limits to 60 lbs SO₂/TAP; Oregon limits emissions on an individual basis for each plant; Montana does not have an SO₂ atmospheric emission limit for aluminum smelters.

(d) Blessinger, J. A. 1985; letter and material submitted 7/3/85, from Environmental Superintendent of Alcoa at Vancouver; Willenberg, J. 1985; letter dated 6/19/85 transmitting air emission data for Alcoa Vancouver plant.

(e) Production numbers for Troutdale are considered proprietary; see Table 4.13 for effluent information.

(f) New air pollution control equipment was operational in May 1985 and is expected to significantly reduce the reported emissions.

of particulate alumina are from ship unloading and about 7 ton/yr of particulate matter are released from alumina conveying, storage, and handling.

Upgraded equipment for control of air emissions was installed and first operated in 1974. Alcoa A-398 dry scrubbers are used to capture particulates and to capture and recycle fluoride emitted from the smelting process. Alcoa 446 dry scrubbers are used to collect combustion products from anode baking furnaces. In addition, nuisance dust collectors (baghouses) are used to control emissions from material handling systems where dust is generated.^(a)

The potroom dry scrubbing equipment (secondary system) has a rated efficiency above 99% for particulates and fluoride from the reduction plant. Control equipment on the anode baking furnaces has efficiencies above 95% for hydrocarbon removal and about 95% for total carbon removal. Other baghouses in the plant have efficiencies above 98% for particulates; the electrostatic precipitator is rated at 95% efficiency.^(b)

Longview. Atmospheric emissions are regulated by the Washington State Air Pollution Control Board relative to the amount of aluminum produced. The fluoride pollution control system must be designed to collect 85% of the emissions and remove 95% of the collected material. Currently, total fluoride emissions range from approximately 2.0 to 2.5 lbs/ton. Particulate emissions rarely exceed 15 lb/ton.

Troutdale. Atmospheric emissions are regulated by an Air Contaminant Discharge Permit (ACDP) from the Oregon Department of Environmental Quality. The permitted releases are related to aluminum production and are listed in Table 4.13.

Revised - Table 4.13
Air Pollutant Emissions from Troutdale

<u>Component</u>	<u>Permitted</u>	<u>Actual (1981)</u>
Fluorides	3.5 lb/ton Al	2.6 lb/ton Al
SO ₂	2868 ton/yr ^(a)	3432.8 ton/yr
Particulates	15.6 lb/ton Al	12.0 lb/ton Al

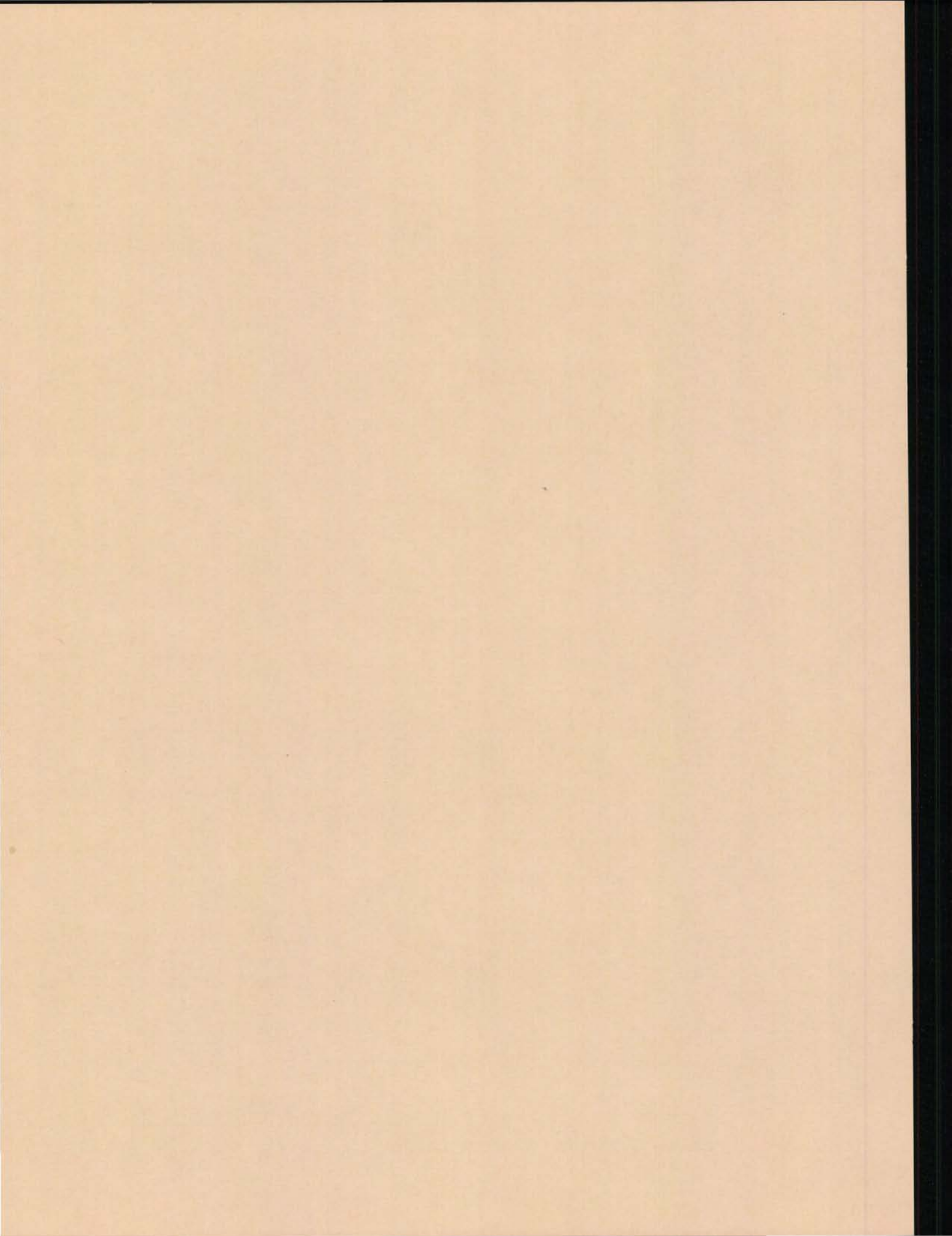
(a) Annual permitted value.

The Dalles. Average release for July 1982 through June 1983 included 6.2 lb/TAP total particulates, 0.5 lb/TAP particulate F⁻, 0.2 lb/TAP gaseous F(HF), and 8.2 lb/TAP SO₂.

(a) Letter and material from J. A. Blessinger submitted July 3, 1985, from Environmental Superintendent of Alcoa Vancouver plant.

(b) Aluminum Company of America (Alcoa). 1976. Environmental Assessment of Alcoa Vancouver operations. Vancouver, Washington.

APPENDIX C
ESTIMATED
ATMOSPHERIC EMISSIONS
IN TONS PER YEAR BY PLANT



APPENDIX C

ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR BY PLANT

This appendix consists of tabulations of estimated aluminum smelter air pollutant emissions for the three periods FY 1987-1991, FY 1992-1996, and FY 1997-2000, and at the two long-run aluminum prices (65¢/lb. and 70¢/lb.) for which studies for the Final EIS were made. These were computed by multiplying the values from Table 4.12 of Appendix A (which shows annual air pollutant emissions for each smelter when operated at capacity) by the average production capacity factor (i.e., annual aluminum production divided by the maximum annual aluminum production capability of the smelter) computed for the respective periods from the Decision Analysis Model results. Table 4.12 of Appendix A is also reproduced in this appendix. The inherent assumption in this series of calculations is that emissions are proportional to aluminum production. While this may not be precisely true, it is a reasonable approximation for this EIS. This appendix shows the results of these calculations only for the no action alternative at the two long-run aluminum prices. Tables like those in this appendix could have been prepared for the other options and combinations, but since the two different aluminum prices result in substantial differences in aluminum smelter operations, and the price effects are greater than what occurs among options, the results at the two aluminum prices approximate the potential range of emissions that would be expected from BPA's actions.

TABLE: 3

ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT 1/

(Reproduction of EIS, Table 4.12)
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT CAPACITY (a) (TAP(000)/YR)	(B) PARTICULATES	(C) FLUORIDES (b)	(D) HYDROCARBONS	(E) SO _x (c)	(F) CO
Plant (1)	ALCOA (d) VANCOUVER	123.37	678.00	185.00	30.00	1,276.00	7,023.00
Plant (2)	ALCOA (f) WENATCHEE	229.95	1,368.00	495.00	401.00	2,737.00	NA
Plant (3)	COLUMBIA FALLS	159.51	837.00	456.00	625.00	1,850.00	NA
Plant (4)	INTALCO	291.27	620.00	117.00	9.00	5,082.00	37,205.00
Plant (5)	KAISER MEAD	232.14	1,544.00	685.00	NA	404.00	24,132.00
Plant (6)	KAISER TACOMA	79.57	600.00	158.00	36.00	1,941.00	11,336.00
Plant (7)	COMMONWEALTH	175.93	595.00	161.00	NA	633.00	NA
Plant (8)	MARTIN- MARIETTA	91.25	435.00	102.00	NA	503.00	15,926.00
Plant (9)	REYNOLDS LONGVIEW	209.88	1,575.00	263.00	NA	NA	NA
Plant (10)	REYNOLDS (e) TROUTDALE	129.94	877.00	162.00	NA	2,799.00	12,822.00
TOTAL:		1,722.80	9,129.00	2,784.00	1,101.00	17,225.00	108,444.00

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

1/ Emission levels assume plants operate at full capacity for the entire year.

TABLE: 4

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

1987-1991
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/YR)	(B) 1/ PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SOx	(F) CO
Plant (1)	ALCOA VANCOUVER	64.60	355	97	16	668	3,677
Plant (2)	ALCOA WENATCHEE	113.60	676	245	198	1,352	0
Plant (3)	COLUMBIA FALLS	138.80	728	397	544	1,610	0
Plant (4)	INTALCO	245.40	522	99	8	4,282	31,346
Plant (5)	KAISER MEAD	125.80	837	371	0	219	13,077
Plant (6)	KAISER TACOMA	55.40	418	110	25	1,351	7,893
Plant (7)	COMMONWEALTH	117.20	396	107	0	422	0
Plant (8)	MARTIN- MARIETTA	69.40	331	78	0	383	12,112
Plant (9)	REYNOLDS LONGVIEW	155.40	1,166	195	0	0	0
Plant (10)	REYNOLDS TROUTDALE	56.00	378	70	0	1,206	5,526
TOTAL:		1,142	5,807	1,767	790	11,493	73,632

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

TABLE: 5

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

1992-1996
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SO _x	(F) CO
Plant (1)	ALCOA VANCOUVER	67.20	369	101	16	695	3,825
Plant (2)	ALCOA WENATCHEE	104.20	620	224	182	1,240	0
Plant (3)	COLUMBIA FALLS	127.00	666	363	498	1,473	0
Plant (4)	INTALCO	235.80	502	95	7	4,114	30,120
Plant (5)	KAISER MEAD	129.80	863	383	0	226	13,493
Plant (6)	KAISER TACOMA	53.60	404	106	24	1,307	7,636
Plant (7)	COMMONWEALTH	110.40	337	101	0	397	0
Plant (8)	MARTIN- MARIETTA	64.80	309	72	0	357	11,310
Plant (9)	REYNOLDS LONGVIEW	149.60	1,123	187	0	0	0
Plant (10)	REYNOLDS TROUTDALE	51.60	348	64	0	1,112	5,092
TOTAL:		1,094	5,578	1,698	727	10,922	71,476

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

TABLE: 6

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

1997-2000
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SO _x	(F) CO
Plant (1)	ALCOA VANCOUVER	67.25	370	101	16	696	3,828
Plant (2)	ALCOA WENATCHEE	107.50	640	231	187	1,280	0
Plant (3)	COLUMBIA FALLS	132.00	693	377	517	1,531	0
Plant (4)	INTALCO	235.75	502	95	7	4,113	30,113
Plant (5)	KAISER MEAD	128.50	855	379	0	224	13,358
Plant (6)	KAISER TACOMA	55.50	418	110	25	1,354	7,907
Plant (7)	COMMONWEALTH	113.00	382	103	0	407	0
Plant (8)	MARTIN- MARIETTA	65.25	311	73	0	360	11,388
Plant (9)	REYNOLDS LONGVIEW	155.00	1,163	194	0	0	0
Plant (10)	REYNOLDS TROUTDALE	50.75	343	63	0	1,093	5,008
TOTAL:		1,111	5,676	1,728	753	11,056	71,603

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

TABLE: 4

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

1987-1991
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/YR)	(B) 1/ PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SO _x	(F) CO
Plant (1)	ALCOA VANCOUVER	38.20	210	57	9	395	2,175
Plant (2)	ALCOA WENATCHEE	76.20	453	164	133	907	0
Plant (3)	COLUMBIA FALLS	92.40	485	264	362	1,072	0
Plant (4)	INTALCO	219.40	467	88	7	3,828	28,025
Plant (5)	KAISER MEAD	74.20	494	219	0	129	7,713
Plant (6)	KAISER TACOMA	33.60	253	67	15	820	4,787
Plant (7)	COMMONWEALTH	78.00	264	71	0	281	0
Plant (8)	MARTIN- MARIETTA	44.80	214	50	0	247	7,819
Plant (9)	REYNOLDS LONGVIEW	93.80	704	118	0	0	0
Plant (10)	REYNOLDS TROUTDALE	28.00	189	35	0	603	2,763
TOTAL:		779	3,732	1,133	526	8,281	53,282

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

TABLE: 5

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

1992-1996
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SO _x	(F) CO
Plant (1)	ALCOA VANCOUVER	32.00	176	48	8	331	1,822
Plant (2)	ALCOA WENATCHEE	74.60	444	161	130	888	0
Plant (3)	COLUMBIA FALLS	93.20	489	266	365	1,081	0
Plant (4)	INTALCO	204.00	434	82	6	3,559	26,058
Plant (5)	KAISER MEAD	63.00	419	186	0	110	6,549
Plant (6)	KAISER TACOMA	36.20	273	72	16	883	5,157
Plant (7)	COMMONWEALTH	73.60	249	67	0	265	0
Plant (8)	MARTIN- MARIETTA	45.40	216	51	0	250	7,924
Plant (9)	REYNOLDS LONGVIEW	101.00	758	127	0	0	0
Plant (10)	REYNOLDS TROUTDALE	24.00	162	30	0	517	2,368
TOTAL:		747	3,620	1,089	526	7,884	49,878

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

TABLE: 6

NO ACTION: ESTIMATED ATMOSPHERIC EMISSIONS IN TONS PER YEAR, BY PLANT

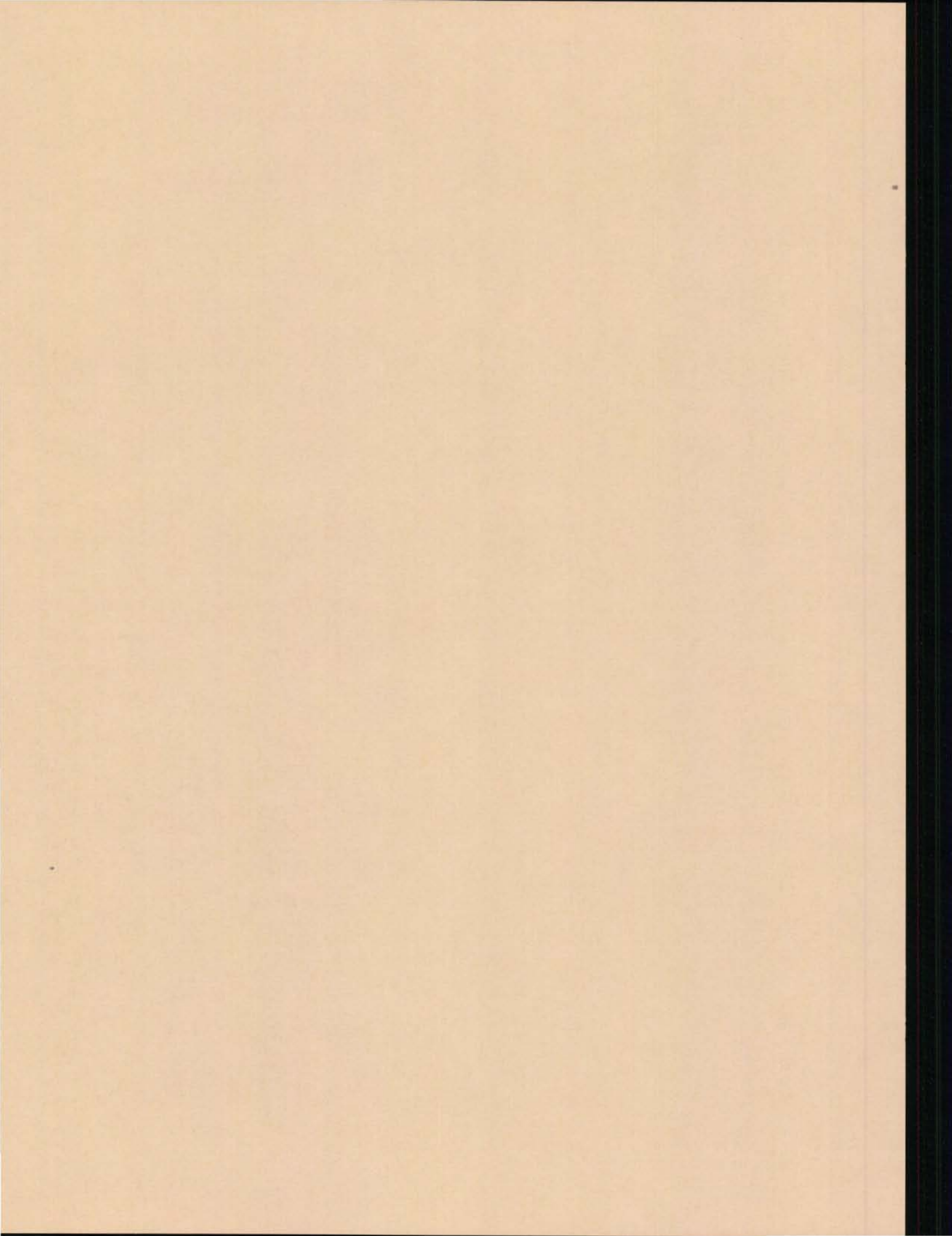
1997-2000
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) PARTICULATES	(C) FLUORIDES	(D) HYDROCARBONS	(E) SO _x	(F) CO
Plant (1)	ALCOA VANCOUVER	27.00	148	40	7	279	1,537
Plant (2)	ALCOA WENATCHEE	74.75	445	161	130	890	0
Plant (3)	COLUMBIA FALLS	90.25	474	258	354	1,047	0
Plant (4)	INTALCO	207.25	441	83	6	3,616	26,473
Plant (5)	KAISER MEAD	53.25	354	157	0	93	5,536
Plant (6)	KAISER TACOMA	36.25	273	72	16	884	5,164
Plant (7)	COMMONWEALTH	71.75	243	66	0	258	0
Plant (8)	MARTIN- MARIETTA	44.75	213	50	0	247	7,910
Plant (9)	REYNOLDS LONGVIEW	100.00	750	125	0	0	0
Plant (10)	REYNOLDS TROUTDALE	18.25	123	23	0	393	1,801
TOTAL:		724	3,465	1,036	513	7,707	48,321

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

APPENDIX D

ESTIMATED WATER POLLUTION DISCHARGES BY PLANT



APPENDIX D

ESTIMATED WATER POLLUTION DISCHARGES BY PLANT

This appendix consists of tabulations of estimated aluminum smelter water pollutant discharges for the three periods FY 1987-1991, FY 1992-1996, and FY 1997-2000, and at the two long-run aluminum prices (65¢/lb. and 70¢/lb.) for which studies for the Final EIS were made. These were computed by multiplying the values from Table 4.1 of Appendix A (which shows annual water pollutant discharges for each smelter when operated at capacity) by the average production capacity factor (i.e., annual aluminum production divided by the maximum annual aluminum production capability of the smelter) computed for the respective periods from the Decision Analysis Model results. Table 4.1 of Appendix A is also reproduced in this appendix. The inherent assumption in this series of calculations is that discharges are proportional to aluminum production. While this may not be precisely true, it is a reasonable approximation for this EIS. This appendix shows the results of these calculations only for the no action alternative at the two long-run aluminum prices. Tables like those in this appendix could have been prepared for the other options and combinations, but since the two different aluminum prices result in substantial differences in aluminum smelter operations, and the price effects are greater than what occurs among options, the results at the two aluminum prices approximate the potential range of annual discharges that would be expected from BPA's actions.

