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
LOAD FORECASTING	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
POWER SYSTEM OPERATION AND EXPANSION	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
RATE AND FINANCIAL ANALYSIS	o Estimates BPA rates by customer class o Derives BPA revenues o Estimates BPA cash flows
EMPLOYMENT IMPACT ANALYSIS	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

	Output	Information Supplied	Relationship to Environmental and Socioeconomic Impacts
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 productions 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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. 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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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

	FY Period	Long-Term Aluminum Price = 65¢/lb. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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

	FY Period	Long-Term Aluminum Price = 65¢/lb. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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	[illegible]	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. A Percent of Games Open	B Average Capacity Factor When Open (%)	A x B	Long-Term Aluminum Price = 70¢/lb. C Percent of Games Open	D Average Capacity Factor When Open (%)	C x D
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.		
	FY 1987-1991	FY 1992-1996	FY 1997-2000
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.		
	FY 1987-1991	FY 1992-1996	FY 1997-2000
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)

Period	65¢/lb. 1/	70¢/lb. 1/
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/

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

Period/Sector	At 65¢/lb. Aluminum	At 70¢/lb. Aluminum
FY 1987 - FY 1991:		
Aluminum DSIs	3,390	5,091
Other Employment	3,659,752	3,659,942
Total Employment	3,663,142	3,665,033
FY 1992 - FY 1996:		
Aluminum DSIs	3,190	4,749
Other Employment	3,975,740	3,975,633
Total Employment	3,978,930	3,980,382
FY 1997 - FY 2000:		
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.		
	FY 1987-1991	FY 1992-1996	FY 1997-2000
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)

	Plants Closed 2/	All Plants Operated As Model Dictates
Smelter Loads		
FY 1987 - 1991	1,611	1,960
FY 1992 - 1996	1,498	1,806
FY 1997 - 2000	1,519	1,840
Total Loads		
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/

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

Period/Sector	No Plant Closures	Two Plants Closed 2/
FY 1987 - FY 1991:		
Aluminum DSIs	5,091	4,073
Other Employment	3,659,942	3,659,879
Total Employment	3,665,033	3,663,952
FY 1992 - FY 1996:		
Aluminum DSIs	4,749	3,879
Other Employment	3,975,633	3,975,744
Total Employment	3,980,382	3,979,623
FY 1997 - FY 2000:		
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/

	Alcoa Vancouver		Alcoa Wenatchee		Columbia Falls		Intalco		Kaiser Mead		Kaiser Tacoma		Commonwealth		The Dalles		Reynolds Longview		Reynolds Troutdal	
	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
Variable:																				
Revenue																				
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
Load																				
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)

	No Action	Revenue Protection	Proposal	Load Maintenance
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/	19.5	0.0	0.0	0.0
Average Aluminum DSI Revenue 3/	18.8	+7.9	+2.4	+1.0
New Resource Firm	20.3	-0.6	-0.3	-0.2
FY 1990:				
Priority Firm	19.9	-1.6	-0.5	-0.4
Industrial Firm Standard 2/	18.5	-0.2	-0.1	-0.1
Average Aluminum DSI Revenue 3/	17.9	+6.6	+1.6	+0.1
New Resource Firm	23.0	-1.7	-0.6	-0.4
FY 1995:				
Priority Firm	19.6	-0.4	-0.2	-0.2
Industrial Firm Standard 2/	18.0	-0.3	-0.1	0.0
Average Aluminum DSI Revenue 3/	17.7	+1.8	+0.8	+0.5
New Resource Firm	28.4	-0.4	-0.1	0.0
FY 2000:				
Priority Firm	19.6	+0.2	0.0	-0.1
Industrial Firm Standard 2/	17.9	+0.2	0.0	-0.1
New Resource Firm	34.0	+0.4	0.0	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

		Variation From No Action Alternative		
Period/Sector	No Action Case	Revenue Protection Alternative	Proposed Variable Rate	Load Maintenance Alternative
FY 1987 - 1991:				
Aluminum DSIs	5,091	-269	-28	+360
Other Employment	3,659,942	+524	+187	+135
Total Employment	3,665,033	+255	+159	+495
FY 1992 - 1996:				
Aluminum DSIs	4,749	-148	-1	+381
Other Employment	3,975,633	+372	+113	+64
Total Employment	3,980,382	+224	+112	+445
FY 1997 - 2000:				
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)

	No Action	Revenue Protection	Proposal	Load Maintenance
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 subtantially 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)

