BEFORE THE ENERGY FACILITY SITING COUNCIL

OF OREGON

In the Matter of the Application of Portland General Electric Company, and Others, For a Site Certificate to Construct and Operate an Energy Facility at the Pebble Springs Site, in Gilliam County, Oregon.	)))))	PROPOSED FINDINGS OF FACT, OPINION, CONCLUSIONS, AND ORDER (Volume I)

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I. INTRODUCTION

A. Background

Portland General Electric Company (PGE), Pacific Power & Light Company (PP&L), Puget Sound Power and Light Company (Puget), and Pacific Northwest Generating Company (PNGC)[1] propose to construct and operate two 1260 megawatt nuclear-fueled power plants in Gilliam County, Oregon.[2]

Oregon Revised Statutes Chapter 469 requires project sponsors to obtain a site certificate from the Energy Facility Siting Council (Siting Council, Council, or EFSC) before constructing the proposed facility. This document embodies recommendations to the Siting Council by the undersigned, who conducted the hearing and considered the evidence. The

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[1]PNGC is a generation and transmission cooperative organized to obtain generating resources for its seventeen members. The members are distribution cooperatives located in Oregon, Idaho, Washington, and Wyoming. The seventeen cooperatives are: Benton Rural Electric Association; Big Bend Electric Cooperative, Inc.; Blachly-Lane County Cooperative Electric Association; Central Electric Cooperative, Inc.; Clearwater Power Company; Columbia Rural Electric Association, Inc.; Consumers Power, Inc.; Coos-Curry Electric Cooperative, Inc.; Inland Power and Light Company; Kootenai Electric Cooperative, Inc.; Lane Electric Cooperative, Inc.; Lincoln Electric Cooperative Inc.; Lower Valley Power and Light Company; Mid-state Electric Cooperative Inc.; Orcas Power and Light Company; Raft River Electric Cooperative Inc.; and Umatilla Electric Cooperative Association.

[2]Initially PGE was alone in applying for a site certificate, but was later joined by PP&L, Puget, and PNGC (At the time of the hearing, PNGC was negotiating to join the other project sponsors, but a final agreement had not been reached. It is assumed the negotiations will be successful.).

recommendations are based on analysis of whether the material received into evidence satisfies the requirements of the Siting Council standards.

In addition to ORS Chapter 469 this proceeding is governed by the Administrative Procedures Act found in ORS Chapter 183 and the rules adopted by the Siting Council, codified in Oregon Administrative Rules Chapter 345.

On December 7, 1972, PGE filed a Notice of Intent to file an application for a site certificate. The Nuclear and Thermal Energy Council (NTEC)[3] gave public notice of the Notice of Intent the following day. After the required one-year waiting period, on December 14, 1973, PGE filed an application to construct and operate an energy facility. As amended, the application is for two pressurized water reactor units. The application was accepted for filing by NTEC on January 8, 1974. Since then, eleven amendments have been made to the application.

Between January and June, 1974, six public workshops were held. PGE, NTEC's staff, state agencies, Gilliam county officials, and interested members of the public reviewed and commented on the application. Public notice was given of the workshops, and minutes kept.

In October, 1974, Lloyd K. Marbet and Harold C. Christiansen filed petitions to intervene in opposition to the site certificate application. In an order dated October 18, 1974, the NTEC granted the petitions, subject to certain conditions.

On October 4 and November 7, 1974, prehearing conferences were held to identify issues. A public hearing was held on the application in Arlington on November 12, 1974, and in Portland on November 14 and 15, 1974. Hearings Officer William C. DuValle presided at the hearing.

After consideration of the evidence, on April 11, 1975, the NTEC issued an order recommending the Governor issue a site certificate to PGE. Messrs. Marbet and Christiansen appealed the order to the Oregon Court of Appeals, which upheld the NTEC decision in June, 1976. Mr. Marbet then requested and was granted review by the Oregon Supreme Court. On March 3, 1977, the Oregon Supreme Court reversed the NTEC Order and remanded for further proceedings.

In April, 1977, the Siting Council announced its intention to adopt standards by which to judge applications to

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[3]NTEC was replaced by the Energy Facility Siting Council in 1975. Oregon Laws 1975, Chapter 606.

construct and operate "energy facilities", as defined in ORS 469.300(10). Hearings Officer Robert Miller presided at a hearing on proposed standards on June 9, 1977. On July 19, 1977, the Siting Council adopted 10 such standards, referred to as "general standards." The Council also decided to adopt "specific standards" applicable to applications for thermal energy facilities, and Mr. Miller conducted a hearing on proposed specific standards on October 24, 25, and 26, 1977. An order adopting 10 specific standards was signed on March 13, 1978. On December 13, 1977, the Council amended the land-use standard, 345-75-025(5)(b); on February 14, 1978, it changed the wording in the general standards to reflect that its final decision is no longer a recommendation to the Governor; and on July 21, 1978, it revised the demand-for-energy standard, 345-75-025(1)(a). The general standards are codified in Division 75, and the specific standards in Division 76, of Chapter 345 of Oregon Administrative Rules (OAR).

On April 20, 1977, the Siting Council gave notice it was reopening the record in the Pebble Springs application proceeding. Full party status without conditions was granted to: Lloyd Marbet, Forelaws on Board, Coalition for Safe Power, Harold Christiansen, Oregon Citizens for Economic and Environmental Balance, Inc. (OCEEB), the Oregon Public Utility Commissioner (PUC), the Josephine County Nuclear Safeguards Committee, the Energy Conservation Coalition (ECC), the Fusion Energy Foundation (FEF), the United States Labor Party in Oregon (USLP), and Lionel V. Topaz. The Oregon Department of Energy (DOE) is the staff for the Siting Council (ORS 469.040(b)) and was treated as a party during the proceeding.

Notices of conferences and hearing sessions were given to the parties, the news media, and those on the Siting Council's mailing list. Five conferences to discuss preliminary and procedural matters were held between August 12, 1977 and May 26, 1978. The hearing was conducted on 72 days between October 11, 1977 and February 27, 1979. The hearing session on October 11, 1977, was conducted in Arlington, and comments were received from residents of the region where the proposed facility is to be located. The other hearing sessions, and all the conferences, were held in either Portland or Salem.

The names of those who have entered appearances during this proceeding appear on Appendix A to this document.

Ten general and ten specific standards establish the criteria for determining whether to approve or reject the application in this proceeding. The general standards address the following subjects:

1. Need for power

    a. Demand for energy

b. Economic prudence of the proposed facility and alternative means for meeting the demand;

2. Public health and safety;

3. Environmental impacts;

4. Beneficial use of wastes and by-products;

5. Land-use plans;

6. Historic or archaeological significance of the proposed site;

7. Water requirements;

8. Ability to construct, operate, and retire the proposed facility;

9. Financial ability; and

10. Socio-economic impacts.

The specific standards establish additional requirements relating to general standards 1(b), 2, 3, 8, and 9.

Currently, ownership of the Pebble Springs Project is allocated like this:

	Unit 1	Unit 2
PGE	40 %	40 %
PP&L	25 %	25 %
Puget	20 %	20 %
PNGC	10 %	0
Unallocated	5 %	15 %

The co-owners expect the unallocated portions to be purchased by utility companies. Until that occurs, the unallocated portions are apportioned among PGE, PP&L, and Puget on a pro rata basis. SCA 5-2.

This document refers to the co-owners, together, as the applicant. ORS 469.300(1) and (12).

B. Interpretation of Standards

General Standard 345-75-020 directs the Council to approve an application for a site certificate if it finds that its standards have been met. The standards therefore govern whether a site certificate application is to be approved or rejected. If the Council makes affirmative findings on all the

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standards, it is duty-bound to approve the application. If the Council does not make affirmative findings on all the standards, it is duty-bound to reject the application.

Compliance with Council standards is being judged in this document by a "literal" or "strict" interpretation of the requirements of the standards. Attempts at meeting standards or significant compliance with them is insufficient. A standard is not met unless there is reliable, probative, and substantial evidence in the record on which specific findings of fact can be made. The comments in the orders adopting the general and specific standards are significant indicators of Council intent.

C. Relationship Between Specific and General Standards

Must the specific standards be satisfied before an affirmative finding can be made on the general standards? Put another way, can a general standard be met by evidence that does not meet the requirements of a corresponding specific standard? Could the applicant ignore a specific standard and choose its own method to prove compliance with a general standard?

Specific Standard 345-76-015(3) answers a related question. It says proof of compliance with three of the five subjects the specific standards address (public health and safety, ability to finance, and ability to construct and operate) is sufficient proof of compliance with the corresponding general standards. Proof of compliance with specific standards dealing with the other two subjects (economic prudence and environmental impacts) is not necessarily sufficient to satisfy the corresponding general standards. More evidence may be required. Specific Standard 345-76-015(3) does not answer the question of whether compliance with the specific standards is a prerequisite to an affirmative finding on the general standards.

The DOE suggests that an affirmative finding can be made on the general standard dealing with ability to finance without meeting the specific standard on ability to finance. But it also argues that the Council cannot make an affirmative finding on the general economic prudence standard without first finding that the specific standards on economic prudence have been met. No persuasive reason was shown why proof of compliance with specific standard is required for one general standard and not required for another. DOE Opening Brief, pp. 192, 199; DOE Memorandum in Support of Opening Brief, p. 22.

A look at the language in the specific standards reveals the Council's desire to be supplied with the information required in the specific standards. Phrases like the "Council will require," "Council must find," and "applicant must" are

found throughout. Compliance with the specific standards is mandatory, not directory.

D. Site Certificate Conditions

If a site certificate issues, ORS 469.400(3) requires it to contain conditions for the protection of public health and safety. The site certificate must also require compliance with state laws and Siting Council Rules. An issue regarding the proper use of site certificate conditions presents itself: May conditions be used in determining whether affirmative findings can be made, or may they be used only after affirmative findings have been made?

The DOE argues that conditions can be used to satisfy requirements of a standard. That is, if proof of compliance with the requirements of a standard is not adequate, the failure can be excused if a protective condition is added to the site certificate. Applicant takes the same position by recommending a condition in the site certificate to satisfy compliance with the ability to finance standard. DOE Memorandum, in Support of its Opening Brief, p. 7; Applicant's Proposed Findings of Fact on Demand, Econ. Prudence, and Ability to Finance, p. 95 and 96; Applicant's Opening Brief on Demand, Econ. Prudence, and Ability to Finance, p. 100.

Using certificate conditions to satisfy requirements of a standard raises several questions: May a condition be used to overcome a minor failure of proof, or also to overcome a major lack of proof? May a condition remedy a lack of proof on standards of lesser controversy, or may a condition remedy a failure of proof regarding a major standard? If a differentiation is made among major-minor failures, and among various standards, where should the line of differentiation be drawn? If a condition is used to satisfy the requirements of a standard, must the hearing be reopened later?

The difficult decisions necessary to answer the foregoing questions are avoided in this document by deciding that certificate conditions are available only after the standards have been met. The standards announce the criteria by which applications will be judged. That judgment should be made by determining whether each standard has been met, not by deciding whether adequate site certificate conditions can be drafted. Also, no authority has been cited indicating the Council has authority to use site certificate conditions to satisfy requirements of standards.

E. Evidence in Record

As stated, the Council must make affirmative findings before a certificate can be approved. The findings must be

based on evidence in the record. Unless a standard indicates otherwise, evidence supporting an affirmative finding of fact need not come from applicant. Existence of the evidence in the record is sufficient.

F. Burden of Proof and Evidentiary Rule

The following position taken in the DOE memorandum filed with its opening brief, at page 3, is adopted:

> The Oregon Administrative Procedures Act (ORS Ch. 183) is silent regarding the burden of proof in a contested case proceeding. It is generally held that, absent a statute, the burden of proof is considered to be upon the party asserting the affirmative of an issue before an administrative agency, just as it would be in a court proceeding. [Citations omitted.]

The Council must make many affirmative findings of fact before a site certificate application can be approved. Absent a statute or rule to the contrary, the parties desiring the Council to make those positive findings have the burden to provide the evidence on which those findings can be made. Opponent-intervenors do not have a burden to demonstrate that a standard has not been met.

On page 6 of the Order Adopting Standards (General), the Council comments:

> The evidentiary test is not a preponderance test. The council is not required to weigh the evidence on each particular standard and determine which party has prevailed. The council is required to review the whole record and base each of its findings as to whether a standard has been met on reliable probative and substantial evidence.

The "evidentiary" test, for the purposes of this proceeding, is neither a "preponderance" test, nor is it any other test along the "continuum of proof."

The findings and conclusions in this document are made under the assumption that they are proper if consistent with statute and decisional law, as well as the Council's rules, and are based on reliable, probative, and substantial evidence. ORS 183.450(5).

G. Description of Record and Abbreviations

Division 25 of Oregon Administrative Rules tells applicants what to include in an application for a site certificate for a thermal power plant. In this proceeding, the application is contained in two bound volumes of material and three volumes of appendices. Evidence sponsored by applicant to support approval of the application is identified as Exhibits A-1 through A-72.[4] Evidence sponsored by the staff of the Siting Council is identified as Exhibits S-1 through S-67. Evidence sponsored by other intervenors is identified as Exhibits I-1 through I-60. Written evidence sponsored by members of the public who did not acquire party status is identified as Exhibits P-1 through P-12. Evidence sponsored by the Council itself is identified as Exhibits C-1 through C-6.

The transcript of the original hearing runs 940 pages and is found in five volumes. The transcript in the reopened hearing (since the matter was remanded by the Oregon Supreme Court) runs 12,575 pages, and is contained in 74 volumes.

At the end of many paragraphs in this proposed order are references to portions of the record where the reader can find evidence on the subject discussed. The references are not intended to be a complete listing of all evidence in the record on each subject, but are intended to aid the reader who is not familiar with the entire record, but would like to study a matter in more detail. The following abbreviations are used in those references:

SCA - Site Certificate Application. Unless otherwise indicated, the references are to page numbers. The number preceding the hyphen denotes the chapter, and the number after the hyphen denotes the page number. For instance, reference SCA 13-18 is to page 18 of chapter 13 in the site certificate application;

Sec. - Section of a document cited. If to the SCA, number before the period indicates the chapter cited;

Fig. - Figure;

App. - Appendix;

Att. - Attachment;

Exh. - Exhibit;

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[4] The application and amendments to it were received into evidence in Exhibits A-1, A-5, A-6, A-8, A-26, and A-71.

Sch. - Schedule;

Tr. - Transcript;

et seq. - The topic is discussed on the following pages, as well;

No. - Number;

p. and pp. - Page and pages.

II. DEMAND FOR ENERGY

A. Introduction and Overview

1. Overview and Definitions

To establish that there is a need for a proposed facility, it must be proved that a demand will exist for the electrical output from the facility, and that the facility will be an economically prudent method of meeting that demand. The demand for the output from the proposed facility will now be addressed.

PGE, PP&L, Puget, and PNGC each presented a forecast of future demand for electricity by their customers. Each company prepared its forecast for its own service territory. The four forecasts were then summed for the applicant composite forecast. The DOE presented a forecast it prepared for the state of Oregon. It utilized the Northwest Energy Policy Project (NEPP) moderate growth scenario to derive a forecast for the West Group Area. The Public Utility Commissioner of Oregon (PUC) presented a forecast prepared by his staff for the Oregon commercial and industrial customers of PGE and PP&L. The PUC then used forecasts prepared by others for the remaining customer classes and service territories to derive a total forecast for the combined service territories of applicant. NEPP presented a forecast for the states of Oregon, Washington, and Idaho. Applicant witness McHugh, who worked on the NEPP forecast, prepared forecasts for Oregon and Washington, based on updates and revisions to the NEPP forecast.

Throughout the discussion of forecast demand, expected resources, and economic prudence, the "Pacific Northwest" (PNW) means the area encompassed by the states of Oregon, Washington, and Idaho. The "West Group" refers to the West Group of the Northwest Power Pool, and encompasses all of the state of Washington, most of the state of Oregon, the portion of northern California served by PP&L, the portion of western Montana west of the Continental Divide served by PP&L and the Bonneville Power Administration (BPA), and BPA loads in southern Idaho.

It does not include any loads of Idaho Power Company in eastern Oregon or southern Idaho. Exh. C-1, p. V; Tr. 7251, 9807.

A utility company has an obligation to supply the firm energy demanded by its customers. As used in this document, a utility company's "ability to meet energy requirements" is its capability to supply the total number of kilowatt hours of electricity demanded by its customers in a particular time period. The rate at which the electricity will be demanded during a time interval will vary. The utility company's resource capability to meet the maximum rate of demand within a time period is its "peak capacity."

A kilowatt hour (kwh) is one kilowatt of electricity supplied to or taken from an electric circuit steadily for one hour. Average yearly demand is the total kilowatt hours demanded in a year divided by 8,760, the number of hours in a year.

In this section, the forecasts will be described; their legal sufficiency will be tested; the differing rates of load growth will be listed; and expected demand will be matched to resources. A party's compliance with General Standard 345-75-025(1)(a) will be determined by comparing its primary forecast with the requirements of the standard. Secondary forecasts were offered as checks on the reasonableness of the primary forecasts, not as proof of compliance with the standard.

2. Applicant Forecasts

PGE utilizes end-use analysis in constructing its primary forecast, called the "company composite" forecast. End-use analysis considers the uses to which the electricity will be put and factors affecting those uses. As a check on the reasonableness of its composite forecast, PGE prepared an econometric forecast. The econometric forecast projects consumption to grow at rates comparable to the composite forecast.

Puget's forecasting methodology is similar to PGE's in that Puget also utilizes end-use analysis in its primary forecast. But Puget uses trending of historical data for its forecast of commercial sector consumption. Puget also prepared an econometric forecast to check the reasonableness of its primary forecast, and the econometric forecast projects growth rates comparable to the primary forecast.

The PP&L forecast is based on extrapolation of historical trends of electricity usage by its customers. The PNGC forecast is the composite of its 17 member cooperatives, all of whom use time-trend analysis to derive their forecasts.

Dr. Kent Anderson, of National Economic Research Associates (NERA), prepared a forecast to check the reasonableness of the applicant forecasts. His forecast is econometric and utilizes data from Oregon and Washington only.

3. DOE Forecast

The DOE prepared an econometric forecast for all customer sectors in Oregon. It also presented an end-use forecast for residential consumption in Oregon. The DOE-preferred forecast for this proceeding consists of the end-use residential forecast and the econometric forecast for the other sectors.

4. NEPP Forecast

The Pacific Northwest Regional Commission, consisting of the governors of Oregon, Washington, and Idaho, and a federal representative appointed by the President of the United States, sponsored a comprehensive study of the energy picture in the PNW. NEPP was created to perform the study, which includes a forecast of demand for energy.