TABLE: 3

ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT 1/

(Reproduction of EIS, Table 4.1)

OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT CAPACITY (a) (TAP(000)/YR)	(B) WATER DISCHARGE (million gal/yr)	(C) (b) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA (d) VANCOUVER	123.37	1,752.00	13.16	COLUMBIA RIVER
Plant (2)	ALCOA (f) WENATCHEE	229.95	3,321.50	74.84	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	159.51	1,715.50	12.89	ONSITE PONDS
Plant (4)	INTALCO	291.27	2,226.50	47.38	STRAITS OF GEORGIA
Plant (5)	KAISER MEAD	232.14	1,241.00	119.11	PEONE CREEK
Plant (6)	KAISER TACOMA	79.57	255.50	5.33	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	175.93	3,248.50	122.00	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	91.25	912.50	60.92	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	209.88	3,321.50	166.32	COLUMBIA RIVER
Plant (10)	REYNOLDS (e) TROUTDALE	129.94	584.00	63.36	COLUMBIA RIVER
TOTAL:		1,722.80	18,578.50	685.31	

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

1/ Pollution levels assume plants operate at full capacity for the entire year.

TABLE: 4

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

1987-1991
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/YR)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	64.60	917	7	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	113.60	1,641	37	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	138.80	1,493	11	ONSITE PONDS
Plant (4)	INTALCO	245.40	1,876	40	STRAITS OF GEORGIA
Plant (5)	KAISER MEAD	125.80	673	65	PEONE CREEK
Plant (6)	KAISER TACOMA	55.40	178	4	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	117.20	2,164	81	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	69.40	694	46	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	155.40	2,459	123	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	56.00	252	27	COLUMBIA RIVER
TOTAL:		1,142	12,346	441	

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

TABLE: 5

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

1992-1996
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	67.20	954	7	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	104.20	1,505	34	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	127.00	1,366	10	ONSITE PONDS
Plant (4)	INTALCO	235.80	1,802	38	STRAITS OF GEORGIA
Plant (5)	KAISER MEAD	129.80	694	67	PEONE CREEK
Plant (6)	KAISER TACOMA	53.60	172	4	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	110.40	2,039	77	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	64.80	648	43	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	149.60	2,368	119	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	51.60	232	25	COLUMBIA RIVER
TOTAL:		1,094	11,780	423	

Source: Decision Analysis Model (DAM): Table 4, 3/19/86.

TABLE: 6

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

1997-2000
ALUMINUM PRICE=\$.70
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	67.25	955	7	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	107.50	1,553	35	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	132.00	1,420	11	ONSITE PONDS
Plant (4)	INTALCO	235.75	1,802	38	STRAITS OF GEORGIA
Plant (5)	KAISER HEAD	128.50	687	66	PEONE CREEK
Plant (6)	KAISER TACOMA	55.50	178	4	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	113.00	2,087	78	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	65.25	653	44	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	155.00	2,453	123	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	50.75	228	25	COLUMBIA RIVER
TOTAL:		1,111	12,015	450	

Source: Decision Analysis Model (DAM): Table 4, 3/19/96.

TABLE: 4

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

1987-1991
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/YR)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	38.20	542	4	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	76.20	1,101	25	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	92.40	994	7	ONSITE PONDS
Plant (4)	INTALCO	219.40	1,677	36	STRAITS OF GEORGIA
Plant (5)	KAISER MEAD	74.20	397	38	PEGONE CREEK
Plant (6)	KAISER TACOMA	33.60	108	2	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	78.00	1,440	54	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	44.80	448	30	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	93.80	1,484	74	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	28.00	126	14	COLUMBIA RIVER
TOTAL:		779	8,317	284	

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

TABLE: 5

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

1992-1996
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	32.00	454	3	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	74.60	1,078	24	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	93.20	1,002	8	ONSITE PONDS
Plant (4)	INTALCO	204.00	1,559	33	STRAITS OF GEORGIA
Plant (5)	KAISER HEAD	63.00	337	32	PEONE CREEK
Plant (6)	KAISER TACOMA	36.20	116	2	HYLEBOS WATERWAY
Plant (7)	COMMONWEALTH	73.60	1,359	51	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	45.40	454	30	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	101.00	1,598	80	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	24.00	108	12	COLUMBIA RIVER
TOTAL:		747	8,066	276	

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

TABLE: 6

NO ACTION: ESTIMATED WATER POLLUTION DISCHARGES IN TONS PER YEAR, BY PLANT

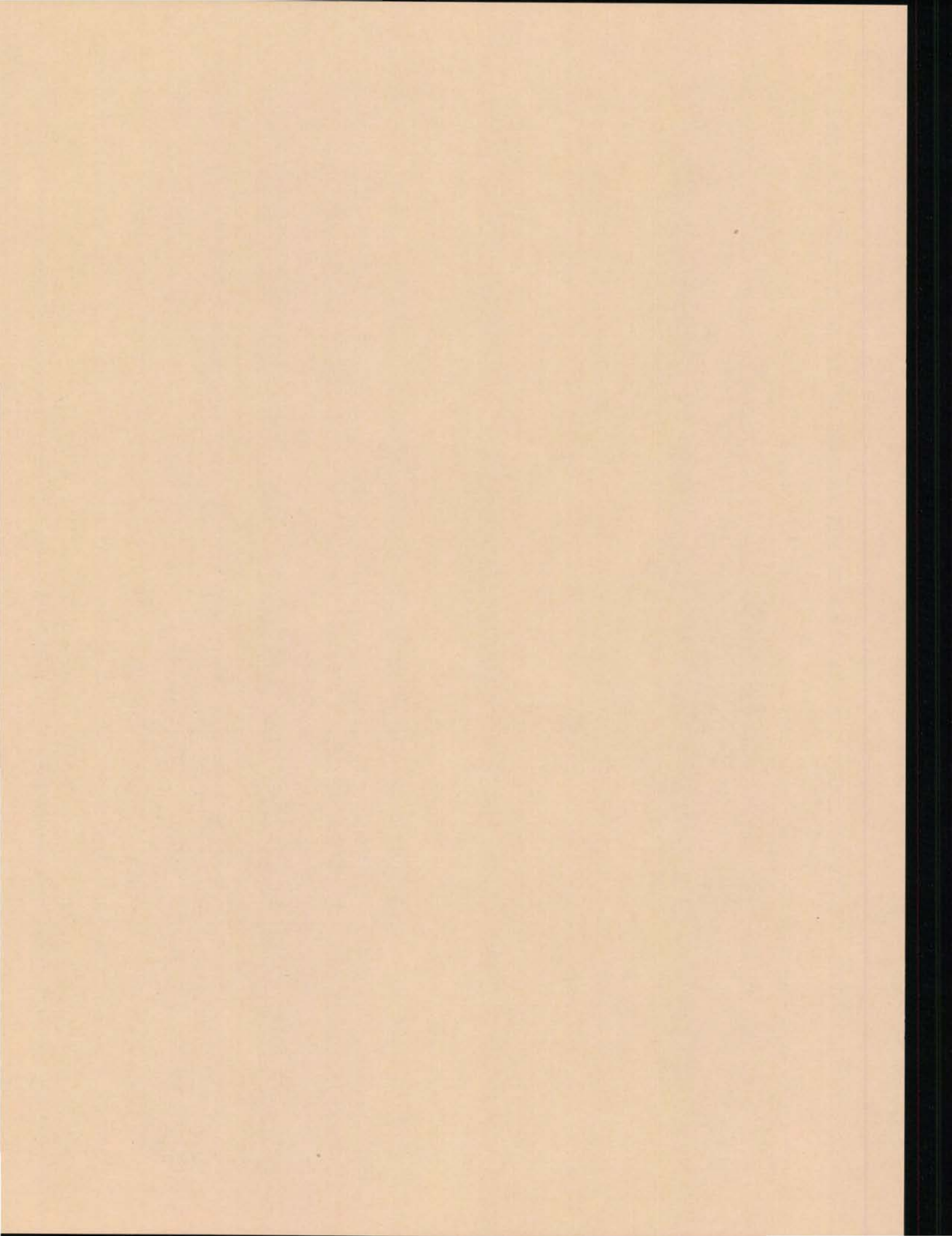
1997-2000
ALUMINUM PRICE=\$.65
OPTION 0

PLANT NUMBER	PLANT NAME	(A) PLANT PRODUCTION (TAP/DAY)	(B) WATER DISCHARGE (million gal/yr)	(C) FLUORIDES (tons/yr)	RECEIVING WATER
Plant (1)	ALCOA VANCOUVER	27.00	383	3	COLUMBIA RIVER
Plant (2)	ALCOA WENATCHEE	74.75	1,080	24	COLUMBIA RIVER
Plant (3)	COLUMBIA FALLS	90.25	971	7	ONSITE PONDS
Plant (4)	INTALCO	207.25	1,584	34	STRAITS OF GEORGIA
Plant (5)	KAISER MEAD	53.25	295	27	PEONE CREEK
Plant (6)	KAISER TACOMA	36.25	116	2	HYLEBOG WATERWAY
Plant (7)	COMMONWEALTH	71.75	1,325	50	COLUMBIA RIVER
Plant (8)	MARTIN- MARIETTA	44.75	448	30	COLUMBIA RIVER
Plant (9)	REYNOLDS LONGVIEW	100.00	1,583	79	COLUMBIA RIVER
Plant (10)	REYNOLDS TROUTDALE	18.25	82	9	COLUMBIA RIVER
TOTAL:		724	7,856	266	

Source: Decision Analysis Model (DAM): Table 4, 03/19/86.

APPENDIX E

DIFFERENCES IN GENERATION IMPACTS AMONG OPTIONS



APPENDIX E
DIFFERENCES IN GENERATION IMPACTS
AMONG OPTIONS

This appendix shows changes, for the various options and combinations analyzed in the final EIS, in environmental impacts resulting from changes in operation of coal-fired, nuclear, and combustion turbine generating resources. These impacts are presented for the two alternate long-run aluminum prices used in the studies for the final EIS. Lines 33 through 37 of the tables show the maximum, minimum, and average differences in annual energy produced by each of the three types of resources between the particular alternative or combination indicated at the head of the column and the no action alternative at the same aluminum price. These differences were computed from values for the amount of energy produced by year by all regional resources of a given type from the Decision Analysis Model. To obtain the values in lines 1 through 34 of the tables, the average difference in energy production (from line 36) was multiplied by impact coefficients from the Energy Technology Characterizations Handbook, March 1983.

The impacts in the tables represent those expected from typical plants of the types shown. To address impacts of changes in operation of specific regional coal-fired, nuclear, and combustion turbine resources was considered beyond the scope of the Final EIS and not pertinent to a decision to implement one or more of the options under consideration.

Impacts on the region's hydroelectric resources are discussed in section 4.2.2 in the main body of the Final EIS.

3/20/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND VARIABLE RATE OPTIONS

DSI Options study: documentation for draft EIS

=====		OPTION 1: REVENUE			OPTION 2: BPA PROPOSAL			OPTION 3: LOAD		
1. VARIABLE (Aluminum price=\$.65/#)		-----			-----			-----		
=====		A	B	C	D	E	F	G	H	I
Line		Coal	Nuclear	GT	Coal	Nuclear	GT	Coal	Nuclear	GT
No.		-----			-----			-----		

Mine Site		1/			1/			1/		

1	Overburden Removed (tons)	-573.17	69590		-486.66	11362		2330.55	161193	
2	Process Water Used (acre/ft)		10			2			23	
3	Solid Waste (tons)	-4.91	2259		-4.17	369		19.96	5234	
Air Pollutants (tons):										
4	Particulates	-54.06	1.49		-45.90	0.24		219.79	3.45	
5	SO ₂	-2.17	0.21		-1.84	0.04		8.82	0.50	
6	NO _x	-5.39	0.23		-4.57	0.04		21.90	0.53	
7	Hydrocarbons	-1.62	0.01		-1.37	.00		6.57	0.02	
8	CO	-2.52	.00		-2.14	.00		10.23	.00	
9	Other	-0.91	0.09		-0.77	0.01		3.69	0.20	
10	Water Pollutants (tons)		49.41			8.07			114.46	
11	Deaths		.00			.00			.00	
12	Injuries	-0.07	0.13		-0.06	0.02		0.28	0.29	
Process Site										

14	Process Water Used (acre/ft)		296.20			48.36			686.09	
15	Solid Waste (tons)		0.63			0.19			1.45	
Air Pollutants (tons):										
16	Particulates		10.84			1.77			25.10	
17	SO ₂		41.72			6.81			96.63	
18	NO _x		10.99			1.79			25.46	
19	Hydrocarbons		0.11			0.02			0.26	
20	CO		0.28			0.05			0.64	
21	Fluoride		0.01			.00			0.01	
22	Water Pollutants (tons)		1.04			0.17			2.40	
Generating Site										

23	Process Water Used (acre/ft)	-100.92	167.36		-85.69	27.32		410.35	387.67	
24	Solid Waste (tons)	-10657.93	167.54		-9049.18	27.35		43335.54	388.09	
Air Pollutants (tons)										
25	Particulates	-122.19	.00	0.00	-103.75	.00	0.08	496.84	0.01	1.18
26	SO ₂	-136.34			-115.76			554.35		
27	NO _x	-192.84	0.09	0.00	-163.73	0.01	2.44	784.09	0.20	34.21
28	Hydrocarbons	-7.20	0.01	0.00	-6.11	.00	0.25	29.26	0.01	3.46
29	CO	-20.89	0.01	0.00	-17.73	.00	0.68	84.92	0.03	9.55
30	CO ₂	-70148			-59559			285223		
31	Other	-0.10	0.06	0.00	-0.09	0.01	0.05	0.41	0.13	0.66
32	Water Pollutants (tons)		0.41			0.07			0.94	
33	Deaths	.00	.00		.00	.00		.00	.00	
34	Injuries	-0.04	0.04		-0.03	0.01		0.16	0.08	
=====		=====			=====			=====		
35	Average AMW difference 2/	-7.57	7.00	0.00	-6.43	1.14	0.07	30.79	16.21	1.00
36	Maximum AMW difference 3/	21	48	2	11	32	2	70	80	5
37	Minimum AMW difference 4/	-51	0	-2	-35	-16	-2	-23	0	-1

1/ To calculate: Environmental impact per one AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characterizations: Environmental Information Handbook, 3/83; DAM.

2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

3/26/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND CON/MOD RATE OPTIONS

OSI Options study:

documentation for draft EIS

II. Con/Mod (Aluminum price=\$.65/#)

Line

No.

Mine Site

1/

1/

1/

		OPTION 1: CON/MOD: 3 mills			OPTION 2: CON/MOD: 5 mills			OPTION 3: CON/MOD: 10 MILLS		
		A	B	C	D	E	F	G	H	I
		Coal	Nuclear	CI	Coal	Nuclear	CI	Coal	Nuclear	CI
		-----			-----			-----		
		1/			1/			1/		
1	Overburden Removed (tons)	-91.92	-23433		108.15	-33375		1162.57	34795	
2	Process Water Used (acre/ft)		-3			-5			5	
3	Solid Waste (tons)	-0.79	-761		0.93	-1084		9.96	1130	
Air Pollutants (tons):										
4	Particulates	-8.67	-0.50		10.20	-0.71		109.64	0.74	
5	SO ₂	-0.35	-0.07		0.41	-0.10		4.40	0.11	
6	NO _x	-0.86	-0.08		1.02	-0.11		10.92	0.11	
7	Hydrocarbons	-0.26	.00		0.30	.00		3.28	.00	
8	CO	-0.40	.00		0.47	.00		5.10	.00	
9	Other	-0.15	-0.03		0.17	-0.04		1.84	0.04	
10	Water Pollutants (tons)		-16.64			-23.70			24.71	
11	Deaths		.00			.00			.00	
12	Injuries	-0.01	-0.04		0.01	-0.06		0.14	0.06	
Process Site										
14	Process Water Used (acre/ft)		-99.74			-142.05			148.10	
15	Solid Waste (tons)		-0.21			-0.30			0.31	
Air Pollutants (tons):										
16	Particulates		-3.65			-3.20			5.42	
17	SO ₂		-14.05			-20.01			20.86	
18	NO _x		-3.70			-5.27			5.50	
19	Hydrocarbons		-0.04			-0.05			0.06	
20	CO		-0.09			-0.13			0.14	
21	Fluoride		.00			.00			.00	
22	Water Pollutants (tons)		-0.35			-0.50			0.52	
Generating Site										
23	Process Water Used (acre/ft)	-16.19	-56.36		19.04	-80.27		204.70	63.58	
24	Solid Waste (tons)	-1709.29	-56.42		2010.93	-80.35		21617.50	83.77	
Air Pollutants (tons):										
25	Particulates	-19.60	.00	0.17	23.06	.00	0.675/71	247.84	.00	1.44
26	SO ₂	-21.87			25.72			276.53		
27	NO _x	-30.93	-0.03	4.89	36.38	-0.04	19.54731	391.13	0.04	41.54
28	Hydrocarbons	-1.15	.00	0.49	1.35	.00	1.977257	14.60	.00	4.20
29	CO	-3.35	.00	1.36	3.54	-0.01	5.456228	42.36	0.01	11.59
30	CO ₂	-11250.11			13235			142281		
31	Other	-0.02	-0.02	0.09	0.02	-0.03	0.375428	0.20	0.01	0.80
32	Water Pollutants (tons)		-0.14			-0.20			0.20	
33	Deaths	.00	.00		.00	.00		.00	.00	
34	Injuries	-0.01	-0.01		0.01	-0.02		0.08	0.02	
		=====			=====			=====		
35	Average AMW difference 2/	-1.21	-2.36	0.14	1.43	-3.36	0.57	15.36	3.50	1.21
36	Maximum AMW difference 3/	5	0	1	16	17	3	33	33	4
37	Minimum AMW difference 4/	-13	-13	-1	-33	-32	-1	-20	-33	-1

1/ To calculate: Environmental impact per ore AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characteristics; Environmental Information Handbook, 6/81; DRI.