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	17.7	-0.5	-0.3	-0.2
Industrial Firm Standard 2/	19.4	0.0	0.0	0.0
Average Aluminum DSI Revenue 3/	18.8	+8.2	+2.2	+0.4
New Resource Firm	20.7	-0.5	-0.3	-0.2
FY 1990:				
Priority Firm	20.4	-1.4	-0.3	-0.1
Industrial Firm Standard 2/	18.8	-0.4	-0.1	+0.1
Average Aluminum DSI Revenue 3/	18.0	+7.1	+1.9	+0.1
New Resource Firm	23.6	-1.4	-0.3	-0.1
FY 1995:				
Priority Firm	19.4	-0.4	-0.2	0
Industrial Firm Standard 2/	17.7	-0.4	-0.1	0
Average Aluminum DSI Revenue 3/	17.7	+0.9	+0.1	-0.2
New Resource Firm	27.5	-0.4	0	+0.4
FY 2000:				
Priority Firm	19.1	0	-0.2	0
Industrial Firm Standard 2/	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

		Variation From No Action Alternative		
Period/Sector	No Action Case	Revenue Protection Alternative	Proposed Variable Rate	DSI Load Maintenance Alternative
FY 1987 - 1991:				
Aluminum DSIs	3,390	-208	-26	+553
Other Employment	3,659,752	+480	+155	+62
Total Employment	3,663,142	+272	+129	+615
FY 1992 - 1996:				
Aluminum DSIs	3,190	-179	-79	+399
Other Employment	3,975,740	+214	-2	-39
Total Employment	3,978,930	+35	-81	+360
FY 1997 - 2000:				
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 2 Plants Closed 2/	Revenue Protection	Proposal	Load Maintenance
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 attendent 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)

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

Period/Sector	No Action With Two Plants Closed 2/	Variation From No Action Alternative: Revenue Protection Alternative	Proposed Variable Reate	Load Maintenance Alternative
FY 1987 - 1991:				
Aluminum DSIs	4,073	+749	+990	+1378
Other Employment	3,659,879	+587	+250	+198
Total Employment	3,663,952	+1336	+1240	+1576
FY 1992 - 1996:				
Aluminum DSIs	3,879	+722	+869	+1251
Other Employment	3,975,744	+261	+2	-47
Total Employment	3,979,623	+983	+871	+1204
FY 1997 - 2000:				
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 (CF_4), 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 Vancouver		Alcoa Wenatchee		Columbia Falls		Intalco		Kaiser Mead		Kaiser Tacoma		Commonwealth		The Dalles		Reynolds Longview		Reynol Troutd
	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢	70¢	65¢
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
FY 1992 - 1996	30	64	60	84	60	82	81	94	32	64	54	78	50	74	57	81	54	78	19
FY 1997 - 2000	26	61	60	84	57	82	80	92	27	63	52	78	48	73	55	79	51	78	15
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
FY 1992 - 1996	30	64	63	86	60	82	82	96	32	64	54	78	50	74	57	81	54	78	19
FY 1997 - 2000	28	63	64	86	57	82	82	94	27	63	52	78	49	73	56	79	52	78	15
5 Mills																			
FY 1987 - 1991	35	57	59	88	57	89	86	95	35	59	46	78	49	75	53	88	48	79	24
FY 1992 - 1996	32	64	63	86	62	89	82	96	32	64	54	80	50	74	57	86	56	80	20
FY 1997 - 2000	31	63	64	86	62	90	87	94	30	65	52	80	50	73	57	86	54	80	17
10 Mills																			
FY 1987 - 1991	37	66	59	88	61	91	86	96	37	67	49	80	52	80	57	88	50	80	25
FY 1992 - 1996	44	74	64	86	69	91	84	96	38	72	56	81	57	81	63	86	56	81	28
FY 1997 - 2000	43	76	66	86	69	92	84	94	39	73	55	82	55	82	64	86	55	82	26

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)

	No Action	3 mills/kWh	5 mills/kWh	10 mills/kWh
Smelter Loads				
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
Total Loads				
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)

Smelter	Load at Capacity Operation (MW)	Estimated Load at Capacity Operation with Improvements (MW)	Reduction (MW)
Alcoa, Vancouver	244.28	207.51	36.77
Alcoa, Wenatchee 1/	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	263.38	223.74	39.64
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)

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

		Variation From No Action Alternative		
Period/Sector	No Action Case	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)

	No Action	3 mills/kWh	5 mills/kWh	10 mills/kWh
Smelter Loads				
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
Total Loads				
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)

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

		Variation From No Action Alternative		
Period/Sector	No Action Case	3 Mills Con/Mod	5 Mills Con/Mod	10 Mills Con/Mod
FY 1987 - 1991:				
Aluminum	3,390	+2	+50	+199
Other Employment	3,659,752	+6	+4	+8
Total Employment	3,663,142	+8	+54	+207
FY 1992 - 1996:				
Aluminum	3,190	+18	+83	+355
Other Employment	3,975,740	-15	-22	-77
Total Employment	3,978,930	+3	+61	+278
FY 1997 - 2000:				
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/