NEPP started work in November, 1975, and published its final report in May, 1978. Several experts from the BPA worked for NEPP, including the NEPP Director, Myron Katz. NEPP also hired independent consultants to perform work. W. Michael McHugh was a major contributor to the demand model used in the NEPP forecast. He also updated and revised the NEPP forecast and presented the results in this proceeding. Exh. A-43; Exh. C-2; Tr. 6858-65, 9473.

The NEPP forecast lists three alternative growth scenarios - low, moderate, and high. Mr. Katz believes the moderate growth scenario is the one most likely to occur. Tr. 6928-29.

5. PUC Forecast

Since the PUC forecast is only for the Oregon commercial and industrial customers of PGE and PP&L, other forecasts are needed to have a complete forecast for applicant's service territory. The PUC uses the DOE end-use forecast for Oregon residential customers (with a slight modification), the PP&L forecast for its loads in Wyoming, Montana, and Idaho, a time-trend projection for the balance of PP&L's Oregon/Washington/California area, and the Puget and PNGC forecasts. The PUC uses this combination of forecasts to match forecasted demand with resources.

B. The Forecasts and General Standard 345-75-025(1)(a)

1. The Standard

One of the affirmative findings of fact which must precede approval of a site certificate application is a finding that:

> There will be a demand for the energy to be supplied by the proposed energy facility, demonstrated by demand forecasting evidence which:
>
> (A) Identifies the contribution of major customer classes to total demand; and
>
> (B) Explains how total demand results from assumptions made regarding various factors which influence energy demand including, but not limited to, population levels, personal income levels, employment levels, energy prices and the effects of conservation and alternative energy programs likely to be in effect during the demand forecasting period.

2. Portland General Electric Co.

a. Forecast Description

The PGE end-use forecast is for the period 1976 to 1997. A separate, more detailed forecast is presented for the first five years of the forecast period.

For the residential sector, the number of customers and use-per-customer are the major components of the forecast. In the five-year forecast projections of population levels, new customer connections, housing demolitions, and vacancy rates are used to derive the estimated number of customers, while in the 20-year forecast a long-term population projection is utilized.

The five-year forecast utilizes direct customer input to derive a forecast of industrial sector demand. In the 20-year forecast, all nonresidential customers are combined, then disaggregated into 13 customer categories. Their electricity demand is forecast on the basis of projected economic activity per category in the PGE service territory.

The nonresidential excluding Schedule 89 sector is treated basically the same in both the five-year and the 20-year forecasts. Both are driven by projections of customer

output and electrical usage intensity. SCA 5-6 through 5-9; SCA App. C.1, PGE, Executive Summary.

b. Identification of Customer Classes

The PGE composite (end-use) forecast disaggregates customers into three classes: residential, Schedule 89 (large industrial accounts taking service at transmission voltage), and non-residential excluding Schedule 89. Consumption of electricity by residential customers is forecasted to increase 2.3 percent per year during the 20-year forecast period. The corresponding annual growth rate for the non-residential excluding Schedule 89 sector is 5.8 percent, and for the Schedule 89 sector it is 7.1 percent. SCA App. C.1, PGE, Executive Summary, pp. xix, xx.

c. Explanation of How Factors Affect Demand

(1) Population

PGE projects population in its service territory to increase at approximately its historical annual rate: 1.8 percent. In the first five years of the forecast period, the population forecast is used as a check against PGE's projection of the number of residential customers in its service territory. In the remainder of the forecast period, the population estimate is used to project housing units. The number of housing units forms the basis for the projection of expected customers. SCA App. C.1, PGE, pp. 11, 19, 194.

(2) Personal Income, Employment Levels, and Energy Prices.

Since 1973, several events have affected customer usage of energy. In 1973, adverse hydroelectric conditions, followed by the oil embargo, encouraged conservation. An economic recession in 1975-76 lowered real income levels and raised the unemployment rate in Oregon.[5] During the 1976-77 water year, streamflow levels were below normal. During these years the real prices of electricity, natural gas, and oil increased, contrasting with the previous downward trend. The impacts of these factors were not quantified individually, but PGE attempted to incorporate their total effect by using recent usage levels in each customer class, and by utilizing end-use analysis in the residential sector. SCA App. C.1, PGE, pp. 13, 14.

Real electricity price increases also affect the demand forecast by encouraging conservation. Conservation efforts, in turn, reduce forecasted total demand. SCA App. C.1, PGE, p. 65.

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[5]"Real" income is income that has been adjusted to a reference time to remove the effects of inflation.

Projections of employment levels, productivity, and energy usage intensity drive the forecast for the non-residential excluding Schedule 89 sector. Tr. 7954-55.

The forecast is the result of interaction among many factors. Among those factors are personal income, employment levels, and energy prices.

(3) Conservation

In the residential sector, PGE estimates specific conservation actions and greater appliance efficiency will reduce electricity consumption below what it would otherwise be. Included among the actions are increased installations of insulation, lower thermostat settings on hot water heaters, increased use of shower flow restrictors, and increased use of heat pumps. SCA App. C.1, PGE, pp. 70-89.

Similarly in the commercial sector, expected conservation measures reduce the demand forecast. Specific conservation actions assumed include lowering heating thermostat settings, raising cooling thermostat settings, reducing lighting loads, and modifying existing buildings to make them more energy-efficient. Resulting total electricity usage in the commercial sector is expected to be 20 percent less in 1982 and 35 percent less in 1997 than extrapolated pre-1973 levels would show. SCA App. C.1, PGE, pp. 93-96.

For the industrial sector (Sch. 89), five industries were isolated and the impacts of conservation on future consumption of electricity were estimated. Specific conservation actions and incentive programs were analyzed for each industry group. Estimated savings for each industry group in 1995 ranged from an eight percent reduction to a 14 percent reduction from what consumption would otherwise be. SCA App. C.1, PGE, pp. 98-103.

(4) Alternative Energy Programs

PGE expects the installation of solar units, used to augment water and space heating, to reduce demand for electricity. PGE estimates that by 1997 twenty percent of homes will have solar-assisted water heaters and five percent of homes will have solar-assisted space heating systems. SCA App. C.1, PGE, pp. 73, 87.

d. Conclusions

The PGE forecast identifies the contribution of major customer classes and explains how forecasted demand results from assumptions made regarding the factors specified in General Standard 345-75-025(1)(a)(B).

3. Pacific Power & Light Co.

a. Description of Forecast

The forecast is based on extrapolation of historical trends of the period January, 1963 to June, 1977. The historical data base is adjusted so it will reflect what is considered to be a normal time period. An exponential curve is then fitted to the historical data and extended to provide a forecast of the future. PP&L divides its service territory into four segments: Oregon/Washington/ California, Montana, Wyoming, and Idaho. Usage in each segment is forecasted separately. In a supplement to its basic forecasting evidence, PP&L discusses various factors that could influence the forecast and considers whether those factors dictate changes in its basic forecasting method. SCA App. C.1, PP&L, p. III-1, 2, App. A, p. 2, App. B, p. 1 et seq.

b. Identification of Customer Classes

The forecast itself does not separate customers into classes. By analysis performed after the forecast was derived, PP&L disaggregates its customers into residential, commercial, and industrial sectors. Historical rates of growth of each sector are used to project future rates of growth. During the forecast period, PP&L expects sales to customers in the three sectors to grow at the following annual rates: residential, 5.1 percent; industrial, 5.6 percent; commercial, 6.6 percent. By 1998, the residential and industrial sectors are each expected to consume 35 percent of total sales and commercial customers 30 percent. The PP&L demand forecasting evidence identifies the contribution of major customer classes to total demand. SCA App. C.1, PP&L, App. B, p. 73; Tr. 7376.

c. Explanation of How Factors Affect Demand

A basic assumption of PP&L's forecast is that fluctuations in economic, social, political, and behavioral variables which may affect the demand for electric power tend to balance out over time. In Appendix B to its forecasting evidence, PP&L discusses each of the factors listed in General Standard 345-75-025(1)(a)(B). Population and income growth and employment levels are expected to continue at or above historical rates. Real electric prices are projected to increase two percent per year, which is lower than the expected increase in oil and natural gas rates. Conservation is expected to improve through more stringent standards for new buildings and retrofitting of existing houses. But the resulting reduction in demand will be offset by increases in the percentage of residences using electricity to heat space and water. Also, the historical data base is not adjusted for the conservation that occurred as a result of the 1973, 1974, and 1977 low water

years, thereby projecting that conservation to continue into the future. Solar water and space heating and the increased use of heat pumps are the alternative energy resources expected to affect demand for electricity. SCA App. C.1, PP&L, p. III-1.

The PP&L forecast is not derived from explicit projections of the behavior of the various factors. But by explaining that its forecast is a matter of fitting a line to historical data, and by explaining that the forecast assumes that the factors causing the historical data to be what they are, will, in the aggregate, behave in a similar manner in the future, PP&L has explained how the forecasted demand results from assumptions about the factors listed in the standard.

d. Conclusions

PP&L's forecasting evidence identifies the contribution of major customer classes and explains how forecasted demand results from assumptions made regarding the factors specified in General Standard 345-75-025(1)(a)(B).

4. Puget Sound Power & Light Co.

a. Forecast Description

Puget prepared a forecast of electricity sales for the period 1978 through 1992 for each of its customer sectors: residential, commercial, and industrial. The forecast was then extended to 1997 by trend extrapolation. The sum of the three sector forecasts comprises the official company forecast. The residential forecast is based on end-use analysis. The commercial forecast is the result of trending historical data, adjusted for income levels, energy prices and population growth. Puget derived its industrial forecast from knowledge of and information from the relatively small number of those customers. Puget also constructed an econometric forecast to test the reasonableness of its main forecast. SCA App. C.1, Puget.

b. Identification of Customer Classes

As stated in the previous paragraph, the three major customer classes contributing to total demand are the residential, commercial, and industrial sectors. Currently, the residential sector accounts for approximately 56 percent, the commercial sector 25 percent, and the industrial sector 19 percent of the company's electricity sales. Between 1978 and 1992, Puget projects sales to customers in the three sectors to grow at the following annual rates: residential, 4.3 percent; commercial, 6.6 percent; and industrial, 5.2 percent. SCA App. C.1, Puget, pp. 4-5, Exh. 3.

c. Explanation of How Factors Affect Demand

(1) Population

Washington population forecasts issued by the BPA and the Washington State Office of Program Planning and Fiscal Management are used to project the number of residential customers Puget will serve each year of the forecast period. Residential customers are further divided into subgroups, and the forecasted usage per customer is multiplied by the number of customers to obtain the total residential usage forecasted. SCA App. C.1, Puget, p. 11.

(2) Personal Income and Employment Levels

Puget assumes the historical 2.5 percent per year rate of growth in personal income will continue throughout the forecast period. An increase in demand for electricity in the residential and commercial sectors will result. Historical employment trends in Puget's service territory are assumed to continue into the future. SCA App. C.1, Puget, pp. 7, 8, Exh. 22, p. 1.

(3) Energy Prices

In the residential sector, expected future energy prices are considered in estimating future penetration of electric space heating into the space heating market. In the industrial sector, expected prices of electricity, natural gas, and oil are considered in determining whether there will be substitution of electricity for other fuels. SCA App. C.1, Puget, pp. 6, 7.

(4) Conservation

Puget assumes building design changes and insulation standards will improve energy usage efficiencies throughout the forecast period. Voluntary conservation efforts will continue. Conservation efforts and actions will decrease the rate of energy load growth. Puget does not quantify the effects of conservation, but considers it judgmentally in its forecast. SCA App. C.1, Puget, p. 9.

(5) Alternative Energy Programs

Puget assumes no alternative energy programs will significantly affect its load growth during the forecast period. Therefore, potential alternative energy programs are not included in its forecast. SCA App. C.1, Puget, p. 10-11.

d. Conclusions

Puget's forecasting evidence identifies the contribution of major customer classes and explains how total demand results from assumptions regarding the factors specified in General Standard 345-75-025(1)(a)(B).

5. Pacific Northwest Generating Co.

a. Forecast Description

All 17 members of PNGC are financed by loans from the Rural Electrification Administration (REA), and prepare forecasts according to guidelines established by the REA. Each uses a time-trend analysis in which a mathematical relationship is established between electricity sales and time. A logarithmic or curvilinear trend curve is fitted to the historical data. Any adjustments for conservation, energy prices, or other factors are then made. Historical data through 1976 are used by 16 members, and through 1975 by one member. SCA 5-12, 5-13.

b. Identification of Customer Classes

Each member projects future electricity consumption for four customer classes: residential, small commercial, large commercial, and irrigation. Totals for all 17 members are not given, nor are annual growth rates for all members given, but the record contains sufficient information from which those numbers can be calculated. The PNGC forecasts do identify the contribution of major customer classes to total demand. SCA App. C.1, PNGC, Atts. 3,4; Exh. A-41.

c. Explanation of How Factors Affect Demand

Since PNGC's forecast is the result of trending analysis, a basic assumption is that electricity sales will continue into the future in a manner consistent with past patterns. Except for adjustments to the forecast owing to important factors expected to occur in the future but which were absent in the past, or which are expected to change or disappear from historical patterns, the effects of the various factors are assumed to offset one another. SCA App. C.1, PNGC, p. 4.

Most PNGC members considered many factors that might cause demand in the future to be different than that indicated by past trends, including the factors listed in General Standard 345-75-025(1)(a)(B). Based on a consideration of these factors, adjustments were made to their forecasts. Nevertheless the adjustments usually offset one another. None of the adjustments was of major significance. SCA App. C.1, PNGC; Exh. A-41.

As was explained in the concluding paragraph of the analysis of the PP&L forecast, a trend forecast is not derived from explicit projections of how various factors will behave. But by explaining that its forecast is a matter of fitting a line to historical data and by explaining that the forecast assumes that the factors causing the historical data to be what they are, will, in the aggregate, behave in a similar manner in the future, PNGC has explained how the forecasted demand results from assumptions about the factors listed in the standard.

d. Conclusions

The PNGC forecasting evidence identifies the contribution of major customer classes and explains how forecasted demand results from assumptions regarding the factors specified in General Standard 345-75-025(1)(a)(B).

6. Public Utility Commissioner

a. Forecast Description

PUC witness Dr. Zepp offers an econometric forecast for PGE's service territory and the Oregon portion of PP&L's service territory. The forecast is for the commercial and industrial customer classes of each company and encompasses the period 1977 through 1997. The PUC forecast adopts the DOE Oregon residential forecast, except that a PUC forecast of PGE residential sales in 1979 is used. Dr. Zepp uses a time-trend forecast for PP&L's service territory in California and Washington. The PUC forecast then utilizes the forecasts prepared by Puget and PNGC for their service territories and PP&L for the remainder of its service territory, to encompass the complete territory served by applicant. Whether the other forecasts utilized by the PUC to make his forecast complete meet General Standard 345-75-025(1)(a) is discussed in the sections dealing with those forecasts. This section examines whether the PUC's econometric forecast of the Oregon commercial and industrial customers of PGE and PP&L meets General Standard 345-75-025(1)(a). Exh. I-42, p. 4; Exh. I-43, Revised Table 12.

b. Identification of Customer Classes

The forecast clearly is for two customer classes: commercial and industrial. In the forecast for PGE, contribution to total demand is listed by commercial and industrial tariff schedules. For PP&L the contribution of the commercial and industrial classes together is shown. Sales in average megawatts are shown for each company for each year 1980 through 1997. The forecast does identify the contribution of the customer classes it analyzes. Exh. I-42, p. 32-33.

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c. Explanation of How Factors Affect Demand

(1) Population, Personal Income, and Employment Levels

Demand for electricity is affected by interaction among various factors. Two factors used in creating the PUC forecast are value-added in manufacturing and personal income. Dr. Zepp obtained the values for those two variables from the DOE. The DOE in turn derived them from BPA population and employment projections. Population, personal income, and employment levels are used as raw data inputs to the forecast of total demand. Exh. I-41, p. 8; Tr. 9003, 9013.

(2) Energy Prices

The econometric model uses four equations, and real electric and natural gas prices are part of the general specifications for all four. Exh. I-42 pp. 5, 9-19.

(3) Conservation and Alternative Energy Programs

These factors affect demand to the extent they were reflected in 1977 actual data, and by the decrease in future demand as a result of rising real electric prices. Tr. 9057-58, 9075.

d. Conclusions

The forecasting evidence of the PUC identifies the contribution of major customer classes and explains how total demand results from assumptions regarding the factors specified in General Standard 345-75-025(1)(a)(B).

7. Department of Energy

a. Forecast Description

The DOE presented an econometric forecast for residential, commercial, and industrial customers. The DOE also presented an end-use forecast for residential customers. The "official" DOE forecast is econometric for the commercial and industrial sectors and end-use for the residential sector. (No DOE witness explicitly stated that the end-use residential forecast supersedes the econometric residential forecast, but that clearly was the DOE position. See Exh. S-30, Timm, p. 10; Tr. pp. 8736, 8911-13, 8934-35; DOE reply brief, p. 4.) Exh. S-30, Timm, Fang, and Nadal Testimony, and Schs. 1F, 1T.

b. Identification of Customer Classes

The basic framework of the DOE econometric forecast presented in this proceeding comes from a model described in a document entitled "Energy Demand Forecasting Model for Oregon" dated February, 1977. That model dealt with electricity, natural gas, and petroleum. Usage was disaggregated into residential, commercial, industrial, transportation, agriculture, and other sectors. The evidence presented in this proceeding concentrated on electricity usage, and on the residential, commercial, industrial, street and highway lighting, and irrigation sectors. The end-use forecast is only for the residential sector. Exh. S-30, Fang, Schs. 1F, 5F.

The DOE forecast identifies the contribution of major customer classes to total demand.

c. Explanation of How Factors Affect Demand

(1) Population, Employment Levels, Personal Income, and Energy Prices

These factors are input assumptions in the econometric forecast. Population is also a data input to the housing stock submodel of the end-use residential forecast. Exh. S-30, Nadal, p. 5, Fang, p. 7.

(2) Effects of Conservation and Alternative Energy Programs

The econometric forecast does not explicitly consider conservation or alternative energy programs. The end-use residential forecast projects that thermal insulation retrofitting, higher insulation standards for new houses, and greater appliance efficiency will reduce consumption of electricity. It also assumes solar installations will assist in heating space and water. Exh. S-30, Timm, p. 9, Nadal p. 33 et seq.

d. Conclusions

The DOE forecast identifies the contribution of major customer classes and explains how assumptions about the factors listed in General Standard 345-75-025(1)(a)(B) affect total demand.