2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

3/20/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND COMBINATION RATE OPTIONS

DSI Options study:

documentation for draft EIS

III. Combination (Con/Mod-Variable)

(Aluminum price=\$.65/#)

Line No.	Mine Site	OPTION 1: REVENUE/5 MILL			OPTION 2: RPA PROP/5 MILL			OPTION 3: LOAD/10 MILL		
		A Coal	B Nuclear	C CT	D Coal	E Nuclear	F CT	G Coal	H Nuclear	I CT
		1/			1/			1/		
1	Overburden Removed (tons)	-351.48	46867		-173	-58228		9965.67	137050	
2	Process Water Used (acre/ft)		7			-8			19	
3	Solid Waste (tons)	-3.01	1522		-1.48	-1891		85.34	4450	
	Air Pollutants (tons):									
4	Particulates	-33.15	1.00		-16.32	-1.25		939.85	2.93	
5	SO ₂	-1.33	0.14		-0.65	-0.18		37.72	0.42	
6	NO _x	-3.30	0.15		-1.63	-0.19		93.64	0.45	
7	Hydrocarbons	-0.99	0.01		-0.49	-0.01		28.09	0.02	
8	CO	-1.54	.00		-0.76	.00		43.74	.00	
9	Other	-0.56	0.06		-0.27	-0.07		15.78	0.17	
10	Water Pollutants (tons)		33.28			-41.35			97.31	
11	Deaths		.00			.00			.00	
12	Injuries	-0.04	0.08		-0.02	-0.11		1.20	0.25	
	Process Site									
14	Process Water Used (acre/ft)		199.48			-247.84			583.33	
15	Solid Waste (tons)		0.42			-0.53			1.24	
	Air Pollutants (tons):									
16	Particulates		7.30			-9.07			21.34	
17	SO ₂		28.09			-34.90			82.15	
18	NO _x		7.40			-9.20			21.65	
19	Hydrocarbons		0.08			-0.09			0.22	
20	CO		0.19			-0.23			0.54	
21	Fluoride		.00			.00			0.01	
22	Water Pollutants (tons)		0.70			-0.87			2.04	
	Generating Site									
23	Process Water Used (acre/ft)	-61.89	112.71		-30.47	-140.04		1754.71	329.60	
24	Solid Waste (tons)	-6535.52	112.94		-3217.49	-140.19		*****	329.96	
	Air Pollutants (tons):									
25	Particulates	-74.93	.00	0.25	-36.89	.00	0.76	2124.54	.00	2.37
26	SO ₂	-83.60			-41.16			2370.44		
27	NO _x	-118.25	0.06	7.33	-58.22	-0.07	21.99	3352.84	0.17	68.42
28	Hydrocarbons	-4.41	.00	0.74	-2.17	.00	2.22	125.11	0.01	6.92
29	CO	-12.81	0.01	2.05	-6.31	-0.01	6.14	363.14	0.03	19.10
30	CO ₂	-43015			-21177			1219644		
31	Other	-0.06	0.04	0.14	-0.03	-0.05	0.42	1.75	0.11	1.31
32	Water Pollutants (tons)		0.27			-0.34			0.80	
33	Deaths	.00	.00		.00	.00		0.02	.00	
34	Injuries	-0.02	0.02		-0.01	-0.03		0.69	0.07	
35	Average AMW difference 2/	-4.64	4.71	0.21	-2.29	-5.86	0.64	131.64	13.75	2.00
36	Maximum AMW difference 3/	26	48	3	18	32	3	1212.00	80.00	7.00
37	Minimum AMW difference 4/	-64	0	-2	-48	-49	-2	18.00	-33.00	0.00

1/ To calculate: Environmental impact per one AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characteristics; Environmental Information Handbook, 6/81; DAM)

2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

3/20/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND VARIABLE RATE OPTION

DSI Options study: documentation for draft EIS

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1. VARIABLE (Aluminum price=\$.70/#)

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Line No.		OPTION 1: REVENUE			OPTION 2: BPA PROPOSAL			OPTION 3: LOAD		
		A Coal	B Nuclear	C CT	D Coal	E Nuclear	F CT	G Coal	H Nuclear	I CT
	Mine Site	1/			1/			1/		
1	Overburden Removed (tons)	32.44	184626		254.14	-34795		2757.73	22723	
2	Process Water Used (acre/ft)		26			-5			3	
3	Solid Waste (tons)	0.28	5994		2.18	-1130		23.62	738	
	Air Pollutants (tons):									
4	Particulates	3.06	3.95		23.97	-0.74		260.08	0.49	
5	SO ₂	0.12	0.57		0.96	-0.11		10.44	0.07	
6	NO _x	0.30	0.60		2.39	-0.11		25.91	0.07	
7	Hydrocarbons	0.09	0.03		0.72	.00		7.77	.00	
8	CO	0.14	.00		1.12	.00		12.10	.00	
9	Other	0.05	0.23		0.40	-0.04		4.37	0.03	
10	Water Pollutants (tons)		131.10			-24.71			16.13	
11	Deaths		.00			.00			.00	
12	Injuries	.00	0.33		0.03	-0.06		0.33	0.04	
	Process Site									
14	Process Water Used (acre/ft)		785.83			-148.10			96.72	
15	Solid Waste (tons)		1.67			-0.31			0.20	
	Air Pollutants (tons):									
16	Particulates		28.75			-5.42			3.54	
17	SO ₂		110.67			-20.86			13.62	
18	NO _x		29.16			-5.50			3.59	
19	Hydrocarbons		0.30			-0.06			0.04	
20	CO		0.73			-0.14			0.09	
21	Flouride		0.01			.00			.00	
22	Water Pollutants (tons)		2.75			-0.52			0.34	
	Generating Site									
23	Process Water Used (acre/ft)	5.71	444.03		44.75	-83.68		485.57	54.65	
24	Solid Waste (tons)	603.28	444.50		4725.69	-83.77		51278.71	54.71	
	Air Pollutants (tons):									
25	Particulates	6.92	0.01	0.25	54.18	.00	0.42	587.91	.00	1.4
26	SO ₂	7.72			60.45			655.95		
27	NO _x	10.92	0.23	7.33	85.50	-0.04	12.22	927.81	0.03	41.5
28	Hydrocarbons	0.41	0.01	0.74	3.19	.00	1.24	34.62	.00	4.2
29	CO	1.18	0.04	2.05	9.26	-0.01	3.41	100.49	.00	11.5
30	CO ₂	3971			31103			337503		
31	Other	0.01	0.15	0.14	0.04	-0.03	0.23	0.48	0.02	0.8
32	Water Pollutants (tons)		1.08			-0.20			0.13	
33	Deaths	.00	.00		.00	.00		0.01	.00	
34	Injuries	.00	0.09		0.02	-0.02		0.19	0.01	
35	Average AMW difference 2/	0.43	18.57	0.21	3.36	-3.50	0.36	36.43	2.29	1.2
36	Maximum AMW difference 3/	46	81	4	20	16	1	53	16	
37	Minimum AMW difference 4/	-31	-16	-3	-9	-32	-1	21	-16	

1/ To calculate: Environmental impact per one AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characterizations: Environmental Information Handbook, 3/83; DAM.

2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

3/20/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND CON/MOD RATE OPTIONS

DSI Options study:

documentation for draft EIS

II. Con/Mod (Aluminum price=\$.70/#)

Line

No.

OPTION 1: CON/MOD: 3 mills

OPTION 2: CON/MOD: 5 mills

OPTION 3: CON/MOD: 10 MILLS

A

B

C

D

E

F

G

H

I

Coal

Nuclear

CT

Coal

Nuclear

CT

Coal

Nuclear

CT

1/

1/

1/

----- Mine Site -----

1 Overburden Removed (tons) -48.67 -58880 232.51 -34085 1611.38 -125688

2 Process Water Used (acre/ft) -10 -5 -18

3 Solid Waste (tons) -0.42 -2236 1.99 -1107 13.80 -4081

Air Pollutants (tons):

4 Particulates -4.59 -1.47 21.93 -0.73 151.77 -2.69

5 SO2 -0.18 -0.21 0.88 -0.11 6.10 -0.39

6 NOx -0.46 -0.22 2.18 -0.11 15.14 -0.41

7 Hydrocarbons -0.14 -0.01 0.66 .00 4.54 -0.02

8 CO -0.21 .00 1.02 .00 7.07 .00

9 Other -0.08 -0.09 0.37 -0.04 2.55 -0.16

10 Water Pollutants (tons) -48.91 -24.20 -89.25

11 Deaths .00 .00 .00

12 Injuries -0.01 -0.12 0.03 -0.06 0.19 -0.23

----- Process Site -----

14 Process Water Used (acre/ft) -293.18 -145.08 -534.97

15 Solid Waste (tons) -0.62 -0.31 -1.13

Air Pollutants (tons):

16 Particulates -10.73 -5.31 -19.57

17 SO2 -41.29 -20.43 -75.34

18 NOx -10.88 -5.38 -19.85

19 Hydrocarbons -0.11 -0.06 -0.20

20 CO -0.27 -0.14 -0.50

21 Fluoride -0.01 .00 -0.01

22 Water Pollutants (tons) -1.03 -0.51 -1.87

----- Generating Site -----

23 Process Water Used (acre/ft) -8.57 -165.66 40.94 -81.97 283.72 -302.28

24 Solid Waste (tons) -904.92 -165.83 4323.50 -82.06 29962.86 -302.60

Air Pollutants (tons):

25 Particulates -10.37 .00 0.00 49.57 .00 0.253414 343.52 .00 1.60

26 SO2 -11.58 55.31 383.28

27 NOx -16.37 -0.09 0.00 78.23 -0.04 7.330242 542.13 -0.16 46.42

28 Hydrocarbons -0.61 .00 0.00 2.92 .00 0.741471 20.23 -0.01 4.70

29 CO -1.77 -0.01 0.00 8.47 -0.01 2.046085 58.72 -0.03 12.96

30 CO2 -5955.94 28456 197208

31 Other -0.01 -0.06 0.00 0.04 -0.03 0.140785 0.28 -0.10 0.89

32 Water Pollutants (tons) -0.40 -0.20 -0.74

33 Deaths .00 .00 .00 .00 .00

34 Injuries .00 -0.03 0.02 -0.02 0.11 -0.06

35 Average AMW difference 2/

36 Maximum AMW difference 3/

37 Minimum AMW difference 4/

-0.64 -6.93 0.00

9 0 1

-10 -32 -1

3.07 -3.43 0.21

17 16 2

-17 -32 -1

21.29 -12.64 1.36

55 0 4

4 -49 -1

1/ To calculate: Environmental impact per one AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characteristics; Environmental Information Handbook, 5/81; DAI

2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

3/20/86

ENVIRONMENTAL IMPACTS OF DIFFERENCE BETWEEN RATE BASE AND COMBINATION RATE OF

DSI Options study:

documentation for draft EIS

III. Combination (Con/Mod-Variable)

(Aluminum price=\$.70/#)

		OPTION 1: REVENUE/5 mill			OPTION 2: BPA PROP/5 MILL			OPTION 3: LOAD/10 MILL		
		A	B	C	D	E	F	G	H	I
		Coal	Nuclear	CI	Coal	Nuclear	CI	Coal	Nuclear	CI
Line No.	Mine Site	1/			1/			1/		
1	Overburden Removed (tons)	248.74	184626		952	-102965		4239.33	-80241	
2	Process Water Used (acre/ft)		26			-14			-11	
3	Solid Waste (tons)	2.13	5994		8.15	-3343		36.30	-2605	
	Air Pollutants (tons):									
4	Particulates	23.46	3.95		89.75	-2.20		399.81	-1.72	
5	SO ₂	0.94	0.57		3.60	-0.32		16.05	-0.25	
6	NO _x	2.34	0.60		8.94	-0.34		39.83	-0.26	
7	Hydrocarbons	0.70	0.03		2.68	-0.01		11.95	-0.01	
8	CO	1.09	.00		4.18	.00		18.61	.00	
9	Other	0.39	0.23		1.51	-0.13		6.71	-0.10	
10	Water Pollutants (tons)		131.10			-73.11			-56.98	
11	Deaths		.00			.00			.00	
12	Injuries	0.03	0.33		0.11	-0.19		0.51	-0.14	
	Process Site									
14	Process Water Used (acre/ft)		785.83			-438.25			-341.54	
15	Solid Waste (tons)		1.67			-0.93			-0.72	
	Air Pollutants (tons):									
16	Particulates		28.75			-16.03			-12.50	
17	SO ₂		110.67			-61.72			-48.10	
18	NO _x		29.16			-16.26			-12.67	
19	Hydrocarbons		0.30			-0.17			-0.13	
20	CO		0.73			-0.41			-0.32	
21	Fluoride		0.01			-0.01			-0.01	
22	Water Pollutants (tons)		2.75			-1.53			-1.19	
	Generating Site									
23	Process Water Used (acre/ft)	43.80	444.03		167.57	-247.63		746.44	-192.98	
24	Solid Waste (tons)	4625.14	444.50		17696.18	-247.90		78828.45	-193.19	
	Air Pollutants (tons)									
25	Particulates	53.03	0.01	0.42	202.89	.00	1.01	903.77	.00	2.37
26	SO ₂	59.16			226.37			1008.37		
27	NO _x	83.68	0.23	12.22	320.18	-0.13	29.32	1426.28	-0.10	68.42
28	Hydrocarbons	3.12	0.01	1.24	11.95	-0.01	2.97	53.22	-0.01	6.92
29	CO	9.06	0.04	3.41	34.68	-0.02	8.18	154.48	-0.02	19.10
30	CO ₂	30441			116472			518828		
31	Other	0.04	0.15	0.23	0.17	-0.08	0.56	0.74	-0.07	1.31
32	Water Pollutants (tons)		1.08			-0.60			-0.47	
33	Deaths	.00	.00		.00	.00		0.01	.00	
34	Injuries	0.02	0.09		0.07	-0.05		0.29	-0.04	
35	Average AMW difference 2/	3.29	18.57	0.36	12.57	-10.36	0.86	56.00	-8.07	2.00
36	Maximum AMW difference 3/	37	81	4	32	0	2	87.00	16.00	5.00
37	Minimum AMW difference 4/	-31	-16	-2	-16	-33	-1	27.00	-49.00	-1.00

1/ To calculate: Environmental impact per one AMW generation, multiplied by average annual AMW difference between rate base and option (see line 35). Sources: Technological Characteristics; Environmental Information Handbook, 6/81; DAM

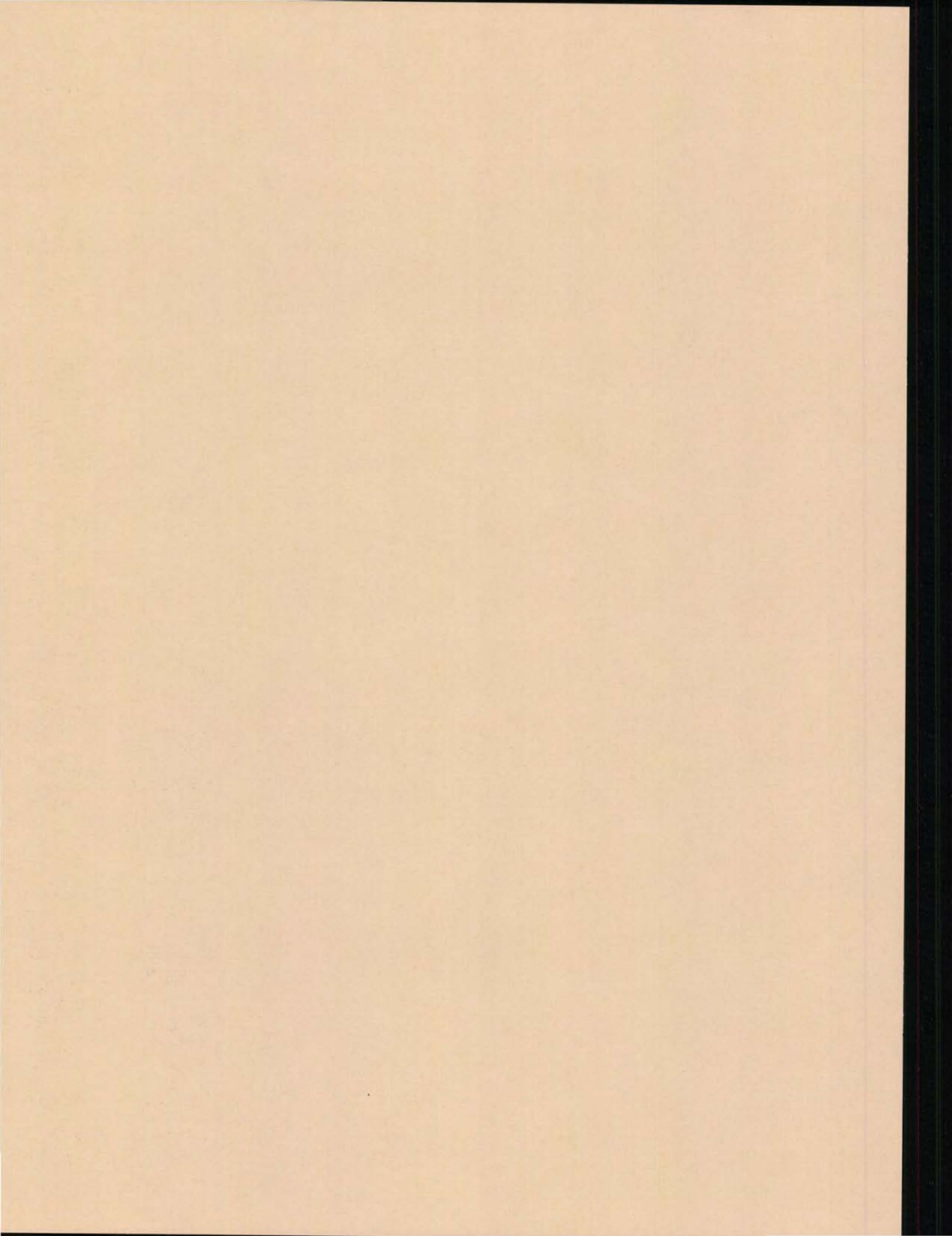
2/ The average annual difference in AMW between rate base and each option (over period 1987 through 2000).

3/ The maximum annual difference in AMW between rate base and each option (1987-2000).

4/ The minimum annual difference in AMW between rate base and each option (1987-2000).

APPENDIX F

POWER RATES BY YEAR



APPENDIX F

POWER RATES BY YEAR

This appendix contains tables reproduced from the output of the Decision Analysis Model which show the expected BPA wholesale power rates under the no action alternative and each other alternative, proposal, or combination studied. These rates are shown for both long-run aluminum prices, 65¢/lb. and 70¢/lb., studied. The tables in this appendix show the results of the model which performs its analysis out to FY 2015. However, for the purposes of this EIS, only results through FY 2000 were used. (See section 2.1 in the main body of the final EIS for an explanation of this cut-off point.)

No Action Alternative

TABLE 18
POWER RATES BY YEAR

Long-run aluminum price = 70¢/lb.