	Alcoa Vancouver		Alcoa Wenatchee		Columbia Falls		Intalco		Kaiser Mead		Kaiser Tacoma		Commonwealth		The Dalles		Reynolds Longview		Reynolds 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
Combinations:																				
Revenue/3 Mills																				
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
Proposal/5 Mills																				
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
Load/10 Mills																				
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)

	No Action	Revenue with 3 mills/kWh	Proposal with 5 mills/kWh	Load with 10 mills/kWh
Smelter Loads:				
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
Total Loads:				
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)
FY 1988:				
Priority Firm	17.4	-0.6	-0.2	-0.2
Industrial Firm				
Standard 2/	19.5	0.0	0.0	0.0
Average Aluminum				
DSI Revenue 3/	18.8	+7.8	+2.1	0.0
New Resource Firm	20.3	-0.6	-0.3	-0.2
FY 1990:				
Priority Firm	19.9	-1.6	-0.4	-0.3
Industrial Firm				
Standard 2/	18.5	-0.3	-0.2	-0.1
Average Aluminum				
DSI Revenue 3/	17.9	+6.3	+1.0	-1.3
New Resource Firm	23.0	-1.8	-0.5	-0.4
FY 1995:				
Priority Firm	19.6	-0.3	-0.2	+0.1
Industrial Firm				
Standard 2/	18.0	-0.7	-0.2	+0.2
Average Aluminum				
DSI Revenue 3/	17.7	+1.5	+0.1	-0.8
New Resource Firm	28.4	-0.4	-0.2	+0.1
FY 2000:				
Priority Firm	19.6	+0.3	0.0	-0.1
Industrial Firm				
Standard 2/	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

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

	No Action	Revenue with 3 mills/kWh	Proposal with 5 mills/kWh	Load with 10 mills/kWh
Smelter Loads:				
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
Total Loads:				
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 consumers, 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 with 3 mills Con/Mod (mills/kWh)	Proposal with 5 mills Con/Mod (mills/kWh)	Load with 10 mills Con/Mod (mills/kWh)
FY 1988:				
Priority Firm	17.7	-0.5	-0.2	-0.1
Industrial Firm Standard 2/	19.4	0.0	0.0	0.0
Average Aluminum DSI Revenue 3/	18.8	+8.1	+2.1	0.0
New Resource Firm	20.7	-0.5	-0.3	-0.2
FY 1990:				
Priority Firm	20.4	-1.4	-0.4	-0.1
Industrial Firm Standard 2/	18.8	-0.4	-0.1	+0.1
Average Aluminum DSI Revenue 3/	18.0	+6.6	+1.3	-1.1
New Resource Firm	23.6	-1.5	-0.4	-0.1
FY 1995:				
Priority Firm	19.4	-0.4	-0.1	+0.2
Industrial Firm Standard 2/	17.7	-0.3	-0.1	+0.2
Average Aluminum DSI Revenue 3/	17.7	+0.7	-0.4	-1.5
New Resource Firm	27.5	-0.3	+0.1	+0.5
FY 2000:				
Priority Firm	19.1	0.0	-0.1	0.0
Industrial Firm Standard 3/	17.4	0.0	-0.1	-0.1
New Resource Firm	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		
Period/Sector	No Action Case	Revenue Protection With 3 Mills Con/Mod	Proposed Var. Rate With 5 Mills Con/Mod	DSI Load Maintenance With 10 Mills Con/Mod
FY 1987 - 1991:				
Aluminum	3,390	-148	+30	+688
Other Employment	3,659,752	+488	+156	+44
Total Employment	3,663,142	+340	+186	+732
FY 1992 - 1996:				
Aluminum	3,190	-131	+10	+769
Other Employment	3,975,740	+188	-18	-129
Total Employment	3,978,930	+57	-8	+640
FY 1997 - 2000:				
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

Smelter	Capacity 2/
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 3/
Reynolds, Longview, WA	191
Reynolds, Troutdale, OR	118
Total Capacity	1,564
Weighted Ave. Power Rate (mills/kWh)	22.8 4/

Ohio Valley Region

Smelter	Capacity
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

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

Gulf Coast Region

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

N.E. Region

Smelter	Capacity
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/

Region	Capacity (000 MTPY 2/)	Weighted Average Power Rate (mills/kWh)	Power Costs 3/ (¢/lb.)	Adjusted Power Costs 4/ (¢/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) 2/	0.03 - 0.05
Fluorspar $(CaF_2)_2$ 2/	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 2/ (MWHr/yr)	Fossil Fuels 2/ 3/ (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 4/	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.