8. Northwest Energy Policy Project

a. Forecast Description

The NEPP basic forecast uses the econometric approach generally, but also utilizes other techniques, particularly end-use analysis in the residential sector. Alternative

assumptions about the future are made and three scenarios listed: low, moderate, and high growth. The forecast is for the states of Washington, Oregon, and Idaho. When the totals for each of the three states are summed, the forecast is for the PNW. In July, 1978, and again in September, 1978, the NEPP moderate growth scenario forecast was adjusted and updated. The revisions resulted in a small increase in the forecasted rate of growth of electricity demand, from 2.93 percent per year to 2.94 percent per year for the PNW. The historical period used in the forecast is 1964 through 1974, and the forecast extends from 1974 to 2000. Exh. C-1, pp. v, viii, xv, xvi, Table V-18; Exh. C-3; Exh. C-4.

b. Identification of Major Customer Classes

The basic NEPP forecast is for electricity and other energy forms, and includes the transportation sector. Pertinent to this proceeding, customer classes are disaggregated into residential, commercial, industrial, and irrigation sectors. The contribution of each sector to total demand is separately listed. The forecast projects residential usage to increase at an average rate of 4.2 percent per year, commercial usage to increase at an average rate of 2.15 percent per year, industrial usage to increase at an average rate of 2.38 percent per year, and irrigation usage to decrease at an average rate of 1.01 percent per year. Exh. C-1, pp. v, 17, 20-27; Exh. C-4, Table 2.

c. Explanation of How Factors Affect Demand

(1) Population

Population levels are the basis for projections of the number of households in the PNW. An increase in population causes an increase in demand for energy. Alternative projections concerning future population levels, along with alternative projections about other variables, are what differentiate the low, moderate, and high growth scenarios. Exh. C-1, pp. vii, 32; Exh. C-3, p. 1.

(2) Personal Income, Employment Levels, and Energy Prices

Per capita income is a variable in the demand forecasts for the residential, commercial, and industrial sectors. Alternative income projections are made for the low, medium, and high growth scenarios. Employment levels for each scenario were supplied by BPA and are used as variables in the commercial and industrial sector forecasts. In the residential sector, electricity and natural gas prices are variables in the forecasts of appliance and residual electricity consumption. In the commercial and industrial sectors, electricity, natural gas, oil, and coal prices are variables used

to forecast demand for electricity. Exh. C-1, pp. 36-41, 46-48, 60-61, 64, 69-70, 100-104; Tr. 7131.

(3) Conservation

The majority view of the NEPP experts is that natural adoption of conservation measures will cause 12 percent less electricity to be consumed in the year 2000 than would otherwise be consumed, assuming the moderate growth scenario materializes. The primary causal factor is the response to increases in energy prices. Also, conservation activities in the past are reflected in historical data, and the forecast projects the historical conservation trend to continue. NEPP also projects increased efficiency over the forecast period of 0.4 percent by the four major home appliances included in its residential forecast. Tr. 6929-6943.

(4) Effects of Alternative Energy Programs

The NEPP assumes that alternative energy programs will not contribute to meeting demand during the forecast period. But if they do contribute, the contribution will occur near the end of the forecast period. Tr. 6944 et seq., 7115-16.

d. Conclusions

The NEPP forecast identifies the contribution of major customer classes to total demand and explains how total demand results from assumptions made concerning the various factors specified in General Standard 345-75-025(1)(a)(B).

9. Mr. McHugh

Mr. McHugh, Vice President of Applied Economic Associates, Inc., updated the data base for the NEPP forecast to include actual 1976 data and removed the consumption of the aluminum industry from the data base and the forecast. His evisions to the NEPP moderate and high growth forecasts for Oregon increase growth rates slightly. Going a step further, Mr. McHugh updated and re-estimated the NEPP model equations for the commercial and industrial sectors. The forecast growth rates for Oregon then become 3.98 percent per year, moderate growth scenario, and 5.66 percent per year, high growth scenario. The corresponding growth rates for Washington are 4.09 percent and 5.88 percent per year. Exh. A-43, pp. 4-6; Exh. C-1, p. 120; Exh. C-4, p. 1.

The forecast presented by Mr. McHugh is an updated and revised version of the NEPP forecast. The analysis of whether the NEPP forecast meets the requirements of General Standard 345-75-025(1)(a) also applies to Mr. McHugh's forecast.

10. Summary

The forecasts of PGE, PP&L, Puget, PNGC, the DOE, the NEPP, Mr. McHugh, and the PUC all identify the contribution of major customer classes and explain how the forecasted demand results from assumptions made regarding the factors listed in General Standard 345-75-025(1)(a)(B).

C. Forecasted Rates of Growth

1. Applicant Forecasts

PGE - PGE's official forecast is that its energy loads will grow 4.5 percent per year between 1976 and 1982, 5 percent between 1982 and 1997, and 4.9 percent for the entire 1976 through 1997 forecast period. By customer sector, the annual growth rates for the 1976 through 1997 forecast period are: residential, 2.3 percent; Schedule 89, 7.1 percent; non-residential excluding Schedule 89, 5.8 percent. PGE's econometric forecast projects rates of growth at various confidence intervals. With 80 percent confidence, it forecasts the yearly growth rate in electricity sales will be between 3.2 percent and 6 percent, with a mean rate of 5 percent. The PGE econometric single point forecast is 4.3 percent. SCA App. C.1, PGE, pp. xvii-xviii.

PP&L - Energy sales to customers are expected to increase an average of 5.7 percent per year during the 1978-1998 forecast period. In the Oregon/Washington/California segment of its service territory (which accounts for over three fourths of its total sales) the expected growth rate is 5.2 percent. By company-wide customer sectors the forecasted annual growth rates are: residential, 5.1 percent; commercial, 6.6 percent; industrial, 5.6 percent. SCA App. C.1, PP&L, p. IV-1 and App. B, p. 73.

Puget - Puget's official forecast is for an average annual growth in energy sales between 1976-77 and 1996-97 of 5 percent. Between 1976-77 and 1986-87 the forecasted annual growth rate is 5.3 percent; the growth rate then drops to 4.8 percent for the last decade of the forecast period. By customer sectors, between 1978 and 1992, the forecasted annual growth rates are: residential, 4.3 percent; commercial, 6.6 percent; industrial, 5.2 percent. Puget's econometric forecast projects a range of possible annual growth rates between 1977 and 1997 of 3.5 percent to 6.3 percent. The base case econometric forecast is 5 percent growth per year. SCA App. C.1, Puget, p. 3 and Tables 3 and 11 (Tables 3 and 11 are also referred to as Exhs. 3 and 11, and are found at the back of the Puget Sec. of App. C.1).

PNGC - PNGC forecasts that the energy loads of its members will grow an average of 10.8 percent per year between 1976 and 1981, and slow to an average growth rate of 7 percent between 1981 and 1995. The annual average rate of

growth for the 1976 through 1995 forecast period is not stated in the record, but it can be determined from the megawatt hour data in the record. The forecast period annual growth rate is 7.9 percent. SCA 5-12; SCA App. C.1, PNGC, Table 1a.

NERA - Dr. Kent Anderson's NERA forecast presents a range of average annual growth rates between 1976 and 1991 of 3.99 percent to 5.66 percent per year. The midpoint is 4.82 percent per year. SCA App. C.1, NERA, App. B, Table S-1 on p. 12.

Applicant Composite - The composite forecast for average annual growth in energy loads of applicant's customers is 5.4 percent per year between 1975-76 and 1989-90. SCA 5-14.

2. Other Forecasts

DOE - The DOE forecasts an average energy load growth in Oregon between 1977 and 1997 of 2.6 percent. By customer sectors, the forecasted growth rates are: residential, 1.8 percent; commercial, 3.3 percent; industrial, 2.9 percent.[6] Exh. S-38.

NEPP - For the PNW, the original NEPP forecast projected yearly electricity consumption to grow 1.43 percent low growth scenario, 2.93 percent moderate growth scenario, and 4.38 percent high growth scenario. The forecast is for the period 1974-2000. The rates of growth for each state individually deviate very little from the overall rate for the PNW. The moderate growth forecast was updated in July and September, 1978, but the forecasted rates of growth changed very little. The main effect was to move some of the growth to earlier in the forecast period, thereby necessitating energy facility construction earlier. By major customer sector, the moderate growth scenario forecasted rates of yearly growth for the PNW are: residential, 3.9 percent; commercial, 2.18 percent; industrial, 2.65 percent. Exh. C-1, pp. 133-159.

McHugh - After revising the NEPP electricity forecast, Mr. McHugh projects, for Oregon, an annual energy growth rate of 3.98 percent under the moderate growth scenario and 5.66 percent under the high growth scenario. For Washington, the corresponding growth rates are 4.09 percent and 5.83 percent per year. Exh. A-43, pp. 5-6.

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[6] In Schedule 13F to Exhibit S-30 commercial growth is listed as 3 percent, and industrial growth is listed as 2.6 percent. The DOE later changed its forecast, but did not revise Schedule 13F. The revised growth rates for those two sectors are not in the record. However, Schedule 53F in Exhibit S-35 lists the expected megawatt hours of consumption for 1977 and 1997. By working with those numbers, the average annual rate of growth was calculated.

PUC - For the 1977-97 period, the PUC forecasts that PGE's commercial and industrial loads will increase an average of 4.8 percent per year. The corresponding growth rate for PP&L's Oregon commercial and industrial loads is 3.7 percent. Together the average annual growth rate is 4.3 percent. Exh. I-41, pp. 4-5; Exh. I-42, p. 24.

D. Matching Forecasted Demand to Resources

1. Applicant's Matching of Loads and Resources

Assuming critical water conditions, applicant anticipates that it will be 1,386 average megawatts deficient in energy in 1985-86, and 845 average megawatts deficient the next year. (Skagit Unit 1 is scheduled to start producing electricity in 1986-87.) That calculation does not include the 600 megawatts applicant can obtain, on a short-term emergency basis, from its oil-fired units such as Beaver, Harborton, and Bethel. Because the expected deficiencies are greater than 600 average megawatts, even using the oil-fired units to obtain the full 500 megawatts will not prevent a deficiency before the earliest possible date for Pebble Springs Unit 1 - 1987. Assuming that Pebble Springs Unit 1 starts producing electricity in 1987 and Unit 2 starts producing electricity in 1989, applicant's loads/resources matching produces a deficiency of 560 average megawatts in 1987-88, and fluctuates between a deficiency of 230 to a surplus of 137 average megawatts through 1995-96. Excluding the oil-fired generation, applicant is deficient in peak capacity most years between 1985-86 and 1995-96. The largest peak deficiency is 966 megawatts in 1985-86, and the largest peak deficiency after the Pebble Springs Project starts producing electricity is 568 megawatts in 1992-93. If the Pebble Springs Units are not built, applicant will be substantially energy and peak capacity deficient during any critical water year between 1986 and 1996. Applicant's matching of loads and resources is for the combined systems of the four co-owners of the Pebble Springs Project. SCA Tables 5-3, 5-3a.

In summary, applicant projects an energy deficiency, beyond the ability of its own resources, as early as 1985-86, if critical water conditions occur then.[7]

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[7] In matching expected demand to generating resources, an important assumption is the amount of hydrogeneration that will be available. Hydrogeneration, in turn, is dependent on the level of streamflows. To assume a critical water period is to assume very adverse streamflows. Applicant, the DOE, the PUC, the NEPP, and Mr. McHugh all assume a critical water period. The critical period is defined in the PNW Coordination Agreement, included as Sch. 3 in Exh. S-43.

2. NEPP Matching of Loads and Resources

The NEPP matching of forecasted demand with resources, after the September, 1978, revisions, and assuming the moderate growth scenario materializes, projects a demand for the output from Pebble Springs Unit 1 during the 1986-90 time period, and a demand for the output from Pebble Springs Unit 2 during the 1991-95 time period. The loads/resources matching is for the PNW. The matching assumes the construction of three 500 megawatt plants to serve Idaho's needs, but those plants are not currently scheduled for construction. Exh. C-4, Table 3; Tr. 6896-99.

3. McHugh Matching of Loads and Resources

Assuming the moderate growth scenario materializes, Mr. McHugh's revisions to the NEPP forecast show a demand for the output from both Pebble Springs Units during the 1986-90 time period. If the high growth scenario comes to pass, the demand date for Pebble Springs Unit 1 moves up to the 1981-85 time period, and the demand date for Unit 2 remains in the 1986-90 time period. Exh. A-44, Table WMM-2 (Installation Interval).

4. PUC Matching of Loads and Resources

PUC Witness Colburn originally suggested that the output from Pebble Springs Unit 1 would be demanded in 1990, and from Unit 2 in 1992. Due to delays in expected, new generating resources, and a reduction in the extent of participation in a proposed generating resource, as well as other factors, Mr. Colburn revised his on-line recommendation to 1987 for Unit 1 and 1991 for Unit 2. The PUC recommends flexibility in setting the operating dates so the Siting Council can change the on-line dates if future events show a need to change them. Exh. I-57, Original Colburn Testimony, p. 2, Second Supplemental Colburn Testimony, p. 1.

5. Energy Conservation Coalition Matching of Loads and Resources

The ECC did not sponsor a forecast of expected growth rates for applicant's electricity loads. It did, however, through its witness Mr. Robert Murray, match future loads and resources using the NEPP moderate growth scenario. Mr. Murray calculated a sales figure for the 1973-74 base year, then increased that number by 2.93 percent per year throughout the forecast period. The 2.93 percent was the forecasted growth rate of electricity demand projected by the original NEPP forecast for the PNW. Mr. Murray's matching of loads and resources indicated no need for the Pebble Springs Project in this century. Exh. I-34, pp. 11-14.

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The NEPP moderate growth forecast was later updated and revised. The forecast changed very little, but greater growth occurs earlier in the forecast period, causing the demand date for the Pebble Springs Facility to advance. Also, delays and imposed loss of participation have been encountered with planned resources. The record does not show what Mr. Murray's matching of loads and resources would reveal if more current information were used.

6. DOE Matching of Loads and Resources

During the hearing, the DOE prepared alternative scenarios, meeting load growth with nuclear-fueled plants in one scenario and meeting load growth with coal-fueled plants in the other scenario. The analysis is for the West Group Area. Under the nuclear scenario, the DOE found a demand for three nuclear plants. The second Plant is Pebble Springs Unit 1, with a demand date of 1995-96. The first and third nuclear plants are Skagit Units 1 and 2 with demand dates of 1993-94 and 1996-97. Under the coal scenario, a series of six plants would be constructed between 1993-94 and 1996-97. Exh. S-43; Exh. S-46, Sch. 12HN (Revised 11-4-78).[8]

The DOE matching of loads and resources, as presented on the record, assumes 4,000 megawatts of electricity could be purchased in an emergency from outside the region (but no more than 1,000 average megawatts in one year), over 900 megawatts could be obtained by curtailing service to BPA interruptible customers, and 250 megawatts could be counted on owing to voluntary reduction in the amount of electricity demanded. Exh. S-43, pp. 44-47; Exh. S-44, p. 2; Exh. S-46, Sch. 7N1 (Revised 11-4-78).

In its opening brief on demand issues, the DOE presents other alternative demand dates for consideration. It utilizes its Oregon forecast and the NEPP moderate growth forecast in presenting one alternative. The DOE converts the two forecasts, which encompass the three states of the PNW, to cover the West Group Area. The DOE assumes the same generating resources as applicant, and West Group planning assumptions are used for plant availability. It finds an on-line date for Pebble Springs Unit 1 of 1994-95. Unit 2 is not demanded through 1996-97. DOE Opening Brief, Demand, pp. 91-93.

In its opening brief on demand issues, the DOE also matches loads and resources for the combined service territory

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[8] Schedules 7N1, 12HN, 13H, 14N1, 14N2, and 15H, attached to Exh. S-43, were revised in Exh. S-44, and are referred to as Schedule _____ (Revised). All but Schedule 13H were further revised in Exh. S-46 and are referred to as Schedule _____ (Revised 11-4-78).

applicant serves. The DOE presents a two-company adjustment case and a four-company case. In the former, adjustments are made to the forecasts of PGE and PP&L only, while in the latter case, adjustments are made in the forecasts of all four project sponsors. In both cases, the adjusted combined loads are compared with combined resources and 600 average megawatts are assumed available from combustion-turbine plants. The four-company adjustment case shows a demand for the output from Pebble Springs Unit 1 in 1989-90, and for the output from Unit 2 in 1993-94. The corresponding demand dates for the two-company adjustment case are 1988-89 and 1991-92. DOE Opening Brief, Demand, pp. 13, 16, 17.

7. Uncertainties

There are, of course, many uncertainties in predicting future events. Uncertainty surrounds other generating resources applicant is counting on. Expected on-line dates for two nuclear power plants in Washington, Skagit Units 1 and 2, have slipped four years, and neither plant has the required licenses and permits. Applicant also relies on the output from two planned coal plants in Montana, Colstrip Units 3 and 4. The probable on-line dates for those units have already slipped five years, and PGE was required to relinquish half of its interest in them before a Montana state license could be obtained for the project. Also, siting of those coal units is prevented unless judicial reversal is obtained of denial by the Environmental Protection Agency of an Environmental Quality Permit and a state court decision striking down state site certification. Further delays in the Skagit and Colstrip Projects are expected. SCA Table 5-3A; SCA App. D. 1, Table D. 1-1; Tr. 7820, 8237, 8256, 11013, 11631; Exh. A-59, p. 3.

Predicting future demand for electricity also is fraught with uncertainties. Future electricity consumption is dependent on many factors. Predicting how those factors will behave is done with all the skill possible, but still without a great deal of confidence. While each forecaster seems to think the forecast he sponsors is the best available, none expresses much confidence that his forecast will turn out to be exactly correct. Myron Katz reflected that attitude when he testified that all forecasts are primitive and poor, but the NEPP forecast is as good as, if not better than, the others. Tr. 6932-33.

E. Analysis of Demand Rates

Applicant, the PUC, NEPP, and Mr. McHugh all find there will be a demand for the electricity to be produced by Pebble Springs Unit 1 by the middle or late 1980's. The earliest date Unit 1 can be built is 1987, coinciding with the demand dates found by the PUC, NEPP, and Mr. McHugh. The DOE sees it differently, however, and presented evidence that the energy from

Unit 1 will not be demanded until 1995-96. It is necessary, therefore, to choose between the DOE matching of loads and resources and the matching by the applicant, the PUC, NEPP, and Mr. McHugh.

The much later DOE demand date is not entirely due to a lower forecast. The NEPP moderate growth forecast projects electricity demand to grow 3 percent per year in Oregon, while the DOE projects the rate to be 2.6 percent. The DOE then uses the NEPP moderate growth forecast for Washington and Idaho as the basis of its matching of loads and resources. The NEPP finds a demand date for Unit 1 of 1986-90, but the DOE finds the demand date to be 1995-96. The two forecasts are not different enough to explain the significant difference in demand dates.

It is not very clear why the DOE demand dates are significantly later than the other demand dates, but several identifiable factors contribute to the difference. The factors either make more resources available to applicant or assume a lower demand under certain circumstances. Several factors will now be discussed individually.