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.9	21.2	26.2	26.2	21.9	29.2	42.1
1987	20.3	20.5	25.4	25.4	21.2	28.8	41.5
1988	17.4	19.5	20.3	20.3	19.2	26.1	39.6
1989	18.8	18.6	21.4	21.4	19.5	26.9	39.3
1990	19.9	18.5	23.0	23.0	20.1	27.7	40.0
1991	19.8	18.4	23.2	23.2	20.1	27.7	40.1
1992	19.8	18.3	24.6	24.6	19.9	27.8	41.0
1993	20.2	18.6	25.8	25.8	20.2	28.1	41.5
1994	19.6	18.0	27.3	27.3	20.1	27.9	41.9
1995	19.6	18.0	28.4	28.4	20.2	28.0	42.9
1996	19.2	17.6	28.9	28.9	20.2	28.0	43.7
1997	19.4	17.8	30.8	30.8	20.6	28.3	44.6
1998	19.6	17.9	32.0	32.0	20.8	28.5	45.3
1999	19.7	17.9	32.6	32.6	20.9	28.7	45.9
2000	19.6	17.9	34.0	34.0	21.2	28.8	46.6
2001	19.3	17.6	34.1	34.1	21.2	28.7	46.6
2002	19.5	17.7	35.0	35.0	21.3	28.8	46.8
2003	19.5	17.8	36.2	36.2	21.4	29.1	47.1
2004	19.9	18.1	37.5	37.5	21.9	29.5	47.6
2005	19.8	18.0	37.4	37.4	22.0	29.5	47.8
2006	19.7	18.0	37.5	37.5	21.9	29.6	47.9
2007	20.2	18.3	38.1	38.1	22.1	30.0	48.2
2008	20.1	18.3	39.1	39.1	22.5	30.1	48.6
2009	20.0	18.2	39.8	39.8	22.8	30.1	49.1
2010	19.8	18.0	39.7	39.7	22.6	30.1	48.9
2011	20.0	18.2	40.6	40.6	22.8	30.3	49.0
2012	20.3	18.4	41.3	41.3	22.9	30.6	49.0
2013	19.3	17.6	41.6	41.6	22.6	30.1	49.3
2014	19.6	17.8	42.5	42.5	22.8	30.4	49.5
2015	19.8	18.0	42.9	42.9	22.8	30.6	49.2

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CASE 1: FISO10A: VAR RATE ALTERNATIVES PROBABILISTIC RUN OPTION 1 VAR RATE GAME = 50
REV PROT

Long-run aluminum
price = 70¢/lb.

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.5	26.0	26.0	22.1	29.2	42.1
1987	20.1	20.4	25.1	25.1	21.3	28.7	41.5
1988	16.8	19.5	19.7	19.7	19.3	25.8	39.6
1989	17.8	18.6	20.4	20.4	19.5	26.3	39.3
1990	18.3	18.3	21.3	21.3	20.1	26.7	40.0
1991	18.7	17.9	21.9	21.9	20.0	27.0	40.1
1992	18.4	17.6	23.1	23.1	19.9	27.0	41.0
1993	19.6	18.1	25.0	25.0	20.2	27.7	41.5
1994	19.3	17.7	26.8	26.8	20.1	27.7	41.9
1995	19.2	17.7	28.0	28.0	20.3	27.7	42.9
1996	19.0	17.4	28.5	28.5	20.3	27.8	43.8
1997	19.5	17.8	30.8	30.8	20.8	28.2	44.8
1998	19.7	18.0	32.0	32.0	21.0	28.5	45.6
1999	19.9	18.1	33.2	33.2	21.3	28.8	46.2
2000	19.8	18.1	34.4	34.4	21.6	28.9	46.9
2001	19.5	17.8	34.3	34.3	21.5	28.8	46.7
2002	19.7	17.9	34.9	34.9	21.5	29.0	47.0
2003	19.7	17.9	35.9	35.9	21.6	29.2	47.2
2004	20.0	18.2	37.2	37.2	21.9	29.5	47.6
2005	19.8	18.0	37.2	37.2	22.0	29.5	47.8
2006	19.7	17.9	37.1	37.1	21.9	29.6	47.8
2007	20.1	18.3	38.1	38.1	22.2	29.9	48.2
2008	20.1	18.2	38.9	38.9	22.4	30.0	48.6
2009	20.0	18.1	39.8	39.8	22.8	30.1	49.1
2010	19.8	18.0	39.8	39.8	22.7	30.1	48.9
2011	20.0	18.2	40.8	40.8	22.9	30.3	49.0
2012	20.3	18.4	41.4	41.4	23.0	30.5	49.1
2013	19.3	17.5	41.5	41.5	22.6	30.0	49.3
2014	19.6	17.8	42.6	42.6	22.8	30.3	49.5
2015	19.9	18.0	43.3	43.3	22.9	30.6	49.3

Long-run aluminum
price = 70¢/lb.TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	21.0	21.3	26.4	26.4	21.9	29.3	42.1
1987	20.3	20.5	25.3	25.3	21.2	28.8	41.5
1988	17.1	19.5	20.0	20.0	19.2	26.0	39.6
1989	18.4	18.6	21.0	21.0	19.5	26.7	39.3
1990	19.4	18.4	22.4	22.4	20.1	27.4	40.0
1991	19.5	18.2	22.8	22.8	20.0	27.5	40.1
1992	19.4	18.0	24.2	24.2	19.9	27.6	41.0
1993	20.1	18.5	25.6	25.6	20.2	28.0	41.5
1994	19.5	17.9	27.1	27.1	20.1	27.9	41.9
1995	19.4	17.9	28.3	28.3	20.2	27.9	42.9
1996	19.2	17.6	28.8	28.8	20.2	27.9	43.7
1997	19.5	17.8	30.8	30.8	20.6	28.3	44.7
1998	19.5	17.8	31.9	31.9	20.8	28.4	45.3
1999	19.6	17.8	32.4	32.4	20.8	28.6	45.9
2000	19.6	17.9	34.0	34.0	21.3	28.8	46.7
2001	19.4	17.7	34.2	34.2	21.3	28.8	46.6
2002	19.5	17.7	34.8	34.8	21.3	28.9	46.9
2003	19.7	17.9	36.3	36.3	21.5	29.2	47.2
2004	19.9	18.1	37.3	37.3	21.9	29.5	47.6
2005	19.8	18.1	37.2	37.2	22.0	29.6	47.8
2006	19.7	18.0	37.3	37.3	21.9	29.6	47.8
2007	20.2	18.3	38.0	38.0	22.2	30.0	48.2
2008	20.1	18.3	39.0	39.0	22.5	30.1	48.7
2009	20.0	18.2	39.7	39.7	22.8	30.2	49.1
2010	19.9	18.0	39.8	39.8	22.7	30.1	48.9
2011	20.0	18.2	40.8	40.8	22.9	30.3	49.0
2012	20.3	18.4	41.4	41.4	23.0	30.6	49.1
2013	19.4	17.6	41.7	41.7	22.7	30.1	49.3
2014	19.7	17.9	42.6	42.6	22.9	30.5	49.5
2015	19.9	18.0	43.1	43.1	22.9	30.7	49.2

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CASE 1: EIS010A: VAR RATE ALTERNATIVES PROBABILISTIC RUN OPTION 3 VAR RATE GAME = 50
LOAD MAINT

Long-run aluminum
price = 70¢/lb.

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	21.9	21.5	27.2	27.2	21.8	29.8	42.0
1987	20.5	20.5	25.6	25.6	21.2	29.0	41.5
1988	17.2	19.5	20.1	20.1	19.2	26.0	39.6
1989	18.4	18.7	21.0	21.0	19.4	26.7	39.3
1990	19.5	18.4	22.6	22.6	20.0	27.4	40.0
1991	19.5	18.2	22.8	22.8	20.0	27.5	40.1
1992	19.6	18.2	24.4	24.4	19.8	27.7	40.9
1993	20.1	18.6	25.8	25.8	20.2	28.1	41.5
1994	19.6	18.0	27.4	27.4	20.0	27.9	41.9
1995	19.4	18.0	28.4	28.4	20.2	27.9	42.9
1996	19.3	17.7	29.0	29.0	20.2	28.0	43.6
1997	19.4	17.8	31.1	31.1	20.7	28.3	44.7
1998	19.5	17.9	32.1	32.1	20.9	28.4	45.3
1999	19.6	17.9	32.8	32.8	20.9	28.6	45.9
2000	19.5	17.8	34.0	34.0	21.2	28.7	46.6
2001	19.3	17.6	34.0	34.0	21.2	28.7	46.6
2002	19.5	17.8	35.2	35.2	21.4	28.9	46.9
2003	19.6	17.9	36.5	36.5	21.5	29.1	47.1
2004	19.9	18.1	37.4	37.4	21.8	29.5	47.6
2005	19.7	18.0	37.3	37.3	21.9	29.5	47.7
2006	19.8	18.0	37.7	37.7	22.0	29.6	47.9
2007	20.1	18.3	38.2	38.2	22.1	30.0	48.2
2008	20.2	18.3	39.1	39.1	22.5	30.1	48.7
2009	20.0	18.2	39.8	39.8	22.8	30.2	49.1
2010	19.9	18.1	39.9	39.9	22.7	30.2	48.9
2011	20.1	18.2	40.6	40.6	22.8	30.3	49.0
2012	20.4	18.5	41.6	41.6	23.0	30.6	49.1
2013	19.5	17.7	42.0	42.0	22.7	30.2	49.3
2014	19.7	17.9	42.7	42.7	22.9	30.5	49.5
2015	19.9	18.1	43.1	43.1	22.9	30.7	49.2

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CASE 1: EIS020A:CON/MOD ALTERNATIVES

PROBABILISTIC RUN

OPTION 1

STD RATE

GAME =

50

W/ INCEN

& C/M=+3ML

Long-run aluminum

price = 70¢/lb.

TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.9	21.2	26.2	26.2	21.9	29.2	42.1
1987	20.3	20.4	25.4	25.4	21.2	28.8	41.5
1988	17.4	19.5	20.3	20.3	19.2	26.1	39.6
1989	18.8	18.6	21.4	21.4	19.5	26.9	39.3
1990	19.9	18.4	23.0	23.0	20.1	27.7	40.0
1991	19.9	18.3	23.2	23.2	20.1	27.7	40.1
1992	19.7	18.2	24.5	24.5	19.8	27.8	41.0
1993	20.2	18.6	25.8	25.8	20.2	28.1	41.5
1994	19.7	18.0	27.3	27.3	20.0	28.0	41.9
1995	19.7	18.1	28.6	28.6	20.2	28.1	42.9
1996	19.2	17.6	28.9	28.9	20.2	28.0	43.7
1997	19.5	17.9	30.9	30.9	20.6	28.3	44.6
1998	19.6	17.9	31.9	31.9	20.8	28.5	45.3
1999	19.7	18.0	32.5	32.5	20.8	28.7	45.9
2000	19.6	17.9	33.9	33.9	21.2	28.8	46.6
2001	19.4	17.6	34.0	34.0	21.2	28.7	46.5
2002	19.5	17.7	35.0	35.0	21.3	28.8	46.8
2003	19.5	17.8	36.0	36.0	21.4	29.1	47.0
2004	19.9	18.1	37.4	37.4	21.8	29.5	47.6
2005	19.7	17.9	37.4	37.4	21.9	29.5	47.8
2006	19.7	17.9	37.3	37.3	21.9	29.6	47.9
2007	20.1	18.3	38.0	38.0	22.1	30.0	48.2
2008	20.1	18.3	39.0	39.0	22.5	30.1	48.7
2009	20.0	18.2	39.8	39.8	22.8	30.2	49.1
2010	19.8	18.0	39.7	39.7	22.6	30.1	48.9
2011	20.0	18.2	40.6	40.6	22.8	30.3	49.0
2012	20.2	18.4	41.2	41.2	22.9	30.6	49.0
2013	19.3	17.5	41.5	41.5	22.6	30.1	49.3
2014	19.6	17.8	42.5	42.5	22.8	30.4	49.5
2015	19.8	17.9	43.0	43.0	22.8	30.6	49.2

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CASE 1: E15020A:CON/MOD ALTERNATIVES

PROBABILISTIC RUN OPTION 2

STD RATE
W/ INCEN
& C/M=+5ML

GAME =

50

Long-run aluminum
price = 70¢/lb.TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.9	21.2	26.2	26.2	21.9	29.2	42.1
1987	20.3	20.4	25.4	25.4	21.2	28.8	41.5
1988	17.5	19.5	20.3	20.3	19.2	26.2	39.6
1989	18.8	18.6	21.4	21.4	19.5	26.9	39.3
1990	19.9	18.4	23.0	23.0	20.1	27.7	40.0
1991	19.8	18.3	23.2	23.2	20.0	27.7	40.1
1992	19.7	18.2	24.4	24.4	19.8	27.8	41.0
1993	20.3	18.7	25.9	25.9	20.2	28.2	41.5
1994	19.7	18.1	27.3	27.3	20.0	28.0	41.9
1995	19.7	18.1	28.5	28.5	20.2	28.1	42.9
1996	19.2	17.6	28.9	28.9	20.2	28.0	43.7
1997	19.5	17.8	30.7	30.7	20.6	28.3	44.6
1998	19.6	17.9	31.8	31.8	20.7	28.5	45.3
1999	19.7	17.9	32.3	32.3	20.7	28.7	45.8
2000	19.6	17.9	33.6	33.6	21.1	28.8	46.6
2001	19.3	17.5	33.7	33.7	21.0	28.7	46.5
2002	19.3	17.6	34.6	34.6	21.2	28.8	46.8
2003	19.4	17.7	35.8	35.8	21.3	29.0	47.0
2004	19.8	18.0	37.0	37.0	21.7	29.4	47.5
2005	19.7	17.9	37.2	37.2	21.8	29.4	47.7
2006	19.6	17.9	37.2	37.2	21.8	29.6	47.8
2007	20.1	18.2	38.0	38.0	22.1	29.9	48.2
2008	20.0	18.2	38.7	38.7	22.4	30.0	48.6
2009	19.9	18.1	39.6	39.6	22.7	30.1	49.1
2010	19.8	18.0	39.8	39.8	22.6	30.1	48.9
2011	20.0	18.1	40.6	40.6	22.8	30.3	49.0
2012	20.3	18.4	41.1	41.1	22.8	30.6	49.1
2013	19.3	17.5	41.5	41.5	22.5	30.0	49.3
2014	19.6	17.8	42.5	42.5	22.7	30.4	49.5
2015	19.7	17.9	42.9	42.9	22.7	30.6	49.2

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CASE 1: FIS020A:CON/MOD ALTERNATIVES

PROBABILISTIC RUN

OPTION 3

STD RATE

GAME =

50

W/ INCEN

S C/M=+10ML

Long-run aluminum

price = 70¢/lb.

TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.9	21.2	26.2	26.2	21.9	29.2	42.1
1987	20.3	20.5	25.4	25.4	21.2	28.8	41.5
1988	17.5	19.5	20.4	20.4	19.2	26.2	39.6
1989	18.8	18.5	21.4	21.4	19.5	26.9	39.3
1990	19.9	18.4	23.0	23.0	20.1	27.7	40.0
1991	19.9	18.3	23.2	23.2	20.0	27.7	40.1
1992	19.7	18.2	24.3	24.3	19.7	27.8	41.0
1993	20.4	18.7	26.1	26.1	20.2	28.2	41.5
1994	19.7	18.1	27.2	27.2	19.9	28.0	41.9
1995	19.8	18.2	28.7	28.7	20.1	28.2	43.0
1996	19.3	17.6	28.9	28.9	20.1	28.0	43.7
1997	19.4	17.8	30.4	30.4	20.4	28.3	44.5
1998	19.7	18.0	31.9	31.9	20.7	28.5	45.3
1999	19.7	18.0	32.4	32.4	20.7	28.7	45.8
2000	19.7	18.0	33.7	33.7	21.1	28.9	46.6
2001	19.3	17.5	33.6	33.6	21.0	28.7	46.5
2002	19.4	17.7	35.0	35.0	21.2	28.8	46.9
2003	19.4	17.7	35.7	35.7	21.3	29.0	47.0
2004	19.7	18.0	36.8	36.8	21.6	29.4	47.5
2005	19.7	17.9	37.0	37.0	21.8	29.4	47.8
2006	19.7	17.9	37.2	37.2	21.8	29.6	47.9
2007	20.1	18.3	38.1	38.1	22.1	30.0	48.2
2008	20.1	18.2	38.7	38.7	22.4	30.1	48.6
2009	20.0	18.2	39.6	39.6	22.8	30.2	49.0
2010	20.0	18.1	40.1	40.1	22.8	30.2	48.9
2011	20.2	18.3	40.8	40.8	22.9	30.4	49.1
2012	20.3	18.5	41.3	41.3	23.0	30.6	49.1
2013	19.4	17.6	41.9	41.9	22.7	30.2	49.3
2014	19.6	17.8	42.3	42.3	22.8	30.4	49.4
2015	19.9	18.0	42.8	42.8	22.8	30.6	49.1

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CASE 1: EIS030A:COMBINATION VAR RATE C PROBABILISTIC RUN OPTION 1 VAR RATE GAME = 50
REV PROT
& C/M=+3ML

Long-run aluminum
price = 70¢/lb.

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.5	26.0	26.0	22.1	29.2	42.1
1987	20.1	20.4	25.1	25.1	21.3	28.7	41.5
1988	16.8	19.5	19.7	19.7	19.3	25.8	39.6
1989	17.8	18.6	20.4	20.4	19.5	26.3	39.3
1990	18.3	18.2	21.2	21.2	20.1	26.7	40.0
1991	18.7	17.9	21.9	21.9	20.0	26.9	40.0
1992	18.4	17.5	23.1	23.1	19.9	27.0	41.0
1993	19.6	18.2	25.1	25.1	20.2	27.7	41.5
1994	19.3	17.7	26.8	26.8	20.1	27.7	41.9
1995	19.3	17.7	28.0	28.0	20.3	27.8	42.9
1996	19.0	17.4	28.5	28.5	20.3	27.8	43.8
1997	19.5	17.9	30.8	30.8	20.8	28.3	44.8
1998	19.7	18.0	32.0	32.0	21.0	28.5	45.5
1999	19.9	18.1	33.1	33.1	21.2	28.8	46.2
2000	19.9	18.1	34.3	34.3	21.5	29.0	46.8
2001	19.5	17.8	34.2	34.2	21.4	28.8	46.7
2002	19.6	17.8	34.8	34.8	21.5	28.9	46.9
2003	19.7	17.9	35.9	35.9	21.6	29.2	47.2
2004	20.0	18.2	37.1	37.1	21.9	29.5	47.6
2005	19.8	18.0	37.1	37.1	22.0	29.5	47.7
2006	19.7	17.9	37.0	37.0	21.9	29.6	47.8
2007	20.1	18.3	38.1	38.1	22.2	29.9	48.2
2008	20.1	18.2	38.9	38.9	22.5	30.0	48.6
2009	20.0	18.2	39.8	39.8	22.8	30.1	49.0
2010	19.8	18.0	39.9	39.9	22.7	30.1	48.8
2011	20.0	18.2	40.8	40.8	22.9	30.3	49.0
2012	20.3	18.4	41.5	41.5	23.0	30.6	49.1
2013	19.4	17.5	41.8	41.8	22.7	30.1	49.3
2014	19.6	17.8	42.6	42.6	22.8	30.4	49.5
2015	19.9	18.0	43.3	43.3	22.9	30.6	49.3

Long-run aluminum
price = 70¢/lb.TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	21.0	21.3	26.4	26.4	21.9	29.3	42.1
1987	20.3	20.4	25.3	25.3	21.2	28.8	41.5
1988	17.2	19.5	20.0	20.0	19.2	26.0	39.6
1989	18.4	18.6	21.0	21.0	19.5	26.7	39.3
1990	19.5	18.3	22.5	22.5	20.1	27.4	40.0
1991	19.5	18.2	22.8	22.8	20.0	27.5	40.1
1992	19.4	17.9	24.1	24.1	19.8	27.6	41.0
1993	20.1	18.5	25.6	25.6	20.2	28.0	41.5
1994	19.5	17.9	27.0	27.0	20.0	27.9	41.9
1995	19.4	17.8	28.2	28.2	20.1	27.9	42.9
1996	19.2	17.6	28.8	28.8	20.1	27.9	43.7
1997	19.4	17.8	30.8	30.8	20.6	28.3	44.6
1998	19.5	17.8	31.8	31.8	20.8	28.4	45.3
1999	19.6	17.8	32.4	32.4	20.8	28.6	45.9
2000	19.6	17.9	33.9	33.9	21.2	28.8	46.6
2001	19.4	17.7	34.0	34.0	21.2	28.8	46.6
2002	19.4	17.6	34.6	34.6	21.2	28.8	46.9
2003	19.5	17.8	36.0	36.0	21.4	29.1	47.2
2004	19.8	18.0	37.0	37.0	21.7	29.4	47.6
2005	19.7	17.9	37.1	37.1	21.9	29.4	47.8
2006	19.7	17.9	37.3	37.3	21.8	29.6	47.9
2007	20.2	18.3	38.2	38.2	22.2	30.0	48.3
2008	20.2	18.3	39.0	39.0	22.5	30.1	48.7
2009	20.0	18.2	39.8	39.8	22.8	30.2	49.1
2010	19.9	18.1	39.9	39.9	22.7	30.2	48.9
2011	20.0	18.2	40.6	40.6	22.9	30.3	49.0
2012	20.3	18.4	41.2	41.2	22.9	30.6	49.0
2013	19.3	17.5	41.7	41.7	22.6	30.1	49.3
2014	19.6	17.8	42.6	42.6	22.8	30.4	49.5
2015	19.8	18.0	43.2	43.2	22.9	30.6	49.2

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CASE 1: EIS030A:COMBINATION VAR RATE C PROBABILISTIC RUN OPTION 3 VAR RATE GAME = 50
 LOAD MAINT
 & C/M=+10ML

Long-run aluminum
 price - 70¢/lb.

TABLE 18
 POWER RATES BY YEAR

(MILLS PER KWH)
 (EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	22.2	21.4	27.6	27.6	21.6	29.9	42.0
1987	20.7	20.5	25.7	25.7	21.2	29.1	41.5
1988	17.2	19.5	20.1	20.1	19.2	26.0	39.6
1989	18.4	18.6	21.0	21.0	19.4	26.7	39.3
1990	19.6	18.4	22.6	22.6	20.0	27.5	40.0
1991	19.5	18.1	22.8	22.8	19.9	27.5	40.0
1992	19.6	18.1	24.1	24.1	19.7	27.7	40.9
1993	20.3	18.7	26.0	26.0	20.1	28.2	41.5
1994	19.8	18.1	27.2	27.2	19.9	28.0	41.9
1995	19.7	18.2	28.5	28.5	20.1	28.1	42.9
1996	19.4	17.8	29.1	29.1	20.1	28.1	43.6
1997	19.5	17.8	30.7	30.7	20.5	28.3	44.6
1998	19.7	18.0	31.9	31.9	20.7	28.5	45.3
1999	19.6	17.8	32.6	32.6	20.8	28.6	45.9
2000	19.5	17.8	33.4	33.4	21.0	28.7	46.5
2001	19.1	17.4	33.5	33.5	21.0	28.6	46.5
2002	19.4	17.6	35.1	35.1	21.3	28.8	47.0
2003	19.4	17.7	35.9	35.9	21.3	29.0	47.0
2004	19.7	18.0	36.9	36.9	21.6	29.4	47.5
2005	19.7	17.9	37.0	37.0	21.8	29.4	47.8
2006	19.7	17.9	37.2	37.2	21.8	29.6	47.9
2007	20.2	18.4	38.1	38.1	22.1	30.0	48.3
2008	20.1	18.3	38.6	38.6	22.4	30.1	48.6
2009	20.1	18.2	39.7	39.7	22.8	30.2	49.1
2010	20.0	18.2	40.2	40.2	22.7	30.3	48.9
2011	20.1	18.3	40.8	40.8	22.9	30.4	49.1
2012	20.4	18.5	41.2	41.2	22.9	30.6	49.1
2013	19.4	17.6	42.0	42.0	22.7	30.2	49.4
2014	19.7	17.9	42.4	42.4	22.8	30.4	49.5
2015	19.9	18.0	42.8	42.8	22.8	30.7	49.1

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CASE 1: EIS010A:VAR RATE ALTERNATIVES PROBABILISTIC RUN OPTION 0 STD RATE GAME = 50
W/ INCEN

No Action Alternative

TABLE 18
POWER RATES BY YEAR

Long-run aluminum price = 65¢/lb.

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.1	26.1	22.1	29.2	42.1
1987	20.3	20.4	25.3	25.3	21.5	28.8	41.5
1988	17.7	19.4	20.7	20.7	19.5	26.4	39.6
1989	19.1	18.5	21.7	21.7	19.7	27.2	39.3
1990	20.4	18.8	23.6	23.6	20.4	28.0	40.1
1991	20.2	18.5	23.7	23.7	20.3	28.0	40.1
1992	19.8	18.1	24.6	24.6	20.0	27.9	41.0
1993	20.0	18.3	25.4	25.4	20.2	28.1	41.5
1994	19.2	17.6	26.1	26.1	19.8	27.8	41.8
1995	19.4	17.7	27.5	27.5	20.9	27.9	42.9
1996	18.9	17.2	27.7	27.7	19.9	27.8	43.6
1997	19.1	17.5	29.9	29.9	20.3	28.1	44.5
1998	19.3	17.6	31.0	31.0	20.5	28.3	45.2
1999	19.3	17.6	31.9	31.9	20.7	28.5	45.8
2000	19.1	17.4	32.6	32.6	20.3	28.5	46.4
2001	18.9	17.2	32.8	32.8	20.3	28.4	46.4
2002	19.0	17.3	33.7	33.7	21.0	28.5	46.8
2003	19.1	17.3	34.7	34.7	21.0	28.8	46.9
2004	19.4	17.6	35.8	35.8	21.4	29.1	47.3
2005	19.3	17.5	36.2	36.2	21.5	29.1	47.7
2006	19.2	17.5	36.0	36.0	21.5	29.2	47.8
2007	19.5	17.7	36.9	36.9	21.7	29.5	48.1
2008	19.6	17.8	38.0	38.0	22.1	29.6	48.6
2009	19.5	17.7	38.7	38.7	22.5	29.7	48.9
2010	19.4	17.6	39.2	39.2	22.4	29.7	48.9
2011	19.4	17.6	39.5	39.5	22.4	29.8	48.9
2012	19.8	17.9	40.5	40.5	22.6	30.2	49.1
2013	18.8	17.0	40.6	40.6	22.3	29.6	49.3
2014	19.1	17.3	42.1	42.1	22.5	29.9	49.5
2015	19.3	17.5	42.5	42.5	22.5	30.1	49.3

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CASE 1: FIS010A:VAP RATE ALTERNATIVES PROBABILISTIC RUN OPTION 1 VAR RATE GAME = 50
REV PROT

Long-run aluminum
price = 65¢/lb.

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.0	26.0	22.1	29.2	42.1
1987	19.8	20.4	24.8	24.8	21.5	28.5	41.5
1988	17.2	19.4	20.2	20.2	19.6	26.1	39.6
1989	18.3	18.5	20.9	20.9	19.8	26.7	39.3
1990	19.0	18.4	22.2	22.2	20.3	27.2	40.0
1991	19.1	18.1	22.5	22.5	20.2	27.3	40.1
1992	19.3	17.7	24.0	24.0	20.0	27.6	41.0
1993	19.5	17.9	25.0	25.0	20.1	27.8	41.5
1994	18.9	17.3	25.9	25.9	19.8	27.6	41.8
1995	19.0	17.3	27.1	27.1	20.0	27.7	42.9
1996	18.9	17.3	28.0	28.0	20.0	27.8	43.7
1997	19.1	17.4	29.8	29.8	20.3	28.0	44.6
1998	19.2	17.5	30.9	30.9	20.6	28.2	45.3
1999	19.3	17.5	31.9	31.9	20.7	28.4	45.9
2000	19.1	17.4	32.3	32.3	20.8	28.4	46.4
2001	19.0	17.3	32.6	32.6	20.8	28.4	46.4
2002	19.1	17.3	33.6	33.6	21.0	28.5	46.7
2003	19.1	17.4	34.8	34.8	21.1	28.7	46.9
2004	19.4	17.7	36.0	36.0	21.4	29.1	47.4
2005	19.4	17.6	36.4	36.4	21.6	29.1	47.7
2006	19.3	17.5	36.2	36.2	21.6	29.2	47.8
2007	19.5	17.7	37.1	37.1	21.8	29.5	48.2
2008	19.6	17.7	38.0	38.0	22.2	29.6	48.6
2009	19.5	17.7	38.6	38.6	22.5	29.7	49.0
2010	19.4	17.6	39.1	39.1	22.4	29.7	48.9
2011	19.4	17.6	39.4	39.4	22.4	29.8	49.0
2012	19.8	17.9	40.5	40.5	22.6	30.1	49.1
2013	19.7	17.0	40.4	40.4	22.2	29.6	49.2
2014	19.1	17.3	42.1	42.1	22.5	29.9	49.5
2015	19.3	17.5	42.6	42.6	22.6	30.1	49.3

Long-run aluminum
price = 65¢/lb.TABLE 13
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.8	21.5	26.2	26.2	22.1	29.3	42.1
1987	20.0	20.4	25.0	25.0	21.4	28.7	41.5
1988	17.4	19.4	20.4	20.4	19.5	26.2	39.6
1989	18.8	19.5	21.4	21.4	19.7	26.9	39.3
1990	20.1	18.7	23.3	23.3	20.4	27.8	40.0
1991	20.0	18.4	23.5	23.5	20.3	27.9	40.1
1992	19.8	18.1	24.6	24.6	20.0	27.9	41.0
1993	19.9	18.2	25.5	25.5	20.2	28.0	41.5
1994	19.2	17.5	26.2	26.2	19.8	27.7	41.8
1995	19.2	17.6	27.5	27.5	20.0	27.9	42.9
1996	19.1	17.4	28.1	28.1	19.9	27.9	43.7
1997	19.1	17.4	29.9	29.9	20.3	28.1	44.6
1998	19.3	17.5	30.7	30.7	20.4	28.2	45.2
1999	19.2	17.5	31.6	31.6	20.6	28.4	45.8
2000	18.9	17.2	32.1	32.1	20.6	28.3	46.3
2001	18.9	17.2	32.6	32.6	20.7	28.4	46.4
2002	19.0	17.2	33.4	33.4	20.9	28.4	46.7
2003	19.0	17.2	34.4	34.4	20.9	28.6	46.8
2004	19.3	17.6	35.9	35.9	21.3	29.0	47.3
2005	19.2	17.5	36.3	36.3	21.5	29.1	47.6
2006	19.1	17.4	36.1	36.1	21.4	29.1	47.7
2007	19.5	17.7	37.2	37.2	21.7	29.4	48.1
2008	19.6	17.8	38.2	38.2	22.2	29.6	48.7
2009	19.5	17.7	39.0	39.0	22.5	29.7	49.0
2010	19.4	17.6	39.3	39.3	22.4	29.7	49.0
2011	19.4	17.6	39.7	39.7	22.4	29.8	49.0
2012	19.8	17.9	40.6	40.6	22.6	30.1	49.1
2013	18.8	17.0	40.8	40.8	22.3	29.6	49.3
2014	19.1	17.4	42.3	42.3	22.5	29.9	49.5
2015	19.3	17.5	42.7	42.7	22.6	30.1	49.3

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CASE 1: EIS010A:VAP RATE ALTERNATIVES PROBABILISTIC RUN OPTION 3 VAR RATE GAME =
LOAD MAINT

50

Long-run aluminum
price = 65¢/lb.TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	21.0	21.5	26.3	26.3	22.1	29.4	42.1
1987	20.3	20.4	25.4	25.4	21.4	28.9	41.5
1988	17.5	19.4	20.5	20.5	19.4	26.2	39.6
1989	19.0	18.6	21.6	21.6	19.6	27.1	39.3
1990	20.3	18.9	23.5	23.5	20.2	27.9	40.0
1991	20.2	18.6	23.6	23.6	20.2	28.0	40.1
1992	20.0	18.4	24.8	24.8	20.0	28.0	41.0
1993	19.9	18.2	25.4	25.4	20.1	28.0	41.5
1994	19.3	17.6	26.4	26.4	19.9	27.8	41.8
1995	19.4	17.7	27.9	27.9	20.1	27.9	42.9
1996	19.1	17.4	28.4	28.4	20.0	27.9	43.7
1997	19.2	17.5	30.2	30.2	20.4	28.1	44.6
1998	19.4	17.6	31.3	31.3	20.6	28.3	45.2
1999	19.3	17.6	32.2	32.2	20.7	28.5	45.9
2000	19.1	17.4	33.0	33.0	20.9	28.5	46.5
2001	19.0	17.3	33.2	33.2	20.9	28.5	46.5
2002	19.1	17.4	34.0	34.0	21.0	28.6	46.8
2003	19.1	17.4	34.9	34.9	21.1	28.8	46.9
2004	19.4	17.6	35.9	35.9	21.4	29.1	47.3
2005	19.3	17.5	36.2	36.2	21.5	29.1	47.6
2006	19.2	17.4	36.1	36.1	21.5	29.2	47.7
2007	19.5	17.7	37.0	37.0	21.7	29.5	48.0
2008	19.6	17.8	38.1	38.1	22.1	29.7	48.6
2009	19.6	17.8	39.1	39.1	22.6	29.8	49.0
2010	19.5	17.7	39.4	39.4	22.5	29.8	48.9
2011	19.4	17.6	39.6	39.6	22.5	29.9	49.0
2012	19.9	18.0	40.7	40.7	22.7	30.2	49.1
2013	18.9	17.1	40.9	40.9	22.3	29.7	49.3
2014	19.2	17.4	42.3	42.3	22.6	30.0	49.5
2015	19.5	17.6	42.9	42.9	22.7	30.3	49.3

Long-run aluminum

price = 65¢/lb.

TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.1	26.1	22.1	29.2	42.1
1987	20.3	20.4	25.3	25.3	21.5	28.8	41.5
1988	17.7	19.4	20.7	20.7	19.5	26.4	39.6
1989	19.1	18.5	21.7	21.7	19.7	27.2	39.3
1990	20.3	18.7	23.5	23.5	20.3	28.0	40.0
1991	20.2	19.5	23.7	23.7	20.3	28.0	40.1
1992	19.8	18.1	24.6	24.6	20.0	27.9	41.0
1993	20.1	18.3	25.4	25.4	20.1	28.1	41.5
1994	19.3	17.6	26.2	26.2	19.8	27.8	41.8
1995	19.4	17.7	27.4	27.4	19.9	27.9	42.9
1996	18.9	17.2	27.7	27.7	19.9	27.8	43.6
1997	19.2	17.5	29.9	29.9	20.3	28.1	44.5
1998	19.3	17.6	30.9	30.9	20.5	28.3	45.2
1999	19.3	17.6	31.8	31.8	20.6	28.5	45.8
2000	19.1	17.3	32.4	32.4	20.7	28.4	46.4
2001	18.9	17.2	32.6	32.6	20.7	28.4	46.3
2002	19.0	17.2	33.6	33.6	20.9	28.5	46.8
2003	19.0	17.3	34.5	34.5	20.9	28.7	46.8
2004	19.4	17.6	35.9	35.9	21.4	29.1	47.4
2005	19.3	17.5	36.2	36.2	21.5	29.1	47.7
2006	19.2	17.5	36.0	36.0	21.5	29.2	47.8
2007	19.6	17.7	37.0	37.0	21.8	29.5	48.1
2008	19.5	17.7	37.9	37.9	22.1	29.6	48.6
2009	19.4	17.6	38.6	38.6	22.4	29.7	48.9
2010	19.4	17.6	39.0	39.0	22.4	29.7	48.9
2011	19.4	17.6	39.4	39.4	22.4	29.8	49.0
2012	19.8	17.9	40.4	40.4	22.6	30.1	49.1
2013	18.7	17.0	40.5	40.5	22.2	29.6	49.3
2014	19.1	17.4	42.2	42.2	22.5	29.9	49.5
2015	19.3	17.5	42.6	42.6	22.5	30.1	49.3

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CASE 1: FISO2LA:CON/MOD ALTERNATIVES

PROBABILISTIC RUN

OPTION 2

STD RATE

GAME =

50

W/ INCEN

8 C/M=+5ML

Long-run aluminum

price = 65¢/lb.

TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.1	26.1	22.1	29.2	42.1
1987	20.3	20.4	25.3	25.3	21.5	28.8	41.5
1988	17.7	19.4	20.7	20.7	19.5	26.4	39.6
1989	19.1	18.5	21.7	21.7	19.7	27.2	39.3
1990	20.4	18.7	23.5	23.5	20.3	28.0	40.0
1991	20.2	18.5	23.7	23.7	20.3	28.0	40.1
1992	19.9	18.1	24.6	24.6	20.0	27.9	41.0
1993	20.1	18.3	25.5	25.5	20.1	28.1	41.5
1994	19.3	17.6	26.1	26.1	19.8	27.8	41.8
1995	19.4	17.7	27.3	27.3	19.9	28.0	42.9
1996	18.9	17.2	27.7	27.7	19.8	27.8	43.6
1997	19.2	17.5	29.9	29.9	20.3	28.2	44.5
1998	19.4	17.6	30.8	30.8	20.5	28.3	45.2
1999	19.3	17.6	31.7	31.7	20.6	28.5	45.8
2000	19.0	17.3	32.2	32.2	20.7	28.5	46.4
2001	19.9	17.2	32.4	32.4	20.7	28.4	46.3
2002	18.9	17.2	33.3	33.3	20.9	28.5	46.7
2003	19.0	17.3	34.4	34.4	20.9	28.7	46.8
2004	19.3	17.6	35.8	35.8	21.3	29.1	47.3
2005	19.2	17.4	36.0	36.0	21.5	29.1	47.6
2006	19.2	17.4	36.0	36.0	21.5	29.2	47.7
2007	19.5	17.7	37.0	37.0	21.8	29.5	48.1
2008	19.5	17.7	37.9	37.9	22.1	29.6	48.6
2009	19.4	17.6	38.6	38.6	22.4	29.7	48.9
2010	19.4	17.6	39.1	39.1	22.4	29.8	48.9
2011	19.4	17.6	39.4	39.4	22.4	29.9	49.0
2012	19.8	17.9	40.3	40.3	22.6	30.1	49.1
2013	18.8	17.0	40.4	40.4	22.2	29.6	49.2
2014	19.1	17.3	41.9	41.9	22.4	29.9	49.4
2015	19.3	17.5	42.5	42.5	22.5	30.1	49.3

Long-run aluminum
price = 65¢/lb.