Beyond the resources applicant estimates will be available to it, the DOE assumes electricity can be purchased from outside the region. The DOE assumes 4,000 megawatts of capacity can be purchased in emergencies. The DOE limits the use to no more than 1,000 average megawatts during one year. Four thousand megawatts is a lot of capacity, but the DOE says it is not as big an item in the determination of demand dates as it may appear. The DOE says that its computer run did not call on outside purchases very much. Exh. S-46, Sch. 15H (Revised 11-4-78), Plant No. 41 on p. 1.

It is difficult to determine from the record just what role the 4,000 megawatts plays in the DOE analysis. Originally, the DOE said it was utilizing 3,000 megawatts of capacity. The 3,000 megawatts was later changed to 4,000 megawatts, and it was explained that instead of treating it as another plant, the 4,000 megawatts of capacity would be used only in emergencies. Specifically, it would be used only after all other resources had been called into full service. Exh. S-43, p. 44; Exh. S-44, p. 2.

The DOE does not contend that applicant has firm contracts to purchase 4,000 megawatts of capacity. Rather, it assumes that much electricity will be available from outside the region in emergencies. It is reasonable to assume some electricity could be purchased in many emergencies. But to build a system that relies on obtaining a substantial amount of electricity from outside the region is risky. If other companies were willing to commit themselves to that obligation,

they would be willing to sign firm contracts. Whether the 4,000 megawatts of capacity are assumed to be additional plants, or available only after all other resources are in use, they still provide additional capacity when needed most. The additional capacity helps explain the DOE's later demand dates.

General Standard 345-75-025(1)(a) requires a finding that there will be "a demand" for the output from the proposed plants. Relying on purchases from outside the region is an implicit statement that demand will exist for the output from the proposed plants, but will be met by some other means. If applicant proposes to meet that demand from its own resources, it has shown there is "a demand" for the output from the proposed facility.

A second additional resource the DOE counts is the interruptible service provided to direct-service customers by BPA. The DOE assumes service to those customers will be interrupted by BPA and the electricity provided to applicant instead. An additional 912 average megawatts is assumed available to applicant. Exh. S-46, Sch. 15H (Revised 11-4-78), Plant No. 39 on p. 1.

The DOE points out that customers on interruptible service pay less because their service is subject to being interrupted. Additional generating resources should not be constructed to meet their needs unless they are charged for it. That is an appealing argument. However, the record does not show that the BPA direct-service interruptible customers would have their service curtailed and the service transferred to applicant. No showing was made that applicant has authority to compel that result, or that BPA would do it. Service to those customers may be curtailed, but not to provide needed electricity to applicant. For example, service to them may be curtailed when stream flows are very low, but the service curtailed would not be transferred to applicant. Exh. S-43, p. 46.

The standard at issue here requires proof of "a demand" for the output from the proposed facility. Even if that demand is by customers taking interruptible service, it is "a demand." It is consistent with the standard to include demand by interruptible customers. The DOE's addition of 912 average megawatts to applicant's resources helps explain its divergence from the results of loads/resources matching by other parties.

A third difference between the loads/resource matching of the DOE and other parties is the DOE assumption concerning voluntary curtailment. During low water years, the DOE assumes appeals to the general public will reduce demand by 250 average megawatts. The DOE urges caution in estimating future voluntary

curtailment because long-term conservation programs and responses to higher prices will make additional voluntary consumption reductions more difficult. Exh. S-43, pp. 42, 45.

Applicant argues that voluntary curtailment due to a shortage of electricity is still a demand for the output from the proposed facility and to treat it as a resource conflicts with the standard. The DOE responds that during low water years appeals for conservation are made and voluntary curtailment does occur; therefore, adding the amount of the curtailment to the resource base is merely a reflection of reality. Applicant's Opening Brief, Demand, p. 40; DOE Reply Brief, p. 8.

Applicant and the DOE both are correct when considered from the perspective each is arguing from. That is, if the curtailment is due to a shortage of electricity, it is a demand. And if appeals and resulting curtailment are a naturally-occurring part of low water years, taking account of the curtailment is merely reflecting reality and not in conflict with the standard.

Whether curtailment is an integral part of a low water year or not, the underlying assumption is a lack of electricity. There would be no particular reason to make special appeals to conserve electricity during low water years unless the lack of water caused a shortage of electricity. The 250 average megawatts can legitimately be considered to be "a demand."

A fourth difference between the loads/resources matching of the DOE and applicant, the PUC, the NEPP, and Mr. McHugh is the amount of electricity to be expected from coal- and oil-fueled generating units. The DOE assumes coal units will be available between 81 and 85 percent of the time. Applicant states that during 1977, when it was generating every possible kilowatt of electricity, its coal plants operated approximately 70 percent of the time. Applicant and the DOE are not talking about the same thing. The DOE assumes the plants will be available 100 percent of the time, less a forced outage rate and time for maintenance. Applicant is talking about actual output data during an historical period. The record does not clearly show which figure should be used in predicting future output. Exh. S-46, Sch. 7N1 (Revised 11-4-78); Exh. A-59, p. 7; Tr. 10,507.

A similar argument prevails concerning the use of oil-fired combustion turbine units. The DOE assumes the units will be available 92 to 93 percent of the time, while applicant expects them to produce electricity between 60 and 65 percent of the time during a critical period. It is uncertain how much applicant should rely on oil-fired generation to meet future demand for electricity. PGE has an air contaminant discharge permit allowing it to operate Bethel, a combustion unit, no

more than 750 hours (out of a possible 17,520) during a two-year period. PGE does not currently have an air contaminant discharge permit to operate another of its oil-fired units, Harborton. Puget's oil-fired combustion turbine, Shuffleton, is nearly 50 years old. Tr. 7838-40, 10557, 10561, 8201.

The factors just discussed may not explain the entire difference between the loads/resources matching of applicant, the PUC, the NEPP, and Mr. McHugh, on the one hand, which indicate a demand for the output from Pebble Springs Unit 1 either before or at the earliest date it could be constructed, and the DOE matching, on the other hand, which does not find a demand until 1995-96. But the factors together have a large enough impact to provide a basis on which to choose between the loads/resources matchings. From the comments made in the discussion of the factors, it is obvious that the matching done by applicant, the PUC, the NEPP, and Mr. McHugh is preferred. They allow applicant to rely to a greater extent on its own combined resources to meet demands placed on it; they take a more realistic view of energy likely to be produced by generating resources; and they take a more realistic view of operating constraints prevailing, and likely to prevail, in the region.

Focusing attention on proposed Pebble Springs Unit 2, applicant proposes to have it on-line in 1989, the NEPP projects a demand for its output between 1991-95 (using the moderate growth scenario), Mr. McHugh finds the demand in the 1986-90 time period (also using the moderate growth scenario), and the PUC finds the demand in 1991. The difference of opinion is basically between 1989 and 1991, not a significant difference.

Uncertainty in the availability of other generating facilities applicant relies on, and uncertainty in the accuracy of demand forecasts makes it inadvisable to select a demand date for Unit 2 narrower than the period between 1989 and 1991. If a site certificate issues, Unit 2 may be constructed to start producing electricity in 1989, subject to the Council's authority to alter that date between the time the certificate issues and the time construction starts. The Council will do that only if sufficient cause to reopen the hearing on the demand date for Unit 2 is presented to the Council to convince it to reopen, and after evidence on the matter is presented, the Council is convinced the date should be changed. The flexibility this option allows is intended to provide an opportunity to present significant new evidence, not reargue evidence already submitted.

The preferred matchings of loads and resources produce similar demand dates for the proposed plants. Those dates are reasonable and are accepted. It, therefore, is unnecessary to make individual decisions about various factors influencing

future demand, e.g., rates of growth of population and energy prices. It also is unnecessary to decide how the costs of overbuilding or underbuilding the system should influence the demand dates.

III. ECONOMIC PRUDENCE

A. Introduction

General Standard 345-75-025(1)(b) and Specific Standards 345-76-025, 345-76-026, and 345-76-027 establish criteria by which to judge the economic prudence of a proposed energy facility and any alternatives to it. The standards require the presentation of a detailed cost analysis and consideration of alternatives to the proposed facility. In this section of the proposed order, the evidence will be scrutinized to determine if the filing requirements of the standards have been met. Then, if that preliminary requirement is met, the positions of the parties on the merits will be examined and the economic prudence of the proposed plants and possible alternatives will be determined.

B. General Standard 345-75-025(1)(b)

General Standard 345-75-025(1) divides need for the proposed facility into two parts - demand for the energy to be supplied by the facility, and the facility's economic prudence. Subsection (b) pertains to economic prudence and requires the Council to find that:

> The proposed facility is a prudent method of meeting all or a part of the demand from an economic cost standpoint taking into account the energy supply system of which it will be a part and other alternatives reasonably available to the applicant. For the purposes of this rule, alternatives include but are not limited to conservation and energy production and generation methods or facilities not regulated by the Council.

The standard requires the Council to decide whether the proposed plants are a prudent method of meeting future demand for electricity. The standard does not require the Council to find that the proposed plants are the superior economic choice, only that they represent a wise management decision from an economic point of view. The proposed facility, or a suggested alternative, will not be judged economically prudent if it suffers from a substantial cost disadvantage based on an analysis meeting the requirements of

Specific Standards 345-76-025 through 345-76-027. Order Adopting Standards (General), p. 8.

The general standard also mandates consideration of alternatives reasonably available to applicant. Conservation and methods or facilities not regulated by the Council must be included in assessing the prudence of the proposed facility.

C. Cost Analysis and Calculational Techniques

1. Standards

Economic Prudence--Cost Analysis

345-76-025 In determining whether a proposed thermal energy facility meets the requirements of OAR 345-75-025(1)(b), the Council will require a cost analysis demonstrating the economic prudence of the proposed facility or its alternative. The cost analysis must:

(1) Include an analysis of the load characteristics of the applicant and its co-owners' customers using a monthly load duration curve or weekly load duration curves characteristic of a month and of the impact upon load characteristics of the customers of the applicant and co-owners expected to result from the following factors during the demand forecast period:

(a) Changing end uses of energy,
(b) Load management practices,
(c) Conservation,
(d) Economic and demographic trends, and
(e) Impacts of composite West Group load profiles.

(2) Include a demonstration that the resources of the applicant and co-owners including the proposed facility or an alternative are designed to:

(a) Meet the applicant and co-owners' energy requirements during the critical water periods, as defined in Section 2, Part I., of the Agreement for Co-ordination and Operations Among Power Systems of the Pacific Northwest, Contract No. 14-02-4822; and

(b) Maintain sufficient peak load capacity so that the planned annual loss of load probability for the system on which the applicant and the co-owners contractually rely shall not be greater than the equivalent of one day in 20 years.

The demonstration must address the following variables:

(A) load characteristics including the impact of factors listed in (1) above;

(B) characteristics of existing and proposed generating units, including unit sizes, maintenance schedules, forced outage rates and other operating constraints;

(C) the availability of purchases or exchanges or [sic] power;

(D) possible delays in the proposed facility and other planned generation.

(3) Include incremental production and investment costs attributable to the proposed facility, or alternative, including:

(a) Incremental fuel, operations and maintenance costs over at least the first ten years of the lifetime of the proposed facility with the following items individually addressed:

(A) fixed and variable fuel and operating and maintenance costs of individual generating units;

(B) purchase and sale of power;

(C) availability of hydrogeneration using an historic range of water flow conditions;

(D) standard operating constraints;

(E) estimated transmission losses;

(F) mitigation costs for identifiable social, health, safety, and environmental impacts.

(b) Incremental capital costs as borne by the applicant and co-owners' ratepayers over at least the first ten years of the facility's lifetime, with the following items individually addressed:

(A) the initial capital cost of the facility or alternative, including mitigation costs for identifiable social, health, safety and environmental impacts;

(B) costs of retirement or decommissioning;

(C) capital costs for transmission facilities.

(c) Mitigation costs discussed in (a)(F) and (b)(A) above shall be considered for the applicants and co-owners' system.

Economic Prudence--Calculational Techniques

345-76-026 In determining and assigning economic costs as required in preparing the cost analysis required under rule 345-76-025, the method shall contain:

(1) A calculation of the present worth of costs determined under rule 345-76-025 using the standard method of present worthing;

(2) A weighting of costs determined under rule 345-76-025(3)(a) by the probability of occurrence of historical stream flow conditions; and

(3) A summation of the annual production and capital costs over at least the first ten years of operation.

2. Must the Analysis of Load Characteristics be Included in the Production Cost Analysis?

The DOE argues that the applicant has failed to meet the requirements of this standard because applicant performed its analysis of load characteristics outside the production

cost model used to estimate capital and operating costs. The DOE argues that load characteristics must be included explicitly in the cost analysis to meet Specific Standard 345-76-025. The language of that standard does not mandate it, but the DOE argues that the cost analysis cannot be evaluated adequately without consideration of the shape of the loads. The DOE points to page 3 of the Order Adopting Standards (Specific) to support its position. The first two paragraphs of the comment under Specific Standard 345-76-025(1) state:

> The word "system" is not used here: the word "system" in the hearings officer's report referred to the service area of the applicant and co-owners, rather than the generating system. Therefore, appropriate wording changes were made to reflect an intent that the cost analysis reflect the load characteristics of the customers of the applicant and co-owners.
>
> This wording has been amended to allow the applicant to include weekly load duration curves characteristic of a month, to allow for plant maintenance shutdowns which might distort strict monthly curves.

Subsection (1) of Specific Standard 345-76-025 requires an analysis of load characteristics of applicant's customers. The analysis must address the factors listed in subparts (1)(a) through (1)(e). Subsection (2) requires a showing that the resources of applicant, including the proposed facility or an alternative, are designed to meet the applicant's energy requirements during a critical water period, and that the resources will maintain sufficient peak load capability so that the planned annual loss of load probability for the system on which applicant relies will not be greater than the equivalent of one day in 20 years. The energy and peak load reliability demonstration must address the factors set out in subparts (2)(b)(A) through (D). Subsection (3) requires a comparison of the expected capital and production costs of the proposed facility and its alternative. In the production cost analysis the items set out in subparts (3)(a)(A) through (F) must be addressed, and in the capital cost analysis the items set out in subparts (3)(b)(A) through (C) must be addressed. The capital and production costs must be compared for at least the first ten years of the lifetime of the proposed facility.

The standard does not mandate that the requirements of the three subsections be combined into one production cost model. To find such a requirement, a "production cost model"

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The standard does not mandate that the requirements of the three subsections be combined into one production cost model. To find such a requirement, a "production cost model"

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and "a cost analysis" must be assumed to mean the same thing. But a cost analysis can include a production cost model and other tools of analysis. Also, the comment in the Order Adopting Standards (Specific) referred to by the DOE is referring to a change to accommodate the Council's final decision on a definition of "system" and to allow weekly load duration curves. It is not addressing whether load characteristics must be included in a production cost model.

3. The DOE Cost Analysis

Specific Standard 345-76-025(1) requires that the cost analysis address the impact of items (a) through (e) on load characteristics expected to result from the items during the forecast period. On page 4 of the Order Adopting Standards (Specific), the Council points out that compliance with that section of the standard "will allow the Council to consider changes during the demand forecast period in the load characteristics resulting from anticipated social and economic influences, including the impacts of composite West Group load profiles. It is necessary to have such an analysis in order to determine whether the proposed facility is or will be part of an optimum mix of electrical generation."

On page 30 of Exhibit S-43, the DOE acknowledges that it has not performed the required analysis of the impacts of the factors on future load characteristics. Instead, it assumes historical load shapes will continue into the future.

Specific Standard 345-76-025(2)(b)(D) requires that possible delays in the proposed facility and other planned generation be included in the demonstration of energy and peak resources. On page 48 of Exhibit S-43, the DOE acknowledges that it has not included possible delays in its analysis.

Specific Standards 345-76-025(3)(a) & (b), and 345-76-026(3) direct that the cost analysis of the proposed facility, or an alternative, include production and capital costs for at least the first ten years of the proposed facility's lifetime. On page 70 of Exhibit S-43, the DOE states that the costs associated with the proposed Pebble Springs Facility were considered for only two years.

In each instance of failure to perform the cost analysis as directed by the standards, the DOE advances plausible reasons why another method was chosen. The requirements of the standards are not nullified by arguments setting out the reasons for a party's failure to meet those requirements, no matter how appealing the arguments may be. Perhaps the arguments should have been made in the rule-adoption proceeding. In any event, they cannot be used successfully in lieu of satisfying the standards. If the standards are to have meaning, the evidence must be judged against them.

D. Alternatives

General Standard 345-75-025(1)(b) requires the economic prudence of the proposed facility to be judged in light of alternatives reasonably available to the applicant. The general standard specifically states that conservation is an alternative that must be considered. Specific Standard 345-76-027 amplifies the general standard, and sections (1) and (2) provide:

> (1) An alternative will be considered reasonably available within the terms of General Standards OAR 345-75-025 (1)(b) if suppliers exist who can provide the necessary materials and equipment to enable construction of the alternative facility to be completed, and for the alternative to become operational within that time period allotted for construction and commencement of operation of the applicant's and co-owners' proposed facility, and the alternative can meet all or part of the requirements of the applicant's and co-owners' demand forecast. If the alternative does not involve construction, it will be considered reasonably available if it can be implemented within the time allotted for construction and commencement of operations of the applicant's and co-owners' proposed facility.
>
> (2) The applicant and co-owners shall discuss in detail in the site certificate application the reason for its determination that an alternative is not reasonably available.

The Council elaborates on the language of subsection (2) in the comments in the Order Adopting Standards (General). On page 8 the Council states:

> The standard requires that specific attention be directed to conservation efforts that could be initiated by the applicant over and above those included in measuring demand . . .
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tificate was approved. These alternatives are not the same as those considered in section (1)(a) of the same rule; section (1)(a) considers those alternatives which, based on evidence in the record will be implemented independent of the decision on the proposed plant.

The standard clearly calls for a detailed discussion of conservation efforts that could be taken "in lieu of" the proposed Pebble Springs Facility. What conservation efforts could be undertaken instead of going forward with the Pebble Springs Facility? If applicant decides that the proposed facility is preferable to alternative conservation efforts, the Council requires a detailed discussion for that determination.

Applicant relies on two arguments to satisfy the obligation of subsection (2). First, it repeats the language on page 8 of the Order Adopting Standards (General) and asserts it has "neither the authority nor the ability" to implement nongeneration alternatives. Second, applicant states that it will undertake all conservation measures that are cost-effective for its customers, whether or not the Pebble Springs Facility is completed, so there is nothing left that could be substituted for the Pebble Springs Facility.

What applicant does not discuss is a separate conservation effort undertaken in lieu of the Pebble Springs Facility, without regard to whether the measures are cost-effective. What is lacking is a showing that applicant seriously considered conservation as an alternative to the Pebble Springs Project - beyond its treatment of conservation as a reduction in forecasted demand. The standard and accompanying order adopting the general standards clearly spell out the obligation to discuss conservation as an alternative to the proposed facility, not just as a reduction in the forecasted demand. A detailed discussion of conservation as an alternative is missing.