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.1	26.1	22.1	29.2	42.1
1987	20.3	20.4	25.3	25.3	21.4	28.8	41.5
1988	17.7	19.4	20.7	20.7	19.5	26.4	39.6
1989	19.1	18.5	21.7	21.7	19.7	27.2	39.3
1990	20.4	18.7	23.5	23.5	20.3	28.0	40.0
1991	20.2	18.5	23.7	23.7	20.2	28.0	40.1
1992	19.9	18.2	24.5	24.5	19.9	27.9	41.0
1993	20.1	18.4	25.5	25.5	20.1	28.2	41.5
1994	19.5	17.7	26.3	26.3	19.8	27.9	41.8
1995	19.5	17.8	27.7	27.7	20.0	28.0	42.9
1996	19.0	17.3	28.0	28.0	19.9	27.9	43.6
1997	19.2	17.5	29.7	29.7	20.2	28.1	44.4
1998	19.4	17.6	30.8	30.8	20.4	28.3	45.1
1999	19.4	17.6	31.8	31.8	20.5	28.5	45.8
2000	19.1	17.4	32.3	32.3	20.7	28.5	46.4
2001	18.9	17.2	32.4	32.4	20.6	28.4	46.3
2002	18.9	17.2	33.3	33.3	20.8	28.4	46.7
2003	18.9	17.2	34.1	34.1	20.8	28.6	46.8
2004	19.3	17.6	35.6	35.6	21.3	29.1	47.3
2005	19.2	17.4	35.9	35.9	21.4	29.0	47.6
2006	19.2	17.5	35.9	35.9	21.4	29.2	47.7
2007	19.6	17.7	37.0	37.0	21.7	29.5	48.1
2008	19.5	17.7	37.8	37.8	22.0	29.6	48.6
2009	19.5	17.7	38.6	38.6	22.4	29.7	48.9
2010	19.5	17.7	39.4	39.4	22.4	29.8	48.9
2011	19.7	17.8	39.9	39.9	22.6	30.0	49.1
2012	19.9	18.1	40.7	40.7	22.7	30.2	49.1
2013	18.9	17.1	40.7	40.7	22.3	29.7	49.3
2014	19.2	17.5	42.1	42.1	22.5	30.0	49.5
2015	19.4	17.6	42.8	42.8	22.6	30.2	49.3

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CASE 1: EIS03LA:COMBINATION VAR RATE C PROBABILISTIC RUN OPTION 1 VAR RATE GAME = 50
REV PROT
& C/M=+3ML

Long-run aluminum
price = 65¢/lb.

TABLE 13
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.4	26.0	26.0	22.1	29.2	42.1
1987	19.8	20.4	24.8	24.8	21.5	28.5	41.5
1988	17.2	19.4	20.2	20.2	19.6	26.1	39.6
1989	18.3	18.5	20.9	20.9	19.7	26.7	39.3
1990	19.0	18.4	22.1	22.1	20.3	27.2	40.0
1991	19.1	18.1	22.5	22.5	20.2	27.3	40.1
1992	19.3	17.7	24.0	24.0	20.0	27.6	41.0
1993	19.6	18.0	25.0	25.0	20.1	27.8	41.5
1994	18.9	17.3	25.9	25.9	19.8	27.6	41.8
1995	19.0	17.4	27.2	27.2	20.0	27.7	42.9
1996	19.0	17.3	28.0	28.0	20.0	27.8	43.7
1997	19.2	17.4	29.8	29.3	20.3	28.1	44.6
1998	19.3	17.6	31.1	31.1	20.6	28.3	45.4
1999	19.3	17.6	31.9	31.9	20.8	28.4	45.9
2000	19.1	17.4	32.2	32.2	20.8	28.5	46.4
2001	19.0	17.3	32.6	32.6	20.8	28.5	46.4
2002	19.0	17.3	33.4	33.4	21.0	28.5	46.7
2003	19.1	17.4	34.5	34.5	21.0	28.7	46.9
2004	19.4	17.6	35.8	35.8	21.4	29.1	47.3
2005	19.4	17.6	36.3	36.3	21.6	29.2	47.7
2006	19.3	17.5	36.0	36.0	21.6	29.2	47.8
2007	19.6	17.7	37.0	37.0	21.8	29.5	48.2
2008	19.5	17.7	37.8	37.8	22.1	29.6	48.6
2009	19.4	17.6	38.4	38.4	22.4	29.6	48.9
2010	19.3	17.5	38.8	38.8	22.3	29.7	48.9
2011	19.3	17.5	39.4	39.4	22.4	29.8	48.9
2012	19.7	17.9	40.4	40.4	22.6	30.1	49.1
2013	18.7	16.9	40.4	40.4	22.2	29.5	49.3
2014	19.1	17.4	42.1	42.1	22.5	29.9	49.5
2015	19.3	17.5	42.6	42.6	22.6	30.1	49.3

Long-run aluminum
price = 65¢/lb.TABLE 18
POWER RATES BY YEAR(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	20.8	21.5	26.2	26.2	22.1	29.3	42.1
1987	20.0	20.4	25.1	25.1	21.4	28.7	41.5
1988	17.5	19.4	20.4	20.4	19.5	26.2	39.6
1989	18.8	18.5	21.4	21.4	19.7	26.9	39.3
1990	20.0	18.7	23.2	23.2	20.3	27.8	40.0
1991	20.0	18.4	23.5	23.5	20.3	27.9	40.1
1992	19.9	18.2	24.6	24.6	20.0	27.9	41.0
1993	20.0	18.2	25.5	25.5	20.1	28.1	41.5
1994	19.2	17.5	26.2	26.2	19.8	27.7	41.8
1995	19.3	17.6	27.6	27.6	20.0	27.9	42.9
1996	19.1	17.4	28.2	28.2	19.9	27.9	43.7
1997	19.2	17.5	30.0	30.0	20.3	28.2	44.6
1998	19.3	17.6	30.8	30.8	20.4	28.3	45.2
1999	19.3	17.5	31.7	31.7	20.6	28.4	45.8
2000	19.0	17.3	31.9	31.9	20.6	28.4	46.3
2001	18.8	17.1	32.3	32.3	20.6	28.3	46.2
2002	18.9	17.1	33.2	33.2	20.8	28.4	46.6
2003	19.0	17.2	34.4	34.4	20.9	28.6	46.8
2004	19.3	17.5	35.7	35.7	21.2	29.0	47.2
2005	19.2	17.4	36.1	36.1	21.4	29.0	47.6
2006	19.2	17.4	36.1	36.1	21.5	29.1	47.8
2007	19.5	17.7	37.1	37.1	21.8	29.5	48.2
2008	19.5	17.7	38.1	38.1	22.1	29.6	48.7
2009	19.4	17.6	38.6	38.6	22.4	29.7	49.0
2010	19.4	17.6	39.1	39.1	22.4	29.7	48.9
2011	19.4	17.6	39.5	39.5	22.4	29.9	49.0
2012	19.8	17.9	40.4	40.4	22.6	30.1	49.2
2013	18.8	17.0	40.6	40.6	22.2	29.6	49.3
2014	19.1	17.4	42.1	42.1	22.5	29.9	49.5
2015	19.4	17.5	42.7	42.7	22.6	30.2	49.3

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CASE 1: FIS03LA:COMBINATION VAR RATE C PROBABILISTIC RUN OPTION 3 VAR RATE GAME = 50
 LOAD MAINT
 & C/M=+10ML

Long-run aluminum
 price = 65¢/lb.

TABLE 18
 POWER RATES BY YEAR

(MILLS PER KWH)
 (EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	PUBLIC NON EXCHANGE	PRIVATE NON EXCHANGE
1986	21.0	21.5	26.3	26.3	22.1	29.4	42.1
1987	20.3	20.4	25.4	25.4	21.4	28.9	41.5
1988	17.6	19.4	20.5	20.5	19.4	26.3	39.6
1989	19.0	13.5	21.7	21.7	19.6	27.1	39.3
1990	20.3	13.9	23.5	23.5	20.2	27.9	40.0
1991	20.2	18.5	23.7	23.7	20.2	28.0	40.1
1992	20.1	13.4	24.8	24.8	19.9	28.0	41.0
1993	20.1	18.4	25.6	25.6	20.1	28.2	41.5
1994	19.5	17.8	26.5	26.5	19.8	27.9	41.8
1995	19.6	17.9	28.0	28.0	20.1	28.1	42.9
1996	19.3	17.5	28.5	28.5	20.0	28.0	43.6
1997	19.3	17.6	30.0	30.0	20.3	28.2	44.5
1998	19.4	17.7	31.0	31.0	20.5	28.4	45.2
1999	19.3	17.5	31.8	31.8	20.6	28.5	45.8
2000	19.1	17.3	32.4	32.4	20.7	28.5	46.4
2001	18.9	17.2	32.6	32.6	20.7	28.4	46.4
2002	19.0	17.2	33.4	33.4	20.8	28.5	46.7
2003	19.0	17.3	34.2	34.2	20.8	28.7	46.8
2004	19.3	17.6	35.4	35.4	21.2	29.0	47.2
2005	19.2	17.4	35.8	35.8	21.4	29.1	47.6
2006	19.2	17.4	36.0	36.0	21.4	29.2	47.7
2007	19.7	17.8	37.0	37.0	21.8	29.6	48.1
2008	19.6	17.8	38.0	38.0	22.1	29.7	48.6
2009	19.6	17.8	38.9	38.9	22.5	29.8	49.0
2010	19.6	17.8	39.7	39.7	22.5	29.9	49.0
2011	19.7	17.8	39.9	39.9	22.6	30.0	49.1
2012	20.1	18.2	40.8	40.8	22.8	30.4	49.2
2013	19.0	17.7	40.8	40.8	22.4	29.8	49.3
2014	19.4	17.6	42.4	42.4	22.7	30.1	49.6
2015	19.5	17.7	42.7	42.7	22.7	30.3	49.3

TABLE 18
POWER RATES BY YEAR

(MILLS PER KWH)
(EXPECTED VALUES)

YEAR	PRIORITY FIRM	DSI STANDARD	NEW RESOURCE	FIRM SURPLUS	STANDARD NONFIRM	NON PUBLIC EXCHANGE	PRIVATE NON EXCHANGE
1986	20.7	21.3	26.1	26.1	22.0	29.2	42.1
1987	20.3	20.4	25.3	25.3	21.3	28.8	41.5
1988	17.6	19.3	20.5	20.5	19.3	26.2	39.6
1989	19.0	18.4	21.6	21.6	19.6	27.0	39.3
1990	20.1	18.4	23.1	23.1	20.2	27.8	40.0
1991	20.0	18.3	23.4	23.4	20.1	27.8	40.1

No Action
Columbia Falls and
The Dalles Smelters
Closed
Long-run aluminum
price = 70¢/lb.

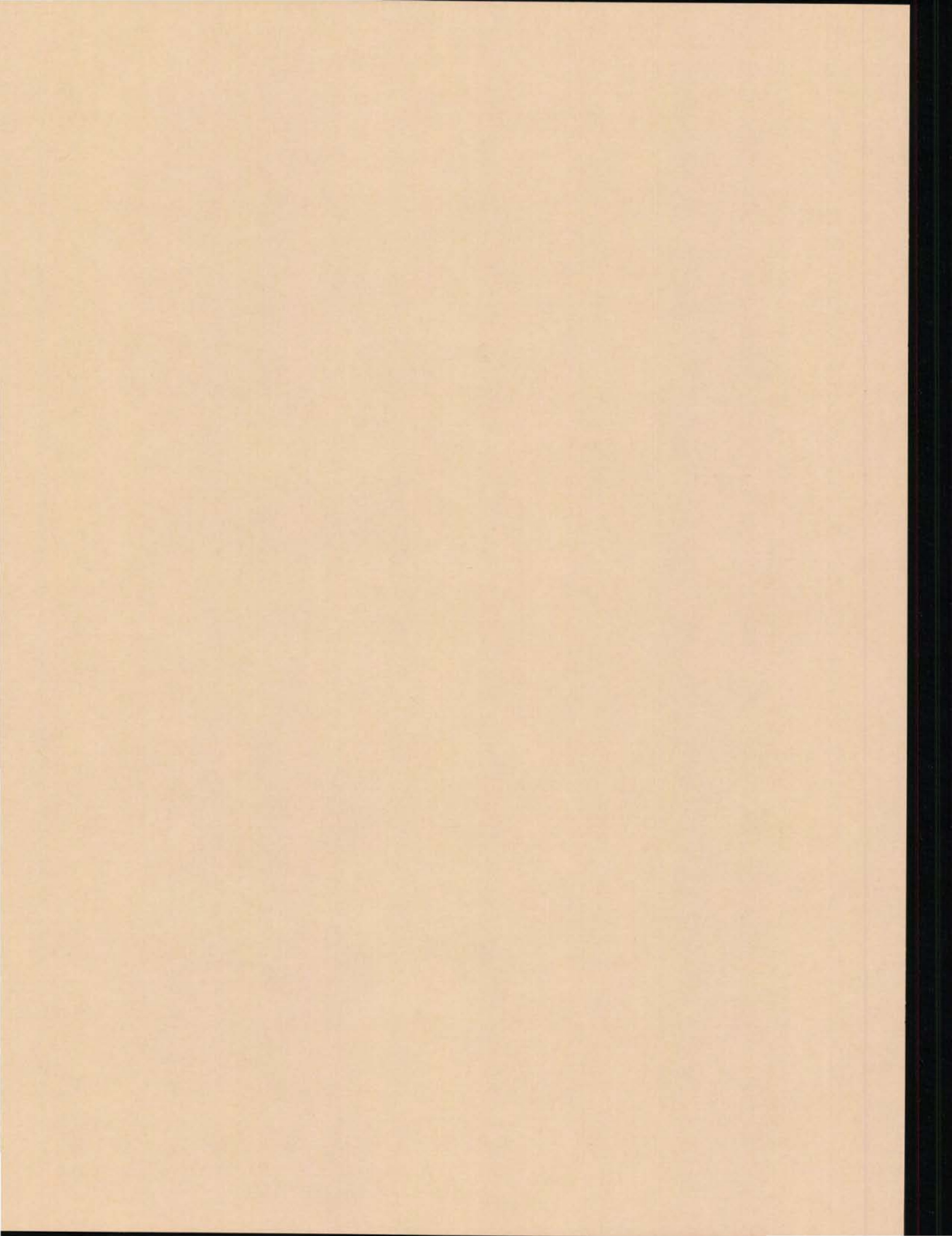
F-22

1992	19.7	18.0	24.3	24.3	19.8	27.8	40.9
1993	20.1	18.3	25.6	25.6	20.1	28.1	41.5
1994	19.4	17.6	26.2	26.2	19.7	27.8	41.8
1995	19.4	17.8	27.7	27.7	20.0	27.9	42.9
1996	19.0	17.3	28.3	28.3	20.0	27.8	43.7
1997	19.2	17.5	29.8	29.8	20.3	28.1	44.5
1998	19.4	17.6	31.3	31.3	20.6	28.3	45.2
1999	19.4	17.6	31.9	31.9	20.6	28.5	45.8
2000	19.3	17.5	32.8	32.8	20.9	28.6	46.5
2001	19.0	17.3	33.0	33.0	20.8	28.5	46.4
2002	19.1	17.3	33.8	33.8	21.0	28.6	46.7
2003	19.1	17.4	34.6	34.6	21.0	28.8	46.8
2004	19.5	17.7	36.1	36.1	21.4	29.2	47.4
2005	19.3	17.5	36.2	36.2	21.6	29.2	47.6
2006	19.3	17.5	36.3	36.3	21.6	29.3	47.7
2007	19.8	17.9	37.4	37.4	21.9	29.7	48.2
2008	19.8	17.9	38.2	38.2	22.2	29.8	48.6
2009	19.7	17.9	38.9	38.9	22.5	29.9	49.0
2010	19.6	17.8	39.4	39.4	22.5	29.9	48.9
2011	19.8	17.9	40.1	40.1	22.6	30.1	49.0
2012	20.1	18.2	41.0	41.0	22.8	30.4	49.2
2013	19.1	17.3	41.3	41.3	22.5	29.9	49.4
2014	19.4	17.6	42.2	42.2	22.6	30.2	49.5
2015	19.6	17.8	42.9	42.9	22.7	30.4	49.3

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CASE 1: EISS10:SENSITIVITY MD/AR CLOSE PROBABILISTIC RUN OPTION 0 STD RATE W/ INCEN GAME = 50

APPENDIX G

EMPLOYMENT IMPACTS



APPENDIX G

EMPLOYMENT IMPACTS

This appendix reports the employment impacts for the various options studied in the Final EIS. To obtain these values, it was necessary to add a base employment level to the employment changes reported by the Decision Analysis Model. The resulting employment values represent actual employment levels per year that derive from the option or combination considered.

The base level employment (Columns B and D of the tables on pages G-2 through G-22) were derived from Tables 70 and 71 in DSI Options Study, Final Report, Part 2. These tables are consolidated on page G-23 of this appendix. Table 70 listed 1985 employment for various regional industries. Table 71 listed the average annual rates of growth for the period 1985-2005 for these same industries. Both tables break the data into respective public and private utility categories. To derive an employment level for any industry group for any year, the growth rates in Table 71 are compounded for the number of years required (in this case 15 years) and then multiplied by the 1985 base year level from Table 70 of the DSI Options Study. Results of these calculations, projected regional employment by industrial sector for 1985-2000, are shown on the table on page G-24 of this appendix.

Nonmanufacturing employment levels were constructed by subtracting total Pacific Northwest manufacturing employment (in BPA Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation, Table 21, page 50) from total annual nonagricultural employment forecasts (Table 19, page 46 of the same document). These calculations are shown in the table on page G-25 of this appendix and are incorporated into the tables on pages G-2 through G-22, column (F).

Estimated BPA service area employment for the years 1987-2000 is shown as column (G) on pages G-2 through G-22 for the no action alternative, and for each proposal, other alternative, and combination studied for the Final EIS. Tables on pages G-2 through G-11 show this information for the cases with a long-run aluminum price of 70¢/lb. and pages G-12 through G-21 show this information for a long-run aluminum price of 65¢/lb. The person-year changes in employment (columns A, C, and E on pages G-2 through G-22) from the Decision Analysis Model, Table 10, for 1987-2000 are then added (or subtracted) to (from) respective yearly employment levels.

As page G-23 evinces, the "Industry" category includes: agriculture, chemicals, manufacturing, food processing, other manufacturing, and nonaluminum DSI industries. The "Other Industry" category includes all other employment: all nonmanufacturing; trade; services; transportation, communications, and utilities (T.C.U.); finance, insurance, and real estate (F.I.R.E.); government; construction; and mining industries.

Table: 1a

Aluminum = \$.70

No Action: EMPLOYMENT IMPACTS

OPTION 0

1987-2000

Year	(A) Aluminum 2/	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(4,878)	4,222	977	718,570	2,577	2,812,200	3,538,546
1988	(3,681)	5,419	1,909	720,953	5,166	2,872,100	3,605,547
1989	(3,538)	5,562	1,792	723,384	4,796	2,938,500	3,674,034
1990	(3,845)	5,255	1,503	725,863	3,988	2,995,100	3,731,709
1991	(4,104)	4,996	1,490	728,389	3,953	3,036,500	3,775,328
1992	(4,287)	4,813	1,313	730,964	3,494	3,116,600	3,857,184
1993	(4,588)	4,512	1,155	733,588	3,062	3,180,700	3,923,017
1994	(4,384)	4,716	1,133	736,261	3,023	3,261,800	4,006,933
1995	(4,174)	4,926	929	738,984	2,492	3,270,900	4,018,231
1996	(4,320)	4,780	809	741,757	2,200	3,347,000	4,096,546
1997	(4,140)	4,960	573	744,580	1,571	3,422,300	4,173,984
1998	(4,316)	4,784	397	747,455	1,103	3,508,400	4,262,139
1999	(4,375)	4,725	253	750,381	722	3,583,000	4,339,081
2000	(4,337)	4,763	82	753,359	276	3,663,800	4,422,280

1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 1b

SUMMARY: Aluminum = \$.70

Year	(A) Aluminum 2/	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(4,009)	5,091	1,534	723,432	4,096	2,930,880	3,665,033
1992-1996	(4,351)	4,749	1,068	736,311	2,854	3,235,400	3,980,382
1997-2000	(4,292)	4,808	326	748,944	918	3,544,375	4,299,371

Table: 2a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 1 (REVENUE)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(5,012)	4,088	1,007	718,570	2,666	2,812,200	3,538,531
1988	(4,148)	4,952	1,989	720,953	5,405	2,872,100	3,605,399
1989	(3,785)	5,315	1,923	723,384	5,187	2,938,500	3,674,309
1990	(4,080)	5,020	1,738	725,863	4,683	2,995,100	3,732,404
1991	(4,367)	4,733	1,675	728,389	4,499	3,036,500	3,775,796
1992	(4,420)	4,680	1,512	730,964	4,082	3,116,600	3,857,838
1993	(4,639)	4,461	1,266	733,588	3,388	3,180,700	3,923,403
1994	(4,489)	4,611	1,194	736,261	3,203	3,261,800	4,007,069
1995	(4,454)	4,646	996	738,984	2,694	3,270,900	4,019,220
1996	(4,494)	4,606	841	741,757	2,298	3,347,000	4,096,502
1997	(4,364)	4,736	553	744,580	1,524	3,422,300	4,173,693
1998	(4,529)	4,571	344	747,455	971	3,508,400	4,261,741
1999	(4,569)	4,531	160	750,381	475	3,583,000	4,338,547
2000	(4,610)	4,490	6	753,359	72	3,663,800	4,421,727

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(4,278)	4,822	1,666	723,432	4,488	2,930,880	3,665,289
1992-1996	(4,499)	4,601	1,162	736,311	3,133	3,235,400	3,980,605
1997-2000	(4,518)	4,582	266	748,944	761	3,544,375	4,298,927

Table: 3a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 2 (BPA PROPOSAL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(4,770)	4,330	984	718,570	2,598	2,812,200	3,538,682
1988	(3,877)	5,223	1,949	720,953	5,285	2,872,100	3,605,510
1989	(3,592)	5,508	1,844	723,384	4,952	2,938,500	3,674,188
1990	(3,830)	5,270	1,577	725,863	4,208	2,995,100	3,732,018
1991	(4,117)	4,983	1,552	728,389	4,137	3,036,500	3,775,561
1992	(4,220)	4,880	1,371	730,964	3,664	3,116,600	3,857,479
1993	(4,515)	4,585	1,179	733,588	3,132	3,180,700	3,923,184
1994	(4,387)	4,713	1,151	736,261	3,076	3,261,800	4,007,001
1995	(4,315)	4,785	957	738,984	2,577	3,270,900	4,018,203
1996	(4,323)	4,777	825	741,757	2,243	3,347,000	4,096,602
1997	(4,236)	4,864	562	744,580	1,544	3,422,300	4,173,850
1998	(4,387)	4,713	412	747,455	1,151	3,508,400	4,262,131
1999	(4,430)	4,670	265	750,381	760	3,583,000	4,339,076
2000	(4,426)	4,674	74	753,359	257	3,663,800	4,422,164

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(4,037)	5,063	1,581	723,432	4,236	2,930,880	3,665,192
1992-1996	(4,352)	4,748	1,097	736,311	2,938	3,235,400	3,980,494
1997-2000	(4,370)	4,730	328	748,944	928	3,544,375	4,299,305

Table: 4a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 3 (LOAD)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(4,428)	4,672	948	718,570	2,489	2,812,200	3,538,879
1988	(3,574)	5,526	1,941	720,953	5,259	2,872,100	3,605,779
1989	(3,178)	5,922	1,847	723,384	4,958	2,938,500	3,674,611
1990	(3,395)	5,705	1,564	725,863	4,167	2,995,100	3,732,399
1991	(3,671)	5,429	1,543	728,389	4,109	3,036,500	3,775,970
1992	(3,849)	5,251	1,345	730,964	3,583	3,116,600	3,857,743
1993	(4,136)	4,964	1,169	733,588	3,101	3,180,700	3,923,522
1994	(3,989)	5,111	1,137	736,261	3,034	3,261,800	4,007,343
1995	(3,872)	5,228	959	738,984	2,580	3,270,900	4,018,651
1996	(4,005)	5,095	814	741,757	2,209	3,347,000	4,096,875
1997	(3,975)	5,125	561	744,580	1,540	3,422,300	4,174,106
1998	(4,126)	4,974	411	747,455	1,146	3,508,400	4,262,386
1999	(4,205)	4,895	255	750,381	732	3,583,000	4,339,263
2000	(4,210)	4,890	93	753,359	311	3,663,800	4,422,453

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(3,649)	5,451	1,569	723,432	4,196	2,930,880	3,665,528
1992-1996	(3,970)	5,130	1,085	736,311	2,901	3,235,400	3,980,827
1997-2000	(4,129)	4,971	330	748,944	932	3,544,375	4,299,552

Table: 2a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 1 (CON/NO 3 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987	(4,849)	4,251	977	718,570	2,576	2,812,200	3,538,574
1988	(3,875)	5,225	1,909	720,953	5,165	2,872,100	3,605,352
1989	(3,581)	5,519	1,791	723,384	4,794	2,938,500	3,673,988
1990	(3,856)	5,244	1,504	725,863	3,992	2,995,100	3,731,703
1991	(4,080)	5,020	1,488	728,389	3,949	3,036,500	3,775,346
1992	(4,253)	4,847	1,316	730,964	3,503	3,116,600	3,857,230
1993	(4,549)	4,551	1,152	733,588	3,053	3,180,700	3,923,044
1994	(4,337)	4,763	1,121	736,261	2,989	3,261,800	4,006,934
1995	(4,148)	4,952	914	738,984	2,448	3,270,900	4,018,198
1996	(4,301)	4,799	808	741,757	2,196	3,347,000	4,096,560
1997	(4,100)	5,000	566	744,580	1,550	3,422,300	4,173,996
1998	(4,276)	4,824	399	747,455	1,111	3,508,400	4,262,189
1999	(4,343)	4,757	251	750,381	717	3,583,000	4,339,106
2000	(4,322)	4,778	81	753,359	272	3,663,800	4,422,290

a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
'87-1991	(4,048)	5,052	1,534	723,432	4,095	2,930,880	3,664,993
'92-1996	(4,318)	4,782	1,062	736,311	2,838	3,235,400	3,980,393
'97-2000	(4,260)	4,840	324	748,944	913	3,544,375	4,299,395

Table: 3a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 2 (CON/MOD 5 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(4,795)	4,305	977	718,570	2,576	2,812,200	3,538,622
1988	(3,886)	5,214	1,905	720,953	5,155	2,872,100	3,605,322
1989	(3,551)	5,549	1,792	723,384	4,796	2,938,500	3,674,021
1990	(3,811)	5,289	1,505	725,863	3,994	2,995,100	3,731,752
1991	(3,966)	5,134	1,491	728,389	3,957	3,036,500	3,775,471
1992	(4,131)	4,969	1,323	730,964	3,520	3,116,600	3,857,377
1993	(4,424)	4,676	1,138	733,588	3,013	3,180,700	3,923,111
1994	(4,207)	4,893	1,114	736,261	2,967	3,261,800	4,007,035
1995	(4,064)	5,036	908	738,984	2,433	3,270,900	4,018,261
1996	(4,189)	4,911	799	741,757	2,170	3,347,000	4,096,637
1997	(3,973)	5,127	571	744,580	1,562	3,422,300	4,174,140
1998	(4,118)	4,982	404	747,455	1,123	3,508,400	4,262,369
1999	(4,207)	4,893	261	750,381	742	3,583,000	4,339,271
2000	(4,189)	4,911	93	753,359	305	3,663,800	4,422,468

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(4,002)	5,098	1,534	723,432	4,096	2,930,880	3,665,040
1992-1996	(4,203)	4,897	1,056	736,311	2,821	3,235,400	3,980,484
1997-2000	(4,122)	4,978	332	748,944	933	3,544,375	4,299,562

Table: 4a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 3 (CON/MOD 10 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(4,625)	4,475	977	718,570	2,576	2,812,200	3,538,798
1988	(3,739)	5,361	1,904	720,953	5,152	2,872,100	3,605,470
1989	(3,378)	5,722	1,795	723,384	4,805	2,938,500	3,674,206
1990	(3,604)	5,496	1,508	725,863	4,003	2,995,100	3,731,970
1991	(3,738)	5,362	1,489	728,389	3,951	3,036,500	3,775,691
1992	(3,906)	5,194	1,323	730,964	3,522	3,116,600	3,857,603
1993	(4,216)	4,884	1,126	733,588	2,978	3,180,700	3,923,276
1994	(4,025)	5,075	1,111	736,261	2,958	3,261,800	4,007,205
1995	(3,733)	5,367	881	738,984	2,356	3,270,900	4,018,488
1996	(3,883)	5,217	805	741,757	2,184	3,347,000	4,096,963
1997	(3,734)	5,366	598	744,580	1,636	3,422,300	4,174,480
1998	(3,855)	5,245	391	747,455	1,084	3,508,400	4,262,575
1999	(3,943)	5,157	256	750,381	727	3,583,000	4,339,521
2000	(3,941)	5,159	74	753,359	250	3,663,800	4,422,642

a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
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(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(3,817)	5,283	1,535	723,432	4,097	2,930,880	3,665,227
1992-1996	(3,953)	5,147	1,049	736,311	2,800	3,235,400	3,980,707
1997-2000	(3,868)	5,232	330	748,944	924	3,544,375	4,299,805

Table: 2a

qqq

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 1 (REVENUE & 3 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987	(4,976)	4,124	1,007	718,570	2,667	2,812,200	3,538,568
1988	(4,149)	4,951	1,989	720,953	5,404	2,872,100	3,605,397
1989	(3,757)	5,343	1,925	723,384	5,191	2,938,500	3,674,343
1990	(4,023)	5,077	1,740	725,863	4,689	2,995,100	3,732,469
1991	(4,306)	4,794	1,677	728,389	4,504	3,036,500	3,775,864
1992	(4,375)	4,725	1,516	730,964	4,092	3,116,600	3,857,897
1993	(4,588)	4,512	1,256	733,588	3,357	3,180,700	3,923,413
1994	(4,449)	4,651	1,186	736,261	3,180	3,261,800	4,007,078
1995	(4,379)	4,721	990	738,984	2,675	3,270,900	4,018,270
1996	(4,427)	4,673	838	741,757	2,288	3,347,000	4,096,556
1997	(4,292)	4,808	549	744,580	1,512	3,422,300	4,173,749
1998	(4,465)	4,635	360	747,455	1,011	3,508,400	4,261,861
1999	(4,529)	4,572	166	750,381	491	3,583,000	4,338,610
2000	(4,564)	4,536	11	753,359	84	3,663,800	4,421,790

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study
Final Report- Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-73.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
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(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987-1991	(4,242)	4,858	1,668	723,432	4,491	2,930,880	3,665,328
1992-1996	(4,444)	4,656	1,157	736,311	3,118	3,235,400	3,980,643
1997-2000	(4,462)	4,638	272	748,944	775	3,544,375	4,299,003

Table: 3a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 2 (BPA PROPOSAL & 5 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987	(4,641)	4,459	982	718,570	2,590	2,812,200	3,538,801
1988	(3,864)	5,236	1,943	720,953	5,268	2,872,100	3,605,500
1989	(3,566)	5,534	1,844	723,384	4,952	2,938,500	3,674,214
1990	(3,783)	5,317	1,574	725,863	4,197	2,995,100	3,732,051
1991	(3,957)	5,143	1,543	728,389	4,109	3,036,500	3,775,684
1992	(4,114)	4,986	1,375	730,964	3,674	3,116,600	3,857,599
1993	(4,359)	4,741	1,178	733,588	3,129	3,180,700	3,923,336
1994	(4,180)	4,920	1,152	736,261	3,078	3,261,800	4,007,211
1995	(4,139)	4,961	960	738,984	2,584	3,270,900	4,018,389
1996	(4,154)	4,946	828	741,757	2,249	3,347,000	4,096,780
1997	(4,077)	5,023	573	744,580	1,572	3,422,300	4,174,048
1998	(4,208)	4,892	414	747,455	1,154	3,508,400	4,262,315
1999	(4,271)	4,829	271	750,381	776	3,583,000	4,339,257
2000	(4,236)	4,864	83	753,359	279	3,663,800	4,422,385

a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study
Final Report- Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-73.

c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987-1991	(3,962)	5,138	1,577	723,432	4,223	2,930,880	3,665,250
1992-1996	(4,189)	4,911	1,099	736,311	2,943	3,235,400	3,980,663
1997-2000	(4,198)	4,902	335	748,944	945	3,544,375	4,299,501

Table: 4a

Aluminum = \$.70

EMPLOYMENT IMPACTS

OPTION 3 (LOAD & 10 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987	(3,937)	5,163	931	718,570	2,437	2,812,200	3,539,301
1988	(3,397)	5,703	1,937	720,953	5,247	2,872,100	3,605,940
1989	(3,057)	6,043	1,849	723,384	4,964	2,938,500	3,674,740
1990	(3,219)	5,881	1,560	725,863	4,155	2,995,100	3,732,559
1991	(3,318)	5,782	1,546	728,389	4,115	3,036,500	3,776,332
1992	(3,414)	5,686	1,361	730,964	3,628	3,116,600	3,858,239
1993	(3,627)	5,473	1,142	733,588	3,021	3,180,700	3,923,924
1994	(3,530)	5,570	1,117	736,261	2,974	3,261,800	4,007,722
1995	(3,483)	5,617	909	738,984	2,435	3,270,900	4,018,845
1996	(3,608)	5,492	798	741,757	2,159	3,347,000	4,097,206
1997	(3,588)	5,512	569	744,580	1,557	3,422,300	4,174,518
1998	(3,720)	5,380	402	747,455	1,113	3,508,400	4,262,750
1999	(3,767)	5,333	257	750,381	737	3,583,000	4,339,708
2000	(3,734)	5,366	122	753,359	385	3,663,800	4,423,032

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study
Final Report- Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-73.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987-1991	(3,386)	5,714	1,565	723,432	4,184	2,930,880	3,665,774
1992-1996	(3,532)	5,568	1,065	736,311	2,843	3,235,400	3,981,187
1997-2000	(3,702)	5,398	338	748,944	948	3,544,375	4,300,002

Table: 1a

Aluminum = \$.65

No Action: EMPLOYMENT IMPACTS

OPTION 0

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987	(6,809)	2,291	974	718,570	2,571	2,812,200	3,536,606
1988	(5,764)	3,336	1,853	720,953	5,004	2,872,100	3,603,246
1989	(5,033)	4,067	1,741	723,384	4,648	2,938,500	3,672,340
1990	(5,224)	3,876	1,427	725,863	3,769	2,995,100	3,730,035
1991	(5,718)	3,382	1,430	728,389	3,782	3,036,500	3,773,483
1992	(5,884)	3,216	1,295	730,964	3,444	3,116,600	3,855,519
1993	(5,936)	3,164	1,161	733,588	3,082	3,180,700	3,921,695
1994	(5,941)	3,159	1,184	736,261	3,169	3,261,800	4,005,573
1995	(5,803)	3,297	964	738,984	2,595	3,270,900	4,016,740
1996	(5,988)	3,112	874	741,757	2,382	3,347,000	4,095,125
1997	(5,758)	3,342	640	744,580	1,761	3,422,300	4,172,623
1998	(5,994)	3,106	469	747,455	1,305	3,508,400	4,260,735
1999	(6,131)	2,969	312	750,381	894	3,583,000	4,337,556
2000	(6,138)	2,962	199	753,359	605	3,663,800	4,420,925

a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

d/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 1b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+..+F)
1987-1991	(5,710)	3,390	1,485	723,432	3,955	2,930,880	3,663,142
1992-1996	(5,910)	3,190	1,096	736,311	2,934	3,235,400	3,978,930
1997-2000	(6,005)	3,095	405	748,944	1,141	3,544,375	4,297,960

Table: 2a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 1 (REVENUE)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,938)	2,162	1,043	718,570	2,776	2,812,200	3,536,751
1988	(6,057)	3,043	1,922	720,953	5,211	2,872,100	3,603,229
1989	(5,367)	3,733	1,845	723,384	4,957	2,938,500	3,672,419
1990	(5,450)	3,650	1,620	725,863	4,339	2,995,100	3,730,572
1991	(5,778)	3,322	1,602	728,389	4,288	3,036,500	3,774,101
1992	(5,909)	3,191	1,381	730,964	3,696	3,116,600	3,855,832
1993	(6,162)	2,938	1,244	733,588	3,325	3,180,700	3,921,795
1994	(6,170)	2,930	1,243	736,261	3,344	3,261,800	4,005,578
1995	(6,061)	3,039	1,025	738,984	2,776	3,270,900	4,016,724
1996	(6,141)	2,959	853	741,757	2,329	3,347,000	4,094,898
1997	(6,021)	3,079	640	744,580	1,765	3,422,300	4,172,364
1998	(6,197)	2,903	474	747,455	1,330	3,508,400	4,260,562
1999	(6,363)	2,737	313	750,381	901	3,583,000	4,337,332
2000	(6,367)	2,733	205	753,359	624	3,663,800	4,420,721

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,918)	3,182	1,606	723,432	4,314	2,930,880	3,663,414
1992-1996	(6,089)	3,011	1,149	736,311	3,094	3,235,400	3,978,965
1997-2000	(6,237)	2,863	408	748,944	1,155	3,544,375	4,297,745

Table: 3a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 2 (BPA PROPOSAL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,777)	2,323	1,010	718,570	2,676	2,812,200	3,536,779
1988	(5,817)	3,283	1,890	720,953	5,115	2,872,100	3,603,341
1989	(5,143)	3,957	1,788	723,384	4,787	2,938,500	3,672,416
1990	(5,295)	3,805	1,472	725,863	3,903	2,995,100	3,730,143
1991	(5,648)	3,452	1,461	728,389	3,873	3,036,500	3,773,675
1992	(5,860)	3,240	1,298	730,964	3,453	3,116,600	3,855,555
1993	(6,057)	3,043	1,171	733,588	3,113	3,180,700	3,921,615
1994	(6,045)	3,055	1,194	736,261	3,201	3,261,800	4,005,511
1995	(5,940)	3,160	975	738,984	2,632	3,270,900	4,016,651
1996	(6,044)	3,056	832	741,757	2,266	3,347,000	4,094,911
1997	(5,952)	3,148	620	744,580	1,709	3,422,300	4,172,357
1998	(6,015)	3,085	476	747,455	1,328	3,508,400	4,260,744
1999	(6,155)	2,945	338	750,381	968	3,583,000	4,337,632
2000	(6,210)	2,890	248	753,359	744	3,663,800	4,421,041