E. Wind Turbine Generators as an Alternative

FOB presented evidence designed to show that a network of wind turbine generators (WTG) could be used as an alternative to the proposed Pebble Springs Facility. Specific Standard 345-76-027(3) requires a party who desires to present the case for an alternative to the proposed facility to present evidence to establish that the alternative is reasonably available to the applicant, and using analysis meeting the requirements of Specific Standards 345-76-025 and 345-76-026, that the alternative is economically prudent.

In an effort to show the WTG network alternative is economically prudent, FOB arranged with the DOE for the DOE to

perform the economic analysis of the WTG, using the DOE cost production model. FOB supplied the description of the system and the data necessary to characterize it. The DOE performed the analysis using the same program it used for its own economic prudence evidence, and supplied a witness to testify about the details of that analysis. Exh. I-53, p. 1; Tr. 10,827-29.

Since the FOB evidence on the economic prudence of the WTG is just like the DOE evidence on economic prudence, it suffers from the same defects. The analysis the DOE performed for itself fails to meet the requirements of Specific Standards 345-76-025 and 345-76-026; the analysis performed for FOB similarly fails to meet the requirements of those specific standards. In its prepared testimony, FOB refers to the failure to include costs for at least the first ten years of the proposed plant's lifetime and argues against the standard. During the evidentiary phase of this proceeding, the wisdom of the standards will not be addressed; rather, the evidence will be weighed against the requirements of the standards. Exh. I-53, pp. 2-4.

F. Conclusions

The applicant's economic prudence evidence is deficient by failing to discuss in detail in the site certificate application the reason for applicant's determination that conservation is not a reasonably available alternative to the proposed facility. The DOE's economic prudence evidence is deficient by failing to address the impacts expected during the forecast period from the factors listed in Specific Standard 345-76-025(1), by failing to include possible delays of the proposed facility and other planned generation in the analysis, and by failing to include capital and production costs for the first ten years of the proposed facility's lifetime. The FOB economic analysis of the WTG has the same deficiencies as the DOE analysis.

No party performed the economic analysis required by Specific Standards 345-76-025 and 345-76-027. Therefore, the requirements of those standards have not been met. As a result, it is not possible to analyze the proposed facility and any alternatives in the manner mandated by the economic prudence standards.

IV. ABILITY TO FINANCE

A. The Standards

General Standard 345-75-025(9) requires applicant to possess or have reasonable assurance of obtaining the funds necessary to construct, operate, and retire the facility, including fuel cycle costs. By virtue of Council Rule

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345-76-015(3), the general standard is satisfied by proof that the requirements of Specific Standard 345-76-045 have been met. That specific standard is met by proof that:

1. Applicant is capable of providing funds to construct, operate, and retire the facility without violating its bond indenture provisions, articles of incorporation, common stock covenants, or similar agreements;

2. Investor-owned co-owners of the facility have a capitalization ratio of at least 30 percent equity; and

3. A co-owner organized as a cooperative has loan commitments, Rural Electrification loan guarantees, or other sources of funds sufficient to pay its share of the costs, and has contracts for the sale of the output from the proposed facility or has rate adjustment provisions in its members' contracts to provide sufficient revenue to retire the debt incurred to construct, operate, and retire the facility.

B. The Need to Finance

Applicant expects the two nuclear power plants at issue here to cost approximately 3.063 billion dollars to construct and prepare to operate. This is the estimated investment cost, including money costs, in 1985-1986 dollars. Tr. 10,064.

Large expenditures for construction of generating sources are not new to applicant. In the past five years, PGE, PP&L, and Puget have financed almost 2.4 billion dollars of construction projects. This section deals with applicant's ability to finance the proposed Pebble Springs Project. SCA 21-5, 21-7, 21-10.

C. The Investor-owned Co-owners

Investor-owned co-owners rely primarily on sales of stock, borrowing of money, and internally generated money to provide the funds necessary to construct facilities to generate electricity. Revenue from sales of electricity is used to pay the costs of selling stock and borrowing money, and to pay the expenses of operating the plants.

When construction funds are needed, the investor-owned co-owners review their capital structures, money market conditions, and any limitations on the sale of stock or issuance of debt instruments. To issue additional secured debt instruments,

earnings before taxes must be at least two times interest charges, including the interest to be incurred by the prospective issuance. Also, bonds can be issued for no more than 60 percent of the value of the property provided as security. Preferred stock can be issued only when income at least equals one-and-one-half times interest charges and annual preferred stock dividend requirements. There are no specific limitations on selling common stock, but utility companies prefer not to allow the proportion of common stock to total capitalization to get too low or to sell common stock when the market price is below book value. SCA 21-5, 21-8, 21-10, 21-11, and App. G.

The various sources of additional funds provide utility companies with considerable flexibility. If the coverage ratio for preferred stock is unacceptably low (as it is for PGE and Puget at the present time), debt instruments and common stock can be issued. Of course, short-term credit arrangements also are routinely used. SCA 21-6, 21-9, 21-11.

The determining factors in coverage ratios, ability to finance future construction projects, and in fact the very viability of the utility companies, are the prices at which they sell electricity. And electricity prices are set by state and federal regulators. The regulators are, in turn, constrained by statutes and judicial decisions, the most notable judicial decision being Federal Power Commission v. Hope Natural Gas Company, 320 U.S. 591 (1944). In that decision, the United States Supreme Court held that utility companies must be allowed to charge rates sufficient to maintain the financial integrity of the companies and to attract capital. Regulators do not have to utilize any particular method in establishing fair and equitable rates, but they must not set rates so low as to constitute a confiscation of a utility's assets.

Applicant points out that the investor-owned co-owners have undertaken major construction projects in the past, and the regulators have allowed them rates sufficient to successfully complete them. There is no reason to believe the regulators will change their habits and deny adequate rates, but if that were to occur, a co-owner could seek judicial relief. SCA 21-1, 21-2.

The specific standard requires investor-owned co-owners of the proposed facility to maintain capitalization of at least 30 percent equity. That should not pose a problem. PGE's target equity capitalization is 50 percent, and its equity capitalization will range between 45.6 percent and 53.9 percent between 1978 and 1989. PP&L's equity capitalization has been at least 42 percent of the total in recent years, and its target equity capitalization is 46 percent. The actual ratio will remain near the target between now and 1989. Puget has maintained an equity capitalization in recent years

around 44 percent, and has a target of 47.4 percent. It will maintain an equity capitalization between 45 percent and 49 percent through 1989. SCA [illegible] through 21-12.

Included in the usual process the Oregon Public Utility Commissioner utilizes in deciding what rates are fair and equitable for regulated utility companies is a determination of an earnings base. The earnings base is multiplied by the cost of capital to find the net operating income. As a general rule, only currently operating facilities are included in the earnings base, but exceptions have been made. By the passage of Ballot Measure 9 in the November, 1978, General Election, Oregon voters told the Commissioner not to include in the earnings base property not presently used for providing utility service. If the Pebble Springs Plants are constructed, the Commissioner will not have the option of including part or all of the plants in the earnings base until each plant is declared operational. Therefore, investors will have to bear the full cost of construction throughout the construction period. The ballot measure affects PGE, since PGE serves only in Oregon; the ballot measure affects PP&L's operations in Oregon; Puget is not directly affected by the ballot measure, and PNGC is not regulated by the Commissioner. The measure may make the cost of financing the Pebble Springs Project more expensive. It will increase the over-all cost of the project. Construction projects which are capital intensive, which have long lead times, or which are beset with significant uncertainty will be affected the most. However, the ability of applicant to finance the Pebble Springs Project should not be significantly affected. The measure does not change the obligation of the PUC to allow a utility to earn a fair rate of return, when compared to other businesses. The Hope decision held that it is the result reached, not the method employed, which is important. Tr. 11,327-33.

Various entities rate the risk of bonds issued by corporations. Two widely-used rating companies are Standard and Poor's Corp., and Moody's Investors Service, Inc. In its rating of public offerings of debt instruments in effect at the time of taking testimony in this proceeding, Moody's gave all three investor-owned co-owners a Baa rating. Standard and Poor's gave Puget and PP&L a Bbb and PGE a Bbb- in its rating of applicant's bonds. All are considered medium-grade ratings. Standard and Poor's considers PGE's bonds to be borderline between medium-grade obligations and obligations with speculative elements. PGE, PP&L, and Puget have been financing projects in recent years with similar ratings and should be able to continue to do so. Tr. 11,381-86

D. Co-owner Organized as Cooperative

PNGC plans to borrow from the Rural Electrification

Administration (REA) for its share of the Pebble Springs construction costs. PNGC has started the process of applying for a loan guarantee, but does not have the guarantee now. Before REA approval can be obtained, an environmental impact statement, contractual arrangements between PNGC and PGE, and a power cost study all must be approved. Then, the REA says, it will be in position to make a loan guarantee, but will not disburse funds until all permits, licenses, and approvals have been obtained. SCA 21-3; SCA App. G, PNGC, Exhs. 2, 3; Tr. 11,318-20, 11,476-80.

Specific Standard 345-76-045(3)(a) also requires a co-owner which is a cooperative to have contracts for the sale of the output from the proposed facility, or have rate adjustment provisions in its members' contracts to provide sufficient revenue to retire the debt incurred in constructing, operating, and retiring the plant. PNGC has apparently elected to meet the first option because it says it has negotiated, or is in the process of negotiating, wholesale power contracts with its members for all of PNGC's share of the output from the Pebble Springs Facility. But the standard says the cooperative must have the contracts, not just be in the process of negotiating them. SCA 21-17.

E. Decommissioning

Decommissioning the plants will cost five percent of total project costs, according to the investor-owned owners. Their computation of costs of the proposed facilities include a net salvage value of minus five percent. They will recover that amount by setting depreciation rates at 105 percent of construction costs. That is the method currently used for the Trojan Nuclear Plant, and five percent is the industry average. PNGC says it will establish a reserve account to cover its share of retirement costs. Retirement costs are legitimate expenses of nuclear power plants, and the plans presented by applicant to fund that expense are accepted as reasonable. SCA 21-18; Tr. 11,433-76.

Applicant has not committed itself to a specific plan for decommissioning the plants. One possibility is to mothball the plants for 100 years after operation ceases, then dismantle. An applicant witness suggested that when plant operation ceases, applicant be required to establish a fund sufficient to dismantle. The fund would be maintained until dismantling started. If a site certificate issues, such a condition should be included in the site certificate agreement. Tr. 11,458-59.

F. Conclusions

PNGC does not have the required loan guarantee, nor does it have sales contracts for its share of the output from

the proposed plants. It has not met the requirements of Specific Standard 345-76-045(3). PGE, PP&L, and Puget have shown that they have the ability to finance their shares of the proposed facility. Applicant has shown compliance with subsections (1) and (2), but not (3), of Specific Standard 345-76-045.

V. ABILITY TO CONSTRUCT, OPERATE, AND RETIRE

A. The Standards

General Standard 345-75-025(8) requires the applicant to prove it has the organizational, managerial, and technical expertise to construct, operate, and retire the proposed facility. By virtue of Council Rule 345-76-015(3), General Standard 345-75-025(8) is satisfied by proof of compliance with Specific Standard 345-76-040. This section discusses the six subsections of Specific Standard 345-76-040.

B. Employment of Architect-Engineer

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

> (1) In those instances where the applicant has not previously designed and constructed a nuclear facility, demonstrate to the Council that it will employ an architect-engineer that has design and construction experience with a similar facility to design and construct the proposed facility.

The Trojan Nuclear Power Plant, near Rainier, Oregon, is a similar facility. PGE operates Trojan and owns 67.5 percent of it. PP&L owns 2.5 percent. PGE had the overall responsibility to design and construct Trojan. Applicant has selected Bechtel Power Corporation (Bechtel) as the architect-engineer for the Pebble Springs Project. Bechtel has experience in the design and construction of nuclear facilities, including the Trojan Plant. SCA 22-3.

Applicant has shown compliance with subsection (1) by proof of PGE's design and construction experience, and by demonstrating that it will employ an architect-engineer with design and construction experience with a similar facility.

C. Deviations

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

(2) Demonstrate that it will establish and implement a formal procedure that will document deviations from normal written operating procedure and classify those deviations as procedural, design, or personnel related, and that will require corrective action to be identified and reviewed by appropriate off-site engineering and management personnel.

PGE, scheduled to be the operator at the proposed Pebble Springs Facility, has a deviations procedure at Trojan set out in Administrative Order AO-4-2. Deviations are defined as preplanned but temporary changes or deviations from written procedures. PGE plans to institute a similar procedure at the Pebble Springs Facility, modifying it to classify deviations as procedural, design, or personnel-related, and to include unintentional departures. Deviations will be reviewed by the Plant Review Board and the Nuclear Operations Board (NOB). SCA 22-9; Exh. A-34, p. 3; Tr. 1867-68, 1876-77, 6698-6700.

The Plant Review Board is on-site at Trojan and consists of the plant superintendent, the assistant superintendent, the operations supervisor, the engineering supervisor, the maintenance supervisor, and the quality assurance supervisor. The NOB is off-site and consists of the assistant vice president for thermal plant operation and maintenance, the plant superintendent, several engineers, and others. Its nine members review and audit the policies, practices, and procedures of the nuclear plant. The principal review of minor deviations is by the Plant Review Board, and its minutes are reviewed by the NOB. Repeated minor deviations, and any major deviations, trigger closer scrutiny by the NOB. Exh. A-34, p. 3, and Att. 5.

It is concluded that PGE's similar procedure at Trojan, coupled with its description of intended changes to comply with this standard, satisfies the requirements of this subsection.

D. <u>On-Site and Off-Site Organizations</u>

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

(3) Demonstrate that it will establish and implement on-site radiological and quality control organizations which report directly to the plant superintendent and an off-site organization, independent of personnel responsible for power production, with authority to compel any

changes at the facility it determines necessary for its operational safety, including shutdown of the facility.

At the Trojan Nuclear Power Plant there are on-site radiological and quality assurance organizations reporting directly to the plant superintendent, and PGE will institute a similar arrangement at Pebble Springs. Two of the seven operating organizations planned for Pebble Springs are quality assurance, and chemical and radiation protection. SCA 22-9.

In its prefiled testimony, PGE indicates the NOB is the off-site organization it is relying on to meet the requirements of the second part of subsection (3). During cross examination, however, the quality assurance department, the radiation protection committee, and the chairman of the board were suggested as possible entities meeting the requirement. Whether these entities meet the other requirements of the second part of subsection (3) was not discussed, and PGE made it clear it considered the NOB to be the organization that meets the standard. SCA Sec. 22. 2.2; Exh. A-34, p. 4, and Att. 5; Tr. 1905, 6712-13.

For Trojan, Standard Practice Instruction No. 200-4 establishes the NOB. PGE plans a similar organization for Pebble Springs. The chairman of the NOB is the assistant vice president, thermal plant operation and maintenance. Other members are the plant superintendent, a nuclear engineer from the nuclear project branch of the engineering-construction department, a mechanical, civil, or nuclear engineer from the generation engineering-construction department, an electrical engineer from the generation engineering-construction department, a chemist, a quality assurance specialist, a health physicist, and a biologist. The assistant vice president for thermal plant operation and maintenance and the plant superintendent have direct responsibility for power production, while the other members do not. Standard Practice Instruction No. 200-4 requires a minority of NOB members to have responsibility for power production. The NOB reviews and audits plant operation and reports to the PGE executive vice president. The NOB operates by majority vote. Exh. A-34, Att. 5; Tr. 1996, 6706.

The off-site organization is required to have authority to compel changes necessary for operational safety, including shutdown. The standard practice instruction establishing the NOB at Trojan does not give authority to the NOB to shut down the facility. In its application to build the Pebble Springs Facility, PGE says the NOB will have authority to compel any changes necessary, including shutdown of the plant. Whether that authority is unfettered becomes unclear as one searches further into the record. In Exhibit A-34, PGE says the findings of the NOB, "because of its membership and

reporting level, constitute compelling reasons to implement any changes at the facility it determines necessary for its operational safety, including shutdown of the facility." (Page 5.) During cross-examination on that statement, the PGE witness responded to a question about whether the NOB could be overruled if the NOB decided the plant should be shut down. He said it was possible, but unlikely. Later he said the executive vice president could overrule the NOB, but he did not think that would occur. It appears the NOB could probably shut the plant down, but could not compel shutdown if there were disagreement. SCA 22-9; Tr. 6745.

Subsection (3) requires the off-site organization to be "independent of personnel responsible for power production." Is an organization independent of personnel responsible for power production when its chairman and another member are directly responsible for power production? Merely posing the question suggests a negative answer. There undoubtedly are reasons PGE desires power production personnel on the NOB, but doing so necessarily makes the organization something other than independent from them.

Applicant argues that it is the functions, not the employees, of the NOB which must be independent. It argues that the NRC uses the criteria of the American National Standards Institute quality assurance program, and that the Institute specifically allows a minority of the independent review group to be involved in power production. But the EFSC standard is clear. It requires the organization to be "independent of personnel responsible for power production." The word "personnel" means people, not functions. Applicant Brief, Site-Specific Standards, p. 96; Exh. A-34, Att. 7, p. 6.

It is concluded that the requirement for an off-site organization independent of personnel responsible for power production, with authority to compel changes, including shutdown, has not been met.

E. Training Program for Management

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

> (4) Demonstrate that it will establish and implement a training program for all company personnel who possess authority to override recommendations by the plant superintendent relating to safety of a nuclear facility, which consists of in-plant training or its equivalent, and relates to specific subject matter areas such as system design, operation and

maintenance and safety related requirements and their bases.

Who has authority to override the recommendations of the plant superintendent? In its prefiled testimony, PGE does not directly answer that question. It says it will train members and alternates of the NOB. It is inferred from that statement that the NOB can override the plant superintendent. During the hearing PGE witnesses were asked about who could overrule the plant superintendent. The answer was unclear, but apparently senior management, including the chairman of the board, the president, and the executive vice president of PGE, in addition to the NOB, can override the plant superintendent. SCA 22-10; Tr. 1913, 6712.

PGE does not plan to train senior management in nuclear safety. Yet they have authority to override the plant superintendent. One PGE witness said he suspected PGE would endeavor to train them if it were determined the standard required it. In the Order adopting this standard, the Siting Council commented that it requires more than a promise that the standard will be satisfied. A demonstration of how applicant intends to comply is required. A statement that applicant may endeavor to do what is required is not a demonstration of how it will comply. Tr. 1918, 6713, 6754, 6758.

For members and alternates of the NOB, planned training covers the subjects mentioned in the standard, and other matters as well.

Applicant has not demonstrated it will establish and implement a training program for all who have authority to override the recommendations of the plant superintendent.

F. Training Program for Operators and Supervisors

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

> (5) Demonstrate it will establish and implement a training program for facility operators and their supervisory personnel, which will include in-plant training in the subjects of system design, operation and maintenance, effluent control and safety related requirements and their bases. Operators partaking in initial facility startup and testing shall have operating experience in a similar facility.