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,736)	3,364	1,524	723,432	4,071	2,930,880	3,663,271
1992-1996	(5,989)	3,111	1,094	736,311	2,933	3,235,400	3,978,849
1997-2000	(6,083)	3,017	421	748,944	1,187	3,544,375	4,297,944

Table: 4a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 3 (LOAD)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,373)	2,727	970	718,570	2,556	2,812,200	3,537,023
1988	(5,137)	3,963	1,887	720,953	5,103	2,872,100	3,604,006
1989	(4,395)	4,705	1,761	723,384	4,704	2,938,500	3,673,054
1990	(4,698)	4,402	1,449	725,863	3,831	2,995,100	3,730,645
1991	(5,181)	3,919	1,439	728,389	3,808	3,036,500	3,774,055
1992	(5,334)	3,766	1,277	730,964	3,388	3,116,600	3,855,995
1993	(5,607)	3,493	1,185	733,588	3,149	3,180,700	3,922,115
1994	(5,574)	3,526	1,177	736,261	3,149	3,261,800	4,005,913
1995	(5,439)	3,661	953	738,984	2,566	3,270,900	4,017,064
1996	(5,599)	3,501	835	741,757	2,271	3,347,000	4,095,364
1997	(5,576)	3,524	619	744,580	1,703	3,422,300	4,172,726
1998	(5,661)	3,439	454	747,455	1,267	3,508,400	4,261,015
1999	(5,921)	3,179	302	750,381	866	3,583,000	4,337,728
2000	(5,920)	3,180	180	753,359	555	3,663,800	4,421,074

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,157)	3,943	1,501	723,432	4,000	2,930,880	3,663,757
1992-1996	(5,511)	3,589	1,085	736,311	2,905	3,235,400	3,979,290
1997-2000	(5,770)	3,331	389	748,944	1,098	3,544,375	4,298,136

Table: 2a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 1 (CON/MOD 3 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,777)	2,323	973	718,570	2,568	2,812,200	3,536,634
1988	(5,804)	3,296	1,852	720,953	5,002	2,872,100	3,603,203
1989	(5,049)	4,051	1,741	723,384	4,648	2,938,500	3,672,324
1990	(5,230)	3,870	1,434	725,863	3,787	2,995,100	3,730,054
1991	(5,679)	3,421	1,433	728,389	3,790	3,036,500	3,773,533
1992	(5,896)	3,204	1,292	730,964	3,434	3,116,600	3,855,494
1993	(5,907)	3,193	1,160	733,588	3,077	3,180,700	3,921,718
1994	(5,919)	3,181	1,173	736,261	3,138	3,261,800	4,005,553
1995	(5,772)	3,328	962	738,984	2,589	3,270,900	4,016,763
1996	(5,965)	3,135	871	741,757	2,374	3,347,000	4,095,137
1997	(5,715)	3,385	636	744,580	1,748	3,422,300	4,172,649
1998	(5,939)	3,161	470	747,455	1,306	3,508,400	4,260,792
1999	(6,073)	3,027	316	750,381	903	3,583,000	4,337,627
2000	(6,072)	3,028	219	753,359	659	3,663,900	4,421,065

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,708)	3,392	1,487	723,432	3,959	2,930,880	3,663,150
1992-1996	(5,892)	3,208	1,092	736,311	2,922	3,235,400	3,978,933
1997-2000	(5,950)	3,150	410	748,944	1,154	3,544,375	4,298,033

Table: 3a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 2 (CON/MOD 5 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,765)	2,335	973	718,570	2,568	2,812,200	3,536,6
1988	(5,742)	3,358	1,852	720,953	5,001	2,872,100	3,603,2
1989	(4,981)	4,119	1,742	723,384	4,651	2,938,500	3,672,3
1990	(5,193)	3,907	1,433	725,863	3,784	2,995,100	3,730,0
1991	(5,619)	3,481	1,432	728,389	3,785	3,036,500	3,773,5
1992	(5,860)	3,240	1,289	730,964	3,425	3,116,600	3,855,5
1993	(5,884)	3,216	1,157	733,588	3,070	3,180,700	3,921,7
1994	(5,848)	3,252	1,176	736,261	3,144	3,261,800	4,005,6
1995	(5,703)	3,397	961	738,984	2,583	3,270,900	4,016,8
1996	(5,839)	3,261	867	741,757	2,363	3,347,000	4,095,2
1997	(5,639)	3,461	625	744,580	1,715	3,422,300	4,172,6
1998	(5,859)	3,241	466	747,455	1,295	3,508,400	4,260,8
1999	(5,953)	3,147	319	750,381	910	3,583,000	4,337,7
2000	(5,968)	3,132	217	753,359	655	3,663,800	4,421,1

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,660)	3,440	1,486	723,432	3,958	2,930,890	3,663,19
1992-1996	(5,827)	3,273	1,090	736,311	2,917	3,235,400	3,978,99
1997-2000	(5,855)	3,245	407	748,944	1,144	3,544,375	4,298,11

Table: 4a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 3 (CON/MOD 10 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,685)	2,415	973	718,570	2,569	2,812,200	3,536,727
1988	(5,478)	3,622	1,856	720,953	5,013	2,872,100	3,603,544
1989	(4,857)	4,243	1,743	723,384	4,653	2,938,500	3,672,523
1990	(5,071)	4,029	1,435	725,863	3,790	2,995,100	3,730,217
1991	(5,462)	3,638	1,429	728,389	3,778	3,036,500	3,773,734
1992	(5,567)	3,533	1,292	730,964	3,432	3,116,600	3,855,821
1993	(5,644)	3,456	1,147	733,588	3,040	3,180,700	3,921,931
1994	(5,576)	3,524	1,158	736,261	3,092	3,261,800	4,005,835
1995	(5,472)	3,628	935	738,984	2,509	3,270,900	4,016,956
1996	(5,516)	3,584	848	741,757	2,306	3,347,000	4,095,495
1997	(5,282)	3,818	644	744,580	1,765	3,422,300	4,173,107
1998	(5,552)	3,548	469	747,455	1,302	3,508,400	4,261,174
1999	(5,613)	3,487	307	750,381	877	3,583,000	4,338,052
2000	(5,637)	3,463	203	753,359	613	3,663,800	4,421,438

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,511)	3,589	1,487	723,432	3,961	2,930,880	3,663,349
1992-1996	(5,555)	3,545	1,076	736,311	2,876	3,235,400	3,979,208
1997-2000	(5,521)	3,579	406	748,944	1,139	3,544,375	4,298,443

Table: 2a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 1 (REVENUE & 3 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,897)	2,203	1,042	718,570	2,772	2,812,200	3,536,787
1988	(6,070)	3,030	1,923	720,953	5,212	2,872,100	3,603,218
1989	(5,297)	3,803	1,851	723,384	4,976	2,938,500	3,672,514
1990	(5,365)	3,735	1,626	725,863	4,356	2,995,100	3,730,680
1991	(5,660)	3,440	1,600	728,389	4,282	3,036,500	3,774,211
1992	(5,822)	3,278	1,377	730,964	3,686	3,116,600	3,855,905
1993	(6,118)	2,982	1,237	733,588	3,304	3,180,700	3,921,811
1994	(6,141)	2,959	1,240	736,261	3,336	3,261,800	4,065,596
1995	(6,011)	3,089	1,013	738,984	2,744	3,270,900	4,016,730
1996	(6,113)	2,987	844	741,757	2,306	3,347,000	4,094,894
1997	(5,990)	3,110	634	744,580	1,747	3,422,300	4,172,371
1998	(6,161)	2,939	441	747,455	1,237	3,508,400	4,260,472
1999	(6,315)	2,785	301	750,381	867	3,583,000	4,337,334
2000	(6,302)	2,798	199	753,359	605	3,663,800	4,420,761

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 2b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,858)	3,242	1,608	723,432	4,320	2,930,880	3,653,480
1992-1996	(6,041)	3,059	1,142	736,311	3,075	3,235,400	3,978,980
1997-2000	(6,192)	2,908	394	748,944	1,114	3,544,375	4,297,735

Table: 3a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 2 (BPA PROPOSAL & 5 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,756)	2,344	1,009	718,570	2,673	2,812,200	3,536,796
1988	(5,812)	3,288	1,888	720,953	5,108	2,872,100	3,603,337
1989	(5,058)	4,042	1,788	723,384	4,788	2,938,500	3,672,502
1990	(5,213)	3,887	1,480	725,863	3,923	2,995,100	3,730,253
1991	(5,562)	3,538	1,459	728,389	3,866	3,036,500	3,773,752
1992	(5,777)	3,323	1,293	730,964	3,436	3,116,600	3,855,616
1993	(5,999)	3,101	1,167	733,588	3,098	3,180,700	3,921,654
1994	(5,965)	3,135	1,196	736,261	3,207	3,261,800	4,005,599
1995	(5,840)	3,260	967	738,984	2,607	3,270,900	4,016,718
1996	(5,920)	3,180	828	741,757	2,256	3,347,000	4,095,021
1997	(5,811)	3,289	602	744,580	1,656	3,422,300	4,172,427
1998	(5,938)	3,162	462	747,455	1,287	3,508,400	4,260,766
1999	(6,049)	3,051	334	750,381	952	3,583,000	4,337,718
2000	(6,054)	3,046	247	753,359	736	3,663,800	4,421,188

a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 3b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
87-1991	(5,680)	3,420	1,525	723,432	4,072	2,930,880	3,663,328
92-1996	(5,900)	3,200	1,090	736,311	2,921	3,235,400	3,978,922
97-2000	(5,963)	3,137	411	748,944	1,158	3,544,375	4,298,025

Table: 4a

Aluminum = \$.65

EMPLOYMENT IMPACTS

OPTION 3 (LOAD & 10 MILL)

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(6,201)	2,899	969	718,570	2,555	2,812,200	3,537,193
1988	(5,030)	4,070	1,878	720,953	5,078	2,872,100	3,604,079
1989	(4,294)	4,806	1,756	723,384	4,690	2,938,500	3,673,136
1990	(4,611)	4,489	1,447	725,863	3,826	2,995,100	3,730,725
1991	(4,973)	4,127	1,433	728,389	3,788	3,036,500	3,774,237
1992	(4,992)	4,108	1,270	730,964	3,366	3,116,600	3,856,308
1993	(5,261)	3,839	1,151	733,588	3,048	3,180,700	3,922,326
1994	(5,182)	3,918	1,156	736,261	3,088	3,261,800	4,006,223
1995	(5,060)	4,040	923	738,984	2,477	3,270,900	4,017,324
1996	(5,210)	3,890	814	741,757	2,206	3,347,000	4,095,667
1997	(5,094)	4,006	610	744,580	1,672	3,422,300	4,173,168
1998	(5,244)	3,856	457	747,455	1,269	3,508,400	4,261,437
1999	(5,325)	3,775	318	750,381	908	3,583,000	4,338,382
2000	(5,368)	3,732	208	753,359	628	3,663,800	4,421,727

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, DSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp. 46, 50.

2/ Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/19/86.

Table: 4b

SUMMARY: Aluminum = \$.65

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,022)	4,078	1,497	723,432	3,987	2,930,880	3,663,874
1992-1996	(5,141)	3,959	1,063	736,311	2,837	3,235,400	3,979,570
1997-2000	(5,258)	3,842	398	748,944	1,119	3,544,375	4,298,679

Table: 1a

Aluminum = \$.70

No Action: EMPLOYMENT IMPACTS

OPTION 0 1/

1987-2000

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987	(5,903)	3,197	981	718,570	2,588	2,812,200	3,537,536
1988	(4,863)	4,237	1,889	720,953	5,108	2,872,100	3,604,287
1989	(4,540)	4,560	1,771	723,384	4,734	2,938,500	3,672,949
1990	(4,812)	4,288	1,486	725,863	3,938	2,995,100	3,730,675
1991	(5,016)	4,084	1,463	728,389	3,876	3,036,500	3,774,312
1992	(5,177)	3,923	1,327	730,964	3,533	3,116,600	3,856,347
1993	(5,414)	3,686	1,169	733,588	3,102	3,180,700	3,922,245
1994	(5,239)	3,861	1,180	736,261	3,156	3,261,800	4,006,258
1995	(5,064)	4,036	958	738,984	2,576	3,270,900	4,017,454
1996	(5,210)	3,890	849	741,757	2,315	3,347,000	4,095,811
1997	(5,061)	4,039	643	744,580	1,765	3,422,300	4,173,327
1998	(5,215)	3,885	454	747,455	1,267	3,508,400	4,261,461
1999	(5,277)	3,823	318	750,381	907	3,583,000	4,336,429
2000	(5,236)	3,864	167	753,359	515	3,663,900	4,421,705

1a, 1b/ Bonneville Power Administration, U. S. Department of Energy, OSI Options Study,
Final Report - Part 2 (Portland, Oregon, June 1985), Tables 70-71, pp. 172-3.

1c/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Tables 19, 21, pp.46, 50.

2/ Decision Analysis Model (DAM), Employment Impacts: Change in Employment (Person-Years), Table 10.
Computer Printout dated: 03/31/86.

Table: 1b

SUMMARY: Aluminum = \$.70

Year	(A) 2/ Aluminum	(B) 1a/ (A + 9100)	(C) 2/ Other Industry	(D) 1b/ Manufacturing + Agriculture	(E) 2/ Other Industry Indirect	(F) 1c/ Nonmanufacturing	(G) TOTAL EMPLOYMENT (B+...+F)
1987-1991	(5,027)	4,073	1,518	723,432	4,049	2,930,880	3,663,952
1992-1996	(5,224)	3,879	1,097	736,311	2,936	3,235,400	3,979,623
1997-2000	(5,191)	3,903	396	748,944	1,114	3,544,375	4,298,731

1/ With the smelters at Columbia Falls and The Dalles held closed.

TABLE 1985

PACIFIC NORTHWEST (REFERENCE) EMPLOYMENT

INDUSTRY	PUBLICS		PRIVATES		TOTAL EMPLOYMENT
	1985 EMPLOYMENT	GROWTH RATE	1985 EMPLOYMENT	GROWTH RATE	
AGRICULTURE	84737	-0.0007	75144	-0.0057	159,881
CHEMICALS 1/	9160	0.0128	5379	0.0149	14,539
FOOD PROCESSING	27698	-0.0016	44245	-0.0029	71,943
LUMBER AND WOOD PROD	53126	-0.0065	71583	-0.0049	124,709
METALS 1/	12089	0.0073	25223	0.0046	37,312
PAPER 1/	15680	0.0041	12421	0.0071	28,101
OTHER MANUFACTURING	94275	0.0117	179782	0.011	274,057
NONALUMINUM DSI	3400	0.0036			3,400
TOTAL	300,165		413,777		713,942

1/ NET OF DSI

2/ BONNEVILLE POWER ADMINISTRATION, U. S. DEPARTMENT OF ENERGY, DSI OPTIONS STUDY
FINAL REPORT - PART 2 (PORTLAND, OREGON, JUNE 1985), TABLES 70, 71, PP. 172-3.

$$\text{EQUATION: } (\text{EMPLOYMENT}_{i,j,t+n}) = (\text{EMPLOYMENT}_{i,j}) * (1 + r)^n$$

where i = industry category
 j = utility category (public or private)
 n = number of years beyond 1985
 t = 1985
 r = (percent) growth rate

1/
TABLE 2

ESTIMATED PACIFIC NORTHWEST EMPLOYMENT

1955 - 2000

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TOTAL EMPLOYMENT 1985	TOTAL EMPLOYMENT 1986	TOTAL EMPLOYMENT 1987	TOTAL EMPLOYMENT 1988	TOTAL EMPLOYMENT 1989	TOTAL EMPLOYMENT 1990	TOTAL EMPLOYMENT 1991	TOTAL EMPLOYMENT 1992	TOTAL EMPLOYMENT 1993	TOTAL EMPLOYMENT 1994	TOTAL EMPLOYMENT 1995	TOTAL EMPLOYMENT 1996	TOTAL EMPLOYMENT 1997	TOTAL EMPLOYMENT 1998	TOTAL EMPLOYMENT 1999	TOTAL EMPLOYMENT 2000
159,881.0	159,393	158,908	158,426	157,945	157,468	156,992	156,519	156,049	155,580	155,115	154,651	154,190	153,731	153,275	152,821
14,539	14,736	14,936	15,139	15,345	15,553	15,765	15,979	16,196	16,416	16,639	16,865	17,094	17,326	17,562	17,800
71,943	71,770	71,598	71,426	71,255	71,084	70,914	70,744	70,574	70,405	70,237	70,068	69,900	69,733	69,566	69,400
124,709	124,013	123,321	122,633	121,948	121,268	120,592	119,919	119,250	118,585	117,924	117,266	116,613	115,963	115,316	114,674
37,312	37,516	37,722	37,928	38,136	38,345	38,555	38,767	38,980	39,193	39,409	39,625	39,843	40,062	40,282	40,503
28,101	28,253	28,407	28,561	28,716	28,872	29,029	29,187	29,346	29,506	29,666	29,828	29,991	30,154	30,319	30,484
274,057	277,138	280,253	283,403	286,589	289,811	293,068	296,363	299,695	303,064	306,471	309,916	313,400	316,923	320,486	324,089
3,400	3,412	3,425	3,437	3,449	3,462	3,474	3,487	3,499	3,512	3,524	3,537	3,550	3,563	3,575	3,588
713,942	716,233	718,570	720,953	723,384	725,863	728,389	730,964	733,588	736,261	738,984	741,757	744,580	747,455	750,381	753,359

BONNEVILLE POWER ADMINISTRATION, U. S. DEPARTMENT OF ENERGY, DSI OPTIONS STUDY
FINAL REPORT - PART 2 (PORTLAND, OREGON, JUNE 1985), TABLES 70, 71, PP. 172-3.

$$\text{EQUATION: EMPLOYMENT}_{i,j,t+n} = \text{EMPLOYMENT}_{i,j} * (1 + r)^n$$

where i = industry category
j = utility category (public or private)
n = number of years beyond 1985
t = 1985
r = (percent) growth rate

1/ See Table 1: Pacific Northwest (Reference) Employment
for industry categories.

TABLE 1
DERIVATION OF
NONMANUFACTURING EMPLOYMENT

	(A)	(B)	(C)
	1/ TOTAL NONAGRICULTURAL EMPLOYMENT FORECASTS BY ...REGION (from Table 19)	2/ TOTAL MANUFACTURING EMPLOYMENT FORECAST BY...REGION (from Table 21)	TOTAL NONMANUFACTURING EMPLOYMENT IN REGION (A - B)
YEAR			
1987	3,382,400	570,200	2,812,200
1988	3,463,000	590,900	2,872,100
1989	3,525,100	586,600	2,938,500
1990	3,576,800	581,700	2,995,100
1991	3,596,200	559,700	3,036,500
1992	3,704,600	588,000	3,116,600
1993	3,769,400	588,700	3,180,700
1994	3,851,500	589,700	3,261,800
1995	3,858,300	587,400	3,270,900
1996	3,925,800	578,800	3,347,000
1997	4,022,100	599,800	3,422,300
1998	4,107,800	599,400	3,508,400
1999	4,180,500	597,500	3,583,000
2000	4,263,400	599,600	3,663,800

1/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Table 19, page 46.

2/ Bonneville Power Administration, U. S. Department of Energy, Bonneville Power Administration
Forecasts of Electricity Consumption in the Pacific Northwest, Technical Documentation
(Portland, Oregon, August 1985), Table 21, page 50.