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PGE will institute a training program for operators and their supervisors similar to what is employed at Trojan. The amount of training required will depend on the previous experience of individual operators. For duty during initial facility start-up, PGE will employ operators who have experience in a similar facility and will try to obtain operators with prior experience in another pressurized water reactor plant. SCA 22-11.

Applicant has demonstrated that it will establish and implement a proper training program for facility operators and their supervisory personnel.

G. Written Agreement Among Owners

To prove it has the ability to construct, operate, and retire a proposed facility, applicant must:

> (6) Demonstrate that it possesses or will execute a binding written agreement, in those instances where the applicant will share ownership of the facility, which commits each owner to:
>
> (a) Comply with ORS Chapter 469, all applicable rules of the Council and all conditions and warranties in the site certificate authorizing siting of the particular facility,
>
> (b) Assign responsibility for facility operation to a designated organization or group,
>
> (c) Abide by a designated procedure for arbitrating disagreements among the co-owners that concern facility operation and management, and
>
> (d) Notify the Council when arbitration is required for disputes relating to facility safety.

The co-owners in the Pebble Springs Project have been negotiating the terms of such an agreement, but it has not been completed. There will be an operating committee composed of members from each co-owner, but PGE will be responsible for facility operation. The committee will make recommendations to the nuclear operations staff, which will be comprised of the PGE employees actually operating the facility. The final decision on operating procedure will be PGE's, and the other co-owners have agreed to this arrangement. SCA 22-4; Tr. 1923, 1939.

PGE promises to execute the proper written agreement, and is willing to submit it to the Siting Council for approval. PGE has co-owners of the Trojan Facility and has an executed contract with them for the plant's operation. Exh. A-34, Att. 9; Tr. 1940.

Applicant has demonstrated that it will execute a binding written agreement which commits each owner to the provisions of Specific Standard 345-76-040(6).

H. Conclusions

Applicant has proved compliance with subsections (1), (2), (5), and (6) of Specific Standard 345-76-040, and has not shown compliance with subsections (3) and (4).

VI. LAND-USE PLANNING

A. The Standard

Before the Council is authorized to approve a site certificate application, it must find that:

> With reference to any site certificate application filed prior to July 1, 1975, siting, construction, and operation of the proposed facility will be carried out in conformance with state-wide planning goals and in conformance with comprehensive land use plans and zoning ordinances of political subdivisions in which the facility is to be located in effect on the effective date of this rule. General Standard 345-75-025(5)(b).

The application in this proceeding was filed on December 14, 1973. General Standard 345-75-025 became effective on December 30, 1977.

B. Discussion and Findings

The proposed facility is planned for Gilliam County, and a ten-mile radius drawn from the proposed site would include land within Morrow County in Oregon and Klickitat County in Washington. The land surrounding the proposed site is primarily agricultural, being used for grazing of cattle and sheep and growing wheat and alfalfa. SCA 2-1, 13-4.

Gilliam County has adopted a comprehensive land-use plan, and on July 8, 1977, became the first Oregon County to receive approval for its comprehensive plan from the Land

Conservation and Development Commission. The Gilliam County zoning ordinance carries out the policies of the comprehensive plan and assigns a zone of "A-E, exclusive farm use zone" to the proposed site and surrounding area. Morrow and Klickitat Counties have prepared comprehensive land-use plans which project agriculture and agribusiness to be the primary uses for the land near the Pebble Springs Site. SCA 13-5, 13-6, 13-17.

The Gilliam County Planning Commission granted PGE conditional use permit to build the proposed nuclear facility. That decision was appealed to the Gilliam County Court (Gilliam County's governing body), and on January 7, 1978, was affirmed. Tr. 1307.

Gilliam, Morrow, Umatilla, Wheeler, and Grant Counties make up Oregon Administrative District 12. An interim land-use plan for 1995 has been prepared for the District, and it projects that the land will continue to be used primarily for irrigable crops.

C. Conclusions

The proposed facility conforms to state-wide planning goals and local comprehensive land use plans and zoning ordinances. The requirements of General Standard 345-75-025(5)(b) have been satisfied.

VII. HISTORIC OR ARCHAEOLOGICAL SITES

A. The Standard

The Council is not authorized to approve a site certificate application unless it finds that "[c]onstruction and operation of the proposed facility will be conducted in a manner to avoid adverse impacts upon historic or archaeological sites, to the extent that relocation of the facility on the site can be accomplished consistent with the Council's other standards." General Standard 345-75-025(6).

B. Discussion and Findings

The University of Oregon, Museum of Natural History, under the direction of David Cole, evaluated the historic, archaeologic, and paleontologic significance of the Pebble Springs Site. The final report of the study was received into evidence. SCA 13-8; Exh. A-4.

The Pebble Springs Site has no locations of historic interest, and no locations listed in the National Register of Historic Places. The closest historic location is the Old Oregon Trail, which passes five miles south of the site. SCA 13-8.

One archaeologic site was found in the Pebble Springs Area. It yielded a stone cluster. The site is badly weathered and little, if any, archaelogic data remains. The site will not be affected by construction. Five locations of possible paleontologic significance were discovered, called locations 7, 10, 12, 13 and 17. The locations are not likely to produce significant findings. Location 17 will be inundated, but not otherwise disturbed. The other locations are not in the construction area and applicant does not intend to disturb any of them. Tr. 235-237; SCA 13-8.

Construction activities may uncover sites of possible historic or archaeologic significance. Applicant's contracts with construction contractors provide that if anything known or suspected to be of historic or archaeologic significance is discovered, work is to cease in that area and applicant is to be notified. Applicant will then evaluate the find, or will obtain an evaluation, before work is resumed. Tr. 247.

No evidence was presented to show construction or operation of the proposed facility will adversely impact historic or archaeologic sites.

C. Conclusions

Construction and operation of the proposed Pebble Springs Facility will be conducted without adverse impacts on historic or archaeologic sites. The requirements of General Standard 345-75-025(6) have been satisfied.

VIII. BENEFICIAL USE OF WASTES AND BY-PRODUCTS

A. The Standard

Before the Siting Council is authorized to approve a site certificate application, it must find that "applicant will make beneficial use of wastes and by-products produced by construction and operation of the proposed facility, including but not limited to heat, to the extent that such beneficial use is reasonably practicable." General Standard 345-75-025(4).

B. Waste Heat

Water heated during the process of cooling the reactor cores will be discharged into a cooling reservoir. PGE, PP&L, and the Boeing Company sponsored a study, performed in 1972-73, of utilizing waste heat produced by thermal power plants. Economic utilization of waste heat was found possible if certain conditions were met. Utilization would have to be near the power plant, and backup heating systems would be necessary to replace the heat lost when the power plant is shut down. SCA 12-4.

Most of the soil near the Pebble Springs Site is unsuitable for cultivation, diminishing the possibility of using waste heat for greenhouses or soil heating to increase agricultural production. Use of waste heat to warm space in buildings in urban areas is not practical because the proposed site is too far from major population centers. Also, the uncertainty of approval of the proposed plants and the time it takes to get a decision on the plants create barriers to joint ventures. SCA 12-5, 12-6.

C. Water Withdrawn from Reservoir

To maintain the quality of the water in the reservoir, 2,880 acre-feet per year will be withdrawn and replaced with fresh water. Applicant will make beneficial use of the withdrawn water by making it available for irrigation and livestock watering. SCA 2-3, 10-7, 13-4; Tr. 350.

D. Chemicals

Columbia River water contains many chemicals, including boron, cadmium, and zinc. In treating the water withdrawn from the river, applicant will add chlorine, sodium, and sulphate to combat the growth of algae, inhibit corrosion, and minimize fouling. The concentration of chemicals will be low and their recovery is either not feasible or more expensive than purchasing them at market prices. SCA 11-2, 11-3; Exh. S-10, p. 6; Exh. S-11; Tr. 352-63.

E. Radioactivity

Radioactivity will be in the form of high-level radioactive spent fuel and low-level radioactive gaseous, liquid, and solid wastes. Spent fuel has energy value which could be recovered and utilized. However, federal policy precludes that possibility at the present time. The costs of recovering low-level radioactivity, coupled with the limited market for any recovered matter, makes beneficial use of it uneconomic. SCA 15-20; Exh. S-10, Att. I, p. A-4.

F. Conclusions

Applicant's past efforts and future plans for the beneficial use of wastes and by-products are adequate. Applicant will make beneficial use of wastes and by-products produced by construction and operation of the proposed facility to the extent that such beneficial use is reasonably practicable. It is concluded that the requirements of General Standard 345-75-025(4) have been satisfied.

IX. WATER REQUIREMENTS

A. The Standard

Before the Council is authorized to approve a site certificate application, it must find that "requirements for water used in construction and operation of the facility can be met without infringing upon the existing water rights of other persons." General Standard 345-75-025(7).

B. Withdrawal of River Water

Applicant plans to pump water from the Columbia River to a reservoir at the Pebble Springs Site. The reservoir will be 1,900 acres in size and have capacity to hold 60,000 acre-feet of water. Water will be drawn from the reservoir to cool the reactor cores of the proposed power plants. After cooling the plants, the water will be returned to the reservoir, creating a closed-cycle cooling system, with no discharges to any other surface body of water during normal operation. A divider dike will separate the intake channel from the discharge channel of the reservoir. SCA 10-5.

Seepage and evaporation will claim a small portion of the water in the reservoir. In addition, applicant has agreed to make 2,880 acre-feet available each year for a neighbor to use for irrigation and livestock watering. That withdrawal of water for farming uses will help reduce the natural concentration of chemicals in the reservoir. If the neighbor does not use the water, applicant will withdraw approximately the same amount to reduce the chemical build-up. Rainfall will partially offset those losses. The remainder of the losses will be replaced by water pumped from the Columbia River. SCA 10-7, 10-8.

A spray pond will serve as a reserve cooling system for each power plant. Each spray pond will cover six acres and have capacity to store 15.5 million gallons of water. Each will be excavated below grade and lined to minimize seepage. The spray ponds will provide cooling in case the reservoir system fails, and will be sufficient to cool the reactor cores for 30 days. Water to keep the ponds full will normally come from the reservoir or the Columbia River, depending on availability. SCA 12-3, 12-4; Tr. 589.

Applicant will install five pumps to get water from the Columbia River to the reservoir. The pumps will be capable of withdrawing water at the rate of 118 cubic feet per second (cfs), with average withdrawal expected to be 77 cfs. The average annual water flow in the Columbia River where the water will be withdrawn is 185,000 cfs, so applicant's withdrawal will be less than 1/20th of 1 percent of the average flow.

Withdrawal of Columbia River water between the Pebble Springs point of appropriation and the Pacific Ocean is estimated to be less than 1,000 cfs. The Deschutes and Willamette Rivers empty into the Columbia River downstream from Arlington, as do other tributaries, making the average flow at the mouth of the Columbia River approximately 60,000 cfs greater than at Arlington. SCA 10-8, App. B, p. 2; Tr. 451, 645.

C. Withdrawal of Well Water

There are two wells at the Pebble Springs Site, each capable of releasing 900 gallons of water per minute. During construction they will be used for construction activities, for domestic purposes, and for fire protection. During operation of the plants, well water will be used for domestic uses such as drinking and sanitation. The wells also will be a reserve source of water for fire protection. Applicant's usage will average no more than 50 gallons per minute. Tr. 437-38.

Mr. and Mrs. Hulden farm west of the Pebble Springs Site. Mrs. Hulden testified in opposition to the plant. She argued that sharing ground water with applicant could adversely impact the Huldens. One of the Hulden wells is between 1-1/2 and 2 miles from the proposed plant site. Higher river levels behind the John Day Dam have raised the water level in that well 55 feet in recent years. Tr. 115, 442.

The two wells at the Pebble Springs Site are about 1,800 feet apart. Applicant withdrew water from one at between 600 and 900 gallons per minute for 12 hours. The resultant drawdown of the water level in the other well was less than 0.2 feet maximum. There are 15 usable wells within a six-mile radius of the Pebble Springs Site, and they withdraw approximately 2,200 acre-feet of water per year. SCA App. B, p. 5; Tr. 441.

D. Permits to Withdraw Water

Applicant applied to the Water Resources Department of Oregon for a permit to withdraw 118 cfs of water from the Columbia River. It also filed with the same agency information about the two wells at the site. The Water Resources Department contemplates no problems in issuing the appropriate permits if applicant gains siting authority. The application to appropriate river water is being held in abeyance now because an applicant must begin work to utilize the water within one year of issuance of a permit. SCA Fig. 4-2; Tr. 431.

E. Conclusions

Applicant's appropriation of ground water through two wells will not infringe on the existing water rights of others.

Applicant's usage will average no more than 50 gallons per minute, and even sustained withdrawal of more than 600 gallons per minute had a minimal impact on a well much closer than the closest off-site usable well.

Applicant's proposed usage of river and well water is small when compared to the total available to it and other users. It is concluded that applicant can meet its water requirements without infringing on the existing water rights of other persons. The requirements of General Standard 345-75-025(7) have been satisfied.

X. ENVIRONMENTAL IMPACTS

A. General Standards

Before the Siting Council is authorized to approve a site certificate application it must find that:

> Reasonably foreseeable disruption to and adverse impacts upon the environment in Oregon, or in adjacent areas that might be directly impacted, including, but not limited to, those caused by discharges of chemicals, waste, heat, moisture, sanitary wastes, and radioactivity from the construction, operation, and retirement of the facility will be reduced to that extent which is reasonably practicable. General Standard 345-75-025(3).

General Standard 345-75-015(1)(b) elaborates on the meaning of "reasonably practicable:"

> For the purposes of sections 345-75-025(2), (3), and (4), in determining what is "reasonably practicable", the Council will reach a conclusion in most cases by finding whether a proposed facility complies with the requirement of other agencies, such as the Federal Nuclear Regulatory Commission of [sic] the Oregon Department of Environmental Quality. See ORS 469.400.

B. Chemicals

Water in the reservoir will contain chemicals present when the water is pumped from the river as well as chemicals added by applicant to counteract the growth of algae, inhibit corrosion, and minimize fouling. Corrosion products also will accumulate in the reservoir. Loss of water through evaporation

and seepage will cause an increase in the concentration of chemicals in the reservoir. If no measures are taken to reduce the buildup of chemicals, in approximately 40 years an equilibrium level will be reached at which the concentration will be almost six times the level of concentration when the reservoir is first filled. The concentration would approximate five times the beginning concentration after ten years of operation. SCA 11-2, 11-3, Fig. 11-1.

The concentration of chemicals in the reservoir is potentially a problem because livestock and wildlife may drink from it, and crops may be irrigated with water from the reservoir. SCA 11-2.

The equilibrium level of chemicals in the reservoir will not exceed the recommendations of the Federal Environmental Protection Agency for livestock watering and irrigation, and will be within human drinking water standards. The Federal Environmental Protection Agency recommendations are considered applicable to wildlife as well. The expected chemical concentration in the reservoir will be less than that of some wells now used to irrigate crops. Having determined there was reasonable assurance that water quality standards will not be violated, the Oregon Department of Environmental Quality issued a permit for the proposed uses of the reservoir. If a problem develops, applicant will take steps to reduce the concentration of chemicals. SCA 11-3; SCA Fig. 4-10. Exh. A-10; Tr. 2271, 2308, 2266.

Any environmental impacts from the discharge of chemicals into the cooling reservoir during operation of the proposed Pebble Springs Facility will be reduced to that extent which is reasonably practicable.

C. Waste Heat and Moisture

Water heated during the process of cooling the reactor cores will be discharged into the cooling reservoir. Except on hot days, the temperature at the surface of the reservoir will be higher than that of the ambient air, causing heat and water vapor to flow into the air. SCA 9-25.

On average, ice storms occur approximately once a year in the Pebble Springs Vicinity. Additional icing due to the existence of the cooling reservoir is expected an average of 370 hours a year. The reservoir will cause additional fogging. The additional icing and fogging will largely be within the boundaries of the proposed facility. SCA 9-4, 9-11, 9-26 through 9-30.

A cooling tower is an alternative to the planned reservoir. The cooling towers also can cause fogging and icing. SCA 19-2, 19-23.

The formation of blue-green algae in the reservoir may be accelerated due to the waste heat discharges. A few strains of the algae can become toxic if they reach bloom proportions. Livestock or waterfowl could possibly be harmed by contacting the algae. SCA 16-12a through 16-12c.

Toxic strains of algae have not been found in Oregon and no known instances of injury to livestock or waterfowl from toxic algae have been reported here. Applicant will monitor the reservoir for algae formation, and measures are available to prevent adverse effects. Tr. 1588, 1593, 1597-99.

The environmental impacts of waste heat and moisture from the proposed Pebble Springs Facility will be insignificant and will be reduced to that extent which is reasonably practicable.

D. Sanitary Wastes

During construction, portable toilets will be used. Disposal will be at a municipal sewage facility. SCA 14-1; Tr. 1452-53.

During operation of the plants, sanitary wastes will be treated in a system that will include a lined lagoon and an evaporation pond. City of Arlington officials foresee no problems with the use of the planned system. SCA 14-1 through 14-3; Exh. S-10, Att. I, pp. A-13, A-14.

Treatment and disposal of sanitary wastes will be performed in a normal manner, and will cause no foreseeable disruption to or adverse impacts on the environment.

E. Radioactive Wastes

The main issue of contention concerns applicant's plans to discharge radioactive liquid effluents into the cooling reservoir. Applicant has designed the facility to discharge water to the reservoir when the water contains radioactivity of not more than one picocurie per milliliter.[9] The DOE contends that only water containing a much lower concentration of radioactivity should be discharged.

The one picocurie per milliliter amount is a design-basis discharge guide, not a regulatory limit. The concentration could be exceeded on occasion without violating NRC limits. The design limit is calculated to allow occasional

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[9]In addition to "milliliter," parties also referred to the quantity of water being measured as "cubic centimeter" and "gram." All three describe the same volume of water.

discharges of greater concentration without having to shut down the plant. Tr. 1702.

The DOE contended in its prepared testimony and at the hearing that the liquid discharged to the reservoir should have no more than 1/100 of a picocurie of radiation per milliliter of water. The DOE also recommended that concentration as a regulatory limit rather than merely as a design objective. In its opening brief submitted after the close of the hearing, the DOE suggests that the Council adopt a regulatory limit of 1/10 of a picocurie per milliliter as a compromise between applicant and the DOE. Exh. S-14, p. E-7; DOE Opening Brief, Sec. V. A., p. 11.

Applicant strenuously resists DOE's suggestion that the radioactive content of liquid discharges be reduced. Applicant points out that the total of liquid and gaseous discharges will not change; if the liquid discharges are reduced the gaseous discharges will rise by an equivalent amount. Applicant argues that plant reliability would suffer if the DOE limits were adopted. Applicant also contends that the monitors to be installed in the plants cannot detect radioactivity in liquid effluents at concentrations less than one picocurie per milliliter. Radioactivity levels down to 1/100 picocurie per milliliter can be detected by analyzing samples in a laboratory. SCA 15-6; Tr. 1685-87, 1704, 1707, 1711-12, 1714.

Applicant commits to meet NRC regulations for radioactive emissions. The one picocurie per milliliter design objective was set in light of current NRC regulations. The design objective could change if NRC regulations change. The DOE finds that applicant would meet the requirements of General Standard 345-75-025(3) if applicant discharges liquid effluents containing no more radioactivity than 1/100 or 1/10 of a picocurie per milliliter. Applicant does not say it will limit radioactive liquid discharges to either of those limits. The DOE does not express an opinion as to whether discharges designed to meet NRC regulations also meet the requirements of Siting Council General Standard 345-75-025(3). No other party filed a brief expressing an opinion on that issue either. Consistent with Section I.D. of this document, the task here is to determine if applicant's plans meet the requirements of the standard. The task is not to determine if the Council can devise restrictions on applicant that insure compliance with the standard.

Would liquid discharges containing radioactivity of one picocurie per milliliter disrupt or adversely impact the environment? Applicant says "No," pointing out that biota routinely receive up to 1,000 rems of radioactivity naturally per year. Biota that will be in or on the cooling reservoir at

the Pebble Springs Facility are expected to receive up to 3.6 additional millirems of radioactivity from operation of the facility. Applicant contends that smaller life-forms are less sensitive to radiation, and that protection of humans is more than adequate protection of other life-forms. SCA Table 15-4; Tr. 1719-20, 1722-23.

The DOE is impressed by the fact that any increase in radioactivity to biota from the proposed facility will be a very small percentage of what the biota receive naturally, but believes in the linear theory of radiation effects. That theory suggests that all radiation exposure, of all concentrations, is harmful. The record does not show how the environmental impacts of discharges of radioactivity would be reduced if radioactive discharges in liquid form were reduced and gaseous discharges were increased by an equivalent amount. Presumably the linear theory of radiation effects applies to radioactivity in gaseous as well as liquid form. If so, the linear theory does not support the argument that liquid discharges should be substituted for gaseous discharges. Perhaps the radioactivity in liquid form would concentrate in certain biota, such as aquatic biota, and gaseous discharges would be distributed more evenly in the environment. But the environmental impacts of increasing gaseous discharges to reduce liquid discharges were not shown. Tr. 1814-15, 1819.

It would, however, be more expensive to reduce radioactive discharges below what is necessary to meet NRC requirements, and the facility would be less reliable. SCA 15-6; Exh. S-13, Table 2; Tr. 1685-87, 1704-13.

The record does not show that there will be disruptions to or adverse impacts upon the environment from discharges of radioactivity as planned by applicant from the proposed Pebble Springs Facility. By meeting the discharge regulations of the NRC, applicant will reduce environmental impacts to the extent which is reasonably practicable.

F. Miscellaneous Environmental Impacts

1. Water Intake Structure

Applicant plans to construct an intake structure on the Columbia River to provide a means for supplying the facility with water. To minimize environmental impacts, applicant will use traveling screens and artificial currents to avoid trapping fish. As a result, there should be no loss of fish, although loss of some organisms living at the river bottom is expected. Also, the intake structure is planned for a location of low fish density as compared to upriver and downriver areas. SCA 16-10; Exh. A-9, pp. 3, 37; Tr. 1432.

2. Soil Erosion

As vegetation is disturbed during construction, the soil will be more vulnerable to erosion. Applicant will minimize soil erosion by minimizing the extent of vegetation disturbance, by applying gravel, water, or paving to heavily used surfaces, and by reseeding, landscaping, and restoring disturbed areas according to guidelines of the U.S. Soil Conservation Service. SCA 13-7, 13-8; Tr. 1451.

3. Transmission Lines

To provide an auxiliary off-site power source, applicant will tap into one of the BPA 230-kilovolt (kV) lines running approximately 3,000 feet north of the proposed facility. The 230-kV tap line will also be extended approximately 3-1/2 miles north and west to the Columbia River to provide electricity for the pumping plant. During construction, a temporary substation will be installed at the location of the tap to the BPA 230-kV line, and a temporary 12.5-kV transmission line will be constructed to the plant site. To convey the electrical output from the proposed facility, applicant will construct two 500-kV transmission lines from the facility approximately one mile west to a switching station. Construction of any additional transmission lines will be on existing rights-of-way. SCA 13-9, 13-10.

Transmission lines associated with the Pebble Springs Facility will be constructed on low-growth range land. Some short-term soil erosion is expected. The use of herbicides is not anticipated. The lines will create noise that will be audible under and alongside the lines, but the noise will be within acceptable limits. The lines will be routed in accordance with the guidelines of the Federal Departments of Interior and Agriculture incorporated in "The Environmental Criteria for Electric Transmission Systems." SCA 13-10 through 13-12.

G. Retirement

In Volume II of this Proposed Order, decommissioning of the proposed facility will be addressed, including the environmental impacts of decommissioning. In this subsection the impacts on land use after the facility ceases producing electricity will be addressed.

Some noncontaminated building rubble from demolition of structures will be buried on-site and some will be disposed of in landfills off-site. If the Facility is entombed for 100 years after operations cease, approximately 12 acres of land will not be usable for other activities during that time.

To the extent the remainder of the site will be used for other activities, the environmental impact then will be less than during operation. After dismantlement and removal of all structures, applicant will restore the site to unrestricted use. SCA App. I, p. 12-1.

The environmental impacts from retirement of the facility will be reduced to that extent which is reasonably practicable.

H. Endangered Species

1. The Standard

In addition to the other environmental considerations, the proposed site must not be "the location of an endangered plant or animal species, as defined in 50 CFR Part 17 as of the effective date of these rules, whose continued existence would be significantly threatened by construction on the site." Specific Standard 345-76-037.

2. Findings and Discussion

The definitional reference in the standard is to the federal lists of endangered wildlife and plants. The lists are amended as additional data become available, and those updated lists are published in the Federal Register. Specific Standard 345-76-037 became effective on January 20, 1978. The July 14, 1977 issue of the Federal Register contains the list of endangered wildlife effective on January 20, 1978. The 1976 Federal Register contains the list of endangered plants effective on January 20, 1978.

Ecological baseline studies were performed by Battelle-Northwest Laboratories, and Beak Consultants, Inc. to identify and describe the distribution and habitats of biota at the Pebble Springs Site. Particular attention was directed to rare or endangered species. SCA 16-4; Exh. A-9.

No plants listed in 1976 Federal Register or in the Oregon Rare and Endangered Species Task Force Report as endangered or threatened were found at the site of the proposed Pebble Springs Facility. No terrestrial vertebrates classified by the Oregon Department of Fish and Wildlife or listed in the Federal Register as threatened or endangered reside at the proposed site. No species classified as threatened or endangered on state or federal lists were found at the proposed site. The endangered peregrine falcon may visit the site as a rare migrant. The threatened northern bald eagle may be attracted to the cooling reservoir area if the area becomes important to waterfowl, a major food source for eagles.

Neither bird will be harmed by the proposed energy facility. SCA 16-12; Exh. A-9, p. 3; Exh. A-33, p. 3; Tr. 2278-80. 2319-20.[10]

No evidence was presented to show that a plant or animal listed as endangered in the Federal Register is located at the Pebble Springs Site.

3. Conclusion

The proposed Pebble Springs Site is not the location of an endangered plant or animal species, as defined in 50 CFR 17 as of January 20, 1978, whose continued existence would be significantly threatened by construction on the site.

I. Conclusions

Applicant's studies and plans to deal with environmental impacts from the proposed facility are reasonable. Reasonably foreseeable disruption to and adverse impacts on the environment from construction, operation, and retirement of the proposed facility will be reduced to that extent which is reasonably practicable. The proposed site is not the location of an endangered plant or species as defined in 50 CFR Part 17 as of January 20, 1978. The requirements of General Standard 345-75-025(3) and Specific Standard 345-76-037 have been satisfied.

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[10]The standard refers to the definitions found in 50 CFR Part 17 as of January 20, 1978. 50 CFR was not offered into evidence. A reading of 50 CFR Part 17 reveals that the list of endangered species is amended from time to time, and the amended lists are published in the Federal Register. No portions of the Federal Register were offered into evidence. In testimony filed prior to the hearing, applicant discussed endangered plants and terrestrial vertebrates. But the standard is concerned about endangered plants and wildlife. Presumably, "wildlife" is a broader term than "terrestrial vertebrates." Only on cross-examination does evidence emerge that allows sufficient findings of fact to be made, but even here the evidence is unspecific. The relevant date is January 20, 1978, but the 1975 and 1976 Federal Register are referred to as the most recent plant species lists. The Federal Register is published frequently, perhaps daily, so a reference to a year seems general. The witness did not specify whether he was referring to a yearly compilation or the Federal Register published on a specific date.

XI. SOCIO-ECONOMIC IMPACTS

A. Statute and Standard

ORS 469.510 directs the Council to "set standards and promulgate rules for the siting, construction and operation of thermal plants and nuclear installations which shall take into account the following: ...(8) Ability of the affected area to absorb the industrial and population growth resulting from operation of the facility."

A prerequisite to approval of a site certificate application is a finding that:

....

(10)(a) The applicant has identified the major and reasonably foreseeable socio-economic impacts on individuals and communities located in the vicinity of the proposed facility resulting from construction and operation, including, but not limited to, anticipated need for increased governmental services or capital expenditures.

(b) The affected area can absorb the projected industrial and population growth resulting from construction and operation of the facility. General Standard 345-75-025(10).

B. Discussion and Findings

Approximately 250 people will be required to operate the two power plants, but during peak construction, 1,400 workers are expected to labor on the plants. The construction workers will bring dependents and cause an increase in service personnel. During the peak, area population is expected to increase by 8,849. That population will locate in urban growth areas in and adjacent to Arlington, Boardman, Condon, Heppner, Umatilla, Stanfield, Hermiston, Irrigon, Pendleton, and Echo. SCA 13-18, 13-22, 13-23; SCA Fig. 13-4.

Applicant identifies 20 social and economic aspects of community life that could potentially be impacted by an industrial development such as a nuclear power facility. Applicant further identifies seven community needs as the major and reasonably foreseeable socio-economic impacts that would result from building and operating the Pebble Springs Plants. Those seven impacts are: increased demand for housing, water, sewage treatment facilities, medical services and facilities, recreational facilities, a change in public safety requirements, and increased strains on educational systems. SCA Sec. 13.7; SCA App. A, p. A-15; Tr. 717.

Applicant retained the consulting firm of Skidmore, Owings, and Merrill (SOM) to analyze the housing and community facilities requirements of the area surrounding the proposed plants. SOM used a computer model of the development process and issued a report in May, 1975. SOM updated the report periodically thereafter, including one dated October, 1977. The Battelle Memorial Institute performed a study for the Nuclear Regulatory Commission on social and economic impacts resulting from nuclear power plants, and performed a case study of the socio-economic impacts of the Pebble Springs Plants. The East Central Oregon Association of Counties and other governmental organizations have also studied potential area growth. SCA 13-16, 13-18; SCA App. A, pp. A-4, A-12, A-17.

The exact number of new people each city will receive is not known, but SOM studied the nearby communities and included in its report an estimate of the total imported population each community would receive. The estimate is based primarily on analysis of the amenities each community offers and of each community's distance to the Pebble Springs Site. The unadjusted results are shown in the SOM print-outs under the heading Gravity Percent Distribution. Arlington would get 81.7 percent of the new population, Boardman would receive 4.4 percent, and other cities would receive even smaller percentages. However, the percentage of new population assigned to each city is then changed by limitations that prevent the normal distribution from occurring. The most pronounced limitation is in Arlington where a lack of mobile home capacity allows that city to accept only 31.8 percent of the new population at the peak of construction, rather than the unadjusted 81.7 percent. The percentage of the new population other cities receive increases accordingly, with Boardman receiving 21.7 percent. The SOM projections are reasonable and are accepted. SCA App. A, pp. A-19 through A-24; Tr. 743 et seq., 854, 887, 898.

Arlington and Boardman prepared comprehensive land-use plans in the early 1960's when the John Day Dam was built. Both cities were then relocated. The passage of the Land Conservation and Development Act in 1973 stimulated further long-term planning. On July 8, 1977, Gilliam County became the first Oregon county to receive approval of its comprehensive plan from the Land Conservation and Development Commission. Arlington hired J. Val Toronto and Associates to study the city's additional needs for sewer and water systems. It also hired David Rowe as a consultant to help prepare its comprehensive plan. Mr. Rowe previously played a major role in helping Gilliam County prepare its own comprehensive plan. Arlington has a preliminary draft of a comprehensive plan, but not a final plan. SCA 13-5, 13-17; Exh. I-10, pp. 1-3; Exh. I-13, p. 5.

The site of the proposed facility is within the Arlington School District. PGE has been paying property taxes

to Gilliam County for several years, with the current valuation being about $50,000,000 - 35 percent of the total assessed value of the county. The taxes paid by PGE directly benefit the county and the Arlington School District, and indirectly benefit other taxing authorities within the county. The property taxes PGE pays can be used to mitigate community impacts caused by the power plants, or used to reduce collections from other property owners, or a combination of the two options. SCA 13-21.

Arlington's population is expected to increase from its present 580 to approximately 3,400 during peak construction activity. The city has capacity to provide water service to 4,000 people, and sewer service to 2,500 people. Arlington has applied to the federal government for a grant to expand its sewer capacity. The significant growth in population will create substantial demands for housing. Applicant and Arlington plan to rely on private developers and contractors to fill the need for temporary and permanent housing. Applicant feels there is inadequate temporary housing in Arlington and has discussed engaging in a joint venture to alleviate that situation. The Arlington School District currently has excess capacity and a fund to finance capital improvements without requiring a new levy or bond. The residents and school board have completed plans to accommodate the new population occasioned by construction of the power plants. SCA 13-31, and App. A, pp. A-24, A-39; Tr. 831, 856.

Arlington has a part-time nurse and is buying an ambulance. For other medical services, residents rely on hospitals and doctors available in other communities, including The Dalles, Hermiston, and Pendleton. The city could use additional medical services, particularly during peak construction activities. Arlington has a one-person police force. Personnel from the offices of the State Police and County Sheriff also patrol the area. Arlington and the surrounding area has protection from a volunteer fire department. In the Arlington-Boardman area there are boat launching, camping, and picnicking facilities, and they are not utilized to their full capacities. Also, the Gilliam County Planning Commission has proposed additional recreational facilities adjacent to regional bodies of water. SCA 13-6, 13-7, 13-19, and App. A, p. A-38.

Arlington Mayor Foster A. Odom testified in favor of the proposed power plants. He sponsored a joint resolution of the City of Arlington and Gilliam County acknowledging the expected increases in population, and accepting and assigning responsibility for mitigating resulting impacts. Developers of subdivisions must provide streets, water, and sewage facilities for new developments. The city will utilize grants and its taxing powers to provide adequate water and sewage system capacity. The city and county jointly will provide adequate detention and emergency facilities. Commercial recreational

facilities will be provided by private entrepreneurs. The county will provide supplementary recreational facilities as needed. Tri-County Health Services, representing Gilliam, Morrow, and Wheeler Counties, is planning to construct an outpatient clinic in Arlington if the power plants are approved. Exh. I-10; Exh. I-11; Tr. 826-899.

Currently there are approximately 700 residents in Boardman. During peak construction activity on the proposed power plants, that population is expected to grow to 2,690, an increase of over 280 percent. A newly expanded water system can supply the water needs of 7,000 people. The city is undertaking improvement of its sewer system to accommodate the needs of 4,000 people. Regional agribusiness developments and the Boardman Coal Plant have spurred recent building construction in Boardman. Private developers and PGE have been able to keep ahead of the rising demand. PGE invested $2,000,000 in an apartment development for workers at the Boardman Coal Site, and purchased other land for development into residential living quarters. SCA App. A, pp. A-42, A-43.

Of the 2,566 new elementary and secondary students expected during construction of the proposed power plants, 20 percent, or 513, are expected to attend school in the Morrow County School District, which encompasses Boardman. At present, the schools are crowded, so substantial expansion is needed before the added strains of new students can be accommodated. A $1[illegible],000 expansion program has been started at the Boardman High School. Other plans include an elementary school in Boardman (Boardman's elementary students now attend school in Irrigon) and a junior high school in the north end of the district. The enhanced tax base created by the Boardman Coal Plant and area agribusiness developments should help provide funds to finance the planned expansion. SCA 13-22.

Recently, a medical-dental clinic was established in Boardman, and federal funds were obtained for an outpatient clinic. Local ambulance service has been available since 1976. The County Sheriff and State Police provide protection, and fire protection is provided by a volunteer department. The city intends to hire an officer to work in both the police and fire departments. SCA App. A, pp. A-42, A-43.

Irrigon, located adjacent to the Columbia River, is a 55 minute drive from the proposed facility. Its present population is 370, and 695 additional people are expected to reside in Irrigon during peak construction activities, for a total of 1,065. The city's water system can supply 2,400 people, but sewage disposal is a problem. Individual septic tanks are used, but an application for a grant to construct a sewage treatment facility has been filed. Another problem is the overcrowding in the Irrigon Elementary School. High school students attend

school in Boardman. It is assumed Irrigon is in the Morrow County School District mentioned in the discussion about the educational needs of Boardman residents. SCA App. A, pp. A-19, A-43, A-60, A-62.

Construction of the proposed power plants will cause population increases in seven other communities, all substantial distances from the proposed site. They are: Condon in Gilliam County; Heppner in Morrow County; and Umatilla, Hermiston, Stanfield, Echo, and Pendleton in Umatilla County. In driving time from the Pebble Springs Site, Condon is the closest at 51 minutes, and Pendleton the farthest at 86 minutes. The population increase each of these communities will experience will be less substantial relative to its present population than at Arlington, Boardman, and Irrigon. Hermiston's population has recently increased dramatically, straining the city's services. A water bond issue was passed in 1977, and an application has been made for a grant to expand its sewer system capacity. Classrooms in Hermiston are crowded, and a bond issue was passed in 1976 to build new classrooms. Hermiston's present population is about 6,000, and primary and secondary population increases due to the proposed power plants will increase that to over 6,800 during peak construction activity, a 15 percent increase. The City of Umatilla needs additional housing and school rooms. SCA App. A, pp. A-19, A-24, A-57, A-69.

PGE has maintained an office in Arlington since late 1974 to facilitate the flow the information to and cooperation with local communities. A PGE representative has attended council, planning commmission, port, and county court meetings; he has met with developers, builders, and government officials; he has distributed reports and assessments, and discussed problems and plans with various people and groups. Local government officials, PGE representatives, and other interested persons have discussed and planned for impacts expected from the Pebble Springs Plants since the plans were first made public. Exh. I-10, p. 3; I-13, p. 5; Tr. 1118.

PGE has paid or obligated itself to pay several hundred thousand dollars to mitigate the impacts of the Boardman Coal Plant and the proposed Pebble Springs Facility. The payments and promises are to local governments and are in addition to tax payments. It has also participated in property development to ease the housing shortage in Boardman. PGE promises it will monitor community needs as the Pebble Springs Project develops and will make additional payments if needed to help communities deal with the impacts from the proposed project. SCA App. A., p. A-169; Tr. 760 et seq., 782, 815, 1111.

C. Conclusions

Exact impacts resulting from construction and operation of the proposed facility can only be projected, not known with

precision. Requested or planned funding may not materialize, requiring aid in unexpected areas. The north central part of the state is growing from activities not related to Pebble Springs, creating and satisfying demands different from projected demands from the proposed power plants. Applicant's efforts to identify the impacts from the proposed facility and possible resources to mitigate them, coupled with its monetary commitments, are reasonable.

Applicant identifies the major and reasonably foreseeable socio-economic impacts resulting from construction and operation of the proposed facility. Potential problems have been identified for which definite solutions have not been detailed. It is not possible to resolve all potential problems substantially in advance of their happening. The standard does not require such an impossibility. Enough has been done to conclude that the affected area can absorb the projected industrial and population growth resulting from construction and operation of the proposed facility. Applicant has satisfied the requirements of General Standard 345-75-025(10).

XII. Safety

A. Emissions During Normal Operations

1. Standard

Before finding that the general standard on public health and safety, 345-75-025(2), has been satisfied, the Council must find that:

> During normal operations of the facility the radiation dose to any individual in an unrestricted area from all pathways will not exceed 3 millirem per year, total body dose, from liquid effluents; 5 millirem per year, total body dose, from gaseous effluents; or 15 millirem per year to any organ from radioactive iodine or particulate releases in gaseous effluents. Specific Standard 345-76-030(1).

2. Discussion and Findings

The standard does not explicitly state whether the numerical limits are per reactor, or per site regardless of the number of reactors. Applicant argues that it means per reactor because the NRC limits are on that basis. The comment to the specific standard says the standard is not intended to be more restrictive than the NRC requirements. The standard applies to "the facility." Facility is defined in rule 345-76-020(3) as "a

thermal power plant and its related or supporting facilities." Order Adopting Standard (Specific), p. 6; Tr. 5509.

The standard apparently sets limits per reactor, but a decision on that issue is not necessary here. The radiation expected from the pebble Springs Facility is substantially below the limits set in the standard, even if the amounts are doubled.[11]

During normal operation of the proposed facility, radiation from two sources may be available for release to the environment. Fission products from the nuclear fission process may be released to the reactor coolant system from a small number of defective fuel elements. Also, small quantities of impurities will appear in the reactor coolant system as a result of neutron activation of coolant water impurities and other material in contact with the coolant. The reactor coolant system water will be recirculated and there will be treatment systems for it, but some radioactivity will be released as gaseous or liquid effluent. SCA 14-2; Tr. 5486.

The amounts to be discharged were estimated according to models and assumptions consistent with NRC regulations. The estimates are of doses to a person continuously located at a residence close to the proposed facility at which a person would receive the highest concentration of radiation. The estimates also assume that: those people will use the cooling reservoir for recreation such as boating, water skiing, swimming, and sunbathing; that they will eat ducks, geese, and livestock which drink from the reservoir; that the reservoir water will be used to irrigate vegetables and pasture in the vicinity; and that 0.1 percent of the fuel elements will leak. Actual experience indicates that estimating fuel element failure at 0.1 percent may be too high by a factor of 20. Tr. 5486-97.

During normal operation, a person in an unrestricted area close to the proposed facility could receive up to .49 millirem of radiation per year to the whole body from liquid effluents from each proposed reactor. SCA Table 15-3.

In the narrative portion of the SCA, applicant does not state the quantities of gaseous and iodine/particulate effluents the proposed facility is expected to discharge, only saying the dose level limits will not be exceeded. Applicant

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[11] Doubling the radiation expected from one reactor is conservative because exposure to man from two identical reactors is apparently less than two times what one reactor emits. Certainly doubling the single dosage would not yield a number that is too low. Tr. 5508-11.

relies on SCA Table 15-7 to show compliance with the quantitative limits in the standard. Unfortunately, the table is not self-explanatory, and no one explained it during the hearing. No quantitative amounts were stated on cross-examination. SCA 15-11, 15-12.

Citing Table 15-7 as authority, applicant says the estimated average annual dose to the whole body from gaseous effluents during normal operation will be .13 millirem, and the dose from radioactive iodine or particulate gaseous effluents will be .43 millirem to any organ. Citing the same table, the DOE lists the dose from gaseous discharges as .04 millirem per year from both plants, and says the radioactive iodine and particulate discharges will be a small fraction of the total radiation exposure listed. Applicant Brief on Site Specific Standards, p. 6; DOE Opening Brief, Sec. VI. B., p. 4.

No evidence was offered to show that the discharge limits of the standard will be exceeded by the proposed facility.

It appears that applicant's interpretation of Table 15-7 is correct. Applicant's estimates are higher than the DOE's, and are adopted here. Both estimates are well below the limits set in the standard.

3. Conclusions

The quantitative limits set in the standard will not be exceeded during normal operation of the proposed Pebble Springs Facility. The requirements of Specific Standard 345-76-030(1) have been met.

XII. SAFETY

B. Plant Security

In order to find that a proposed nuclear facility satisfies the requirements of the general standard on public health and safety, the Council must find that:

> (2) Security measures at the facility will be capable of providing protection against industrial sabotage, which could result in uncontrolled release of radioactivity, by a determined violent extended assault, attack by stealth, or deception of several persons with the following attributes, assistance, and equipment:
> (a) Well-trained and dedicated individuals,
> (b) Inside assistance,

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(c) Automatic weapons,
(d) Hand-held equipment, including incapacitating agents and explosives.
Specific Standard 345-76-030(2).

Applicant says the security measures at the Pebble Springs Facility will meet the requirements of the Nuclear Regulatory Commission and the Siting Council. The specifics of those measures are still in the planning stage. Even if the plans were final, applicant would not make them public out of concern that doing so would impair or destroy their effectiveness. Tr. 2080, 2085-2102, 2152-2154, 2383-2388, 4019-4028.

Applicant discusses access control, personnel screening, guards, physical barriers, alarms, and other security measures under consideration. But the evidence does not tell how determined saboteurs will be repelled. Applicant promises to meet the standard, but does not demonstrate how.

The record cannot support a finding that the security measures at the proposed Pebble Springs Facility will be capable of protecting against determined sabotage of the type specified in Specific Standard 345-76-030(2).[12]

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[12] Independent of the process of approving or rejecting a site certificate application, the Siting Council has authority, under ORS 469.530(3), to review and approve nuclear power plant security programs. Information on plant security supplied to the Council for its review and approval is confidential, and the Council's reviews are exempt from the Oregon Public Meetings Law. The Council currently reviews, in closed executive sessions, the security programs at the Trojan Nuclear Power Plant. ORS 192.500(2)(j), 192.690(2); OAR 345-70-020.

The Council did not want the specifics of the security plans for Trojan or Pebble Springs to be presented on the record in this proceeding. Siting Council Minutes of August 8, 1978, meeting; Tr. 4024.

Perhaps the Council, in adopting the plant security standard at issue here, wanted to give intervenors an opportunity to present substantive evidence on plant security, or intended to condition a site certificate, if approved, on satisfactory proof of an adequate security plan presented to the Council in closed executive session. Or perhaps it wanted to rely on its own intimate knowledge of nuclear power plant security to satisfy the standard. In any event, the conclusion reached on this standard, as on all the standards, is from a weighing of the evidence presented on the record with the requirements of the standard.

C. Spent Fuel Storage

1. The Standard

Before the Council is authorized to find that General Standard 345-75-025(2) is satisfied, the Council must find that:

> (6) Spent fuel storage systems will be designed to: (a) Prevent loss of water from the fuel pool that would uncover fuel, (b) Protect fuel from mechanical damage, (c) Provide the capability for limiting the potential off-site exposure so that an individual continuously located at any point on the outer boundary of the low-population zone will not receive a whole-body dose in excess of 25 rem or a dose to the thyroid in excess of 300 rem, due to iodine exposure, assuming all the activity in the fuel rod gaps has been released from one fuel assembly. Specific Standard 345-75-030(6).

2. On-Site Storage of Spent Fuel

Applicant plans to replace one-third of the fuel assemblies in each unit each year. Before shipping them off-site for permanent disposal, the spent fuel assemblies will be stored underwater on-site in the fuel building. This section deals with that on-site storage.

For each nuclear unit, applicant plans to have a water-filled pool for storing the spent fuel assemblies. The water level will be at least ten feet above the top of the active portion of the spent fuel elements. Each pool will have capacity to hold the fuel from ten annual refuelings. The pools will be constructed of reinforced concrete and lined with stainless steel. SCA 3-11 through 3-13, 15-14; Tr. 5354.

3. Prevention of Loss of Water

Water for the pools will come from the makeup and purification system, with reserve capability provided by the spray ponds. Redundant monitoring equipment will alarm locally and in the control room if the water level falls below predetermined levels. A separate leak detection system will be installed behind the stainless steel liner. All piping connections are designed to prevent siphoning of pool water. The spent fuel pools are designed to withstand the effects of a "safe shutdown earthquake" - a seismic event producing ground acceleration of 0.25g. SCA 3-10, 3-11, 3-13; Tr. 1387, 5362.

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4. Protection from Mechanical Damage

The storage racks for the spent fuel assemblies will be designed to withstand a "safe shutdown earthquake." Heavy objects will not be allowed to fall on the spent fuel, and crane stops will be used to preclude heavy loads from traveling over the top of stored fuel. Projectile protection will be provided by a reinforced concrete pool cover, by reinforcing the fuel building walls, or by other measures providing similar protection. SCA 3-10 through 3-15; Tr. 5363.

5. Capability for Limiting Radiation Exposure

Radiation detectors will be provided in the pool area to sound alarms if conditions become abnormal. The alarms will be sounded in the pool area and in the control room. Two independent vent systems will have filters and absorbers to remove radioactive particles and iodines. If an accident involving spent fuel occurs and all the activity in the fuel rod gaps from one fuel assembly is released, the radiation exposure at the outer boundary of the low population zone will be 1.5 rem to the thyroid, and 0.4 rem whole body dose. SCA 3-13, 3-16, 3-17, and App. H, pp. H-2 through H-4.

6. Other Evidence

The staff of the NRC reviewed the planned storage facilities for spent fuel at the proposed Pebble Springs Facility and concluded that the design criteria meet the requirements of the NRC. SCA 3-13; SCA Exh. 1, Sec. 9.1.2.

No parties presented evidence that the spent fuel storage plans for Pebble Springs are not designed to meet the requirements of the standard.

7. Conclusions

The spent fuel storage systems for the Pebble Springs Facility are designed to prevent the loss of water, protect the fuel from mechanical damage, and limit potential radiation exposure as specified in Specific Standard 345-76-030(6). The requirements of that standard have been met.

XII. SAFETY

D. Spent Fuel Transportation

1. The Standard

Specific Standard 345-76-030(7) mandates that:

Spent fuel will be shipped in a container such that, if the following hypothetical accident occurs, radiation levels 3 feet from the external surface of the container will not exceed 1 rem per hour, no more than 0.1 percent of the total radioactivity of the container will be released, no more than 1000 curies of inert gases will be released, and the contents of the container will remain subcritical:

(a) A free drop of 30 feet onto a flat unyielding surface, striking the surface in a position for which maximum damage is expected,

(b) A free drop of 40 inches onto a vertical six-inch diameter rod which is at least 8 inches long,

(c) Exposed to a heat equivalent of an oil fire (defined to be 1475° F. for at least 30 minutes), then,

(d) All portions immersed under at least 3 feet of water for at least eight hours.

The Siting Council standard is a paraphrase of the NRC standard on transportation of spent fuel.

2. Shipment of Spent Fuel Assemblies

Applicant plans to replace a third of the fuel assemblies in the core of each plant each year. The fuel assemblies removed will be temporarily stored under water at the plant in a spent fuel pool. Then the fuel assemblies will be placed into special casks for shipment to an off-site storage facility or reprocessing plant. The two Pebble Springs Plants will generate approximately 136 spent fuel assemblies per year, requiring 14 rail car shipments or between 45 and 136 truck shipments per year. The spent fuel assemblies will be radioactive, requiring special handling. SCA 15-14.

The NRC has licensed five different models of shipping casks to transport spent fuel assemblies. Applicant will ship spent fuel assemblies from the Pebble Springs Facility in casks licensed by the NRC. SCA 15-15, 15-18; Tr. 5295.

One of the five approved casks is the General Electric IF-300 fuel shipping cask. Applicant does not have a contract to ship spent fuel from the Pebble Springs Facility in IF-300 casks, but offered the evidence about the IF-300 cask because it is representative of available shipping containers. Exh. A-27; Tr. 5220.

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A typical shipping cask has a thick, leak-tight corrosion-resistant stainless steel liner, a central heat transfer medium such as water or helium, and shielding for gamma radiation of steel, lead, and uranium several inches thick. Protection against impact, puncture, and fire is provided by thick outer plates, protective impact-absorbing crash frames, or other protective overpacks. Heat is dissipated through surface fins; and pressure-relief valves or rupture disks are provided to prevent overpressurization. SCA 15-16; Tr. 5330.

3. Ability of Shipping Casks to Withstand Accidents

General Electric submitted a safety analysis report to the NRC along with its application for licensing approval for the IF-300 cask. The report analyzed cask performance if subjected to the free drop of 30 feet, the 40-inch drop onto a rod, the fire of at least 1,475 degrees F. for at least 30 minutes, and then immersion in three feet of water for at least eight hours. The analysis showed radiation levels three feet from the container to be less than one rem per hour. No more than a tenth of one percent of the total radioactivity in the container was released. In addition, no more than 1000 curies of inert gases were released and the contents of the container remained subcritical. The values shown by the analysis were accepted by the NRC, and are accepted here. Tr. 5251.

In addition to analysis showing that nuclear fuel shipping casks can successfully withstand the specified accident sequence, spent fuel shipping casks have been tested in accident situations at Sandia Laboratory in New Mexico. The tests were performed on casks that had been licensed by the NRC, but had become obsolete because they were not long enough to transport current spent fuel assemblies.

In one test, a truck-mounted spent fuel cask was crashed head-on into a rigid concrete barrier at 60 miles per hour. Only superficial damage to the fins and external piping resulted, with no cask leakage. The test was repeated with the impact increased to 85 miles per hour. There was slight bulging of the forward end of the cask, buckling in the fuel pins close to the impact end, and inconsequential seepage from the cask head. In a third test, a 109-ton locomotive crashed broadside into a truck-mounted spent fuel cask at 81 miles per hour. Some fins were damaged, but the structural integrity of the cask was not compromised. In a fourth test, a cask mounted on a rail car was put in a fire pit and burned for about 100 minutes with the heat much greater than specified in the Siting Council standard. Integrity of the cask was not compromised. The 30-foot free fall specified in the Siting Council standard corresponds to a crash velocity of 30 miles per hour, much less than that used in the successful Sandia tests. Testimony was received concerning additional tests performed at Oak Ridge

National Laboratory in Tennessee. The tests involved the 30-foot fall and the 40-inch drop onto a rod. Test results were not stated. Tr. 5287-88.

The design of current spent fuel shipping casks is better than of those used in the Sandia tests, and the current casks are considered to be superior to the crash-tested casks. Tr. 5332-33.

4. Pressure Release System

In the analysis and tests presented by applicant, the pressure release mechanism on the casks did not fail. Pressure release valves are designed to open and release pressure when the pressure reaches a pre-set value, such as 375 psig. (at 450° F.) on the IF-300 cask. When the pressure drops below that value, the valve closes. The DOE raised the possibility of a pressure release valve failing to open or reseat as designed. After an accident severe enough to create excessive internal pressure, failure of a pressure release valve could lead to emissions greater than allowed by the standard. Exh. S-18, p. 7-2.

DOE witness Godard calculated the probabilities connected with a pressure release valve failure. He used the equipment failure rate from the Rasmussen study, WASH-1400, to estimate the failure probability of the pressure release system. He also conservatively assumed that no corrective action would be taken after the accident, and that the accident would cause a loss of cooling capability. He estimated the probability of a severe accident followed by failure of the pressure release system to be about one chance in a billion per year. Exh. S-18, Table 7-1.

Applicant responded that the pressure release system on an NRC-approved cask would be of nuclear quality. The NRC would require initial inspection under accident conditions and quarterly retesting. The pressure release valve on the IF-300 cask is housed in a protective structure capable of withstanding the specified drop tests without collapse. Analysis presented to the NRC would have to show proper operation of the valves, and the NRC would have to agree with those values before issuing a license. Exh. A-27, pp. 3,4; Tr. 5317.

Even the conservative analysis done by Mr. Godard does not indicate a danger to the public from transportation of spent fuel. No other evidence was presented to show a danger, and a one in one billion chance that the standard will be exceeded is not undue. The DOE concludes that the standard has been met. DOE Opening Brief, Sec. IV. H.

Rupture disks can also be used to prevent the buildup of excessive pressure. No evidence was presented regarding rupture disk failure.

5. Summary and Conclusions

Evidence supporting an affirmative finding on the standard at issue includes the following:

a. Applicant will use a shipping cask that has been approved by the NRC. The standard at issue here is a paraphrase of the NRC standard;

b. Analysis of the IF-300 cask shows it can endure the specified accident sequence and not exceed the emission limits of the standard;

c. The Sandia tests show the casks can withstand severe crashes, and a fire as specified in the standard, without significant structural damage.

It is concluded that applicant will ship the spent fuel from the Pebble Springs Facility in containers that can withstand the accident sequence specified in the standard without emitting more radiation than allowed in the standard. The requirements of Specific Standard 345-76-030(7) have been satisfied.

XII. SAFETY

E. Dam Safety and Dewatering

1. Dam Safety

Before the Council is authorized to conclude that a proposed facility meets the requirements of the general standard on public health and safety, Specific Standard 345-76-035(2) requires the Council to find that any earth-filled dams to be built at an energy facility are capable of "withstanding, without failure, reasonably expected loads."

Applicant intends to construct a reservoir at the Pebble Springs Facility to store water used to cool the reactors. The reservoir will be 1,900 acres in surface area, and hold approximately 60,000 acre-ft. of water. The reservoir will be formed by damming both ends of a shallow depression. SCA 10-5.

The foundation on which the dams will be constructed is comprised of pomona basalt, a lava layer. The core of the dams will consist of compacted clay material; the shells surrounding the core will be composed of sand, silt, and gravel. The slopes on either side of the core will be inclined at three horizontal feet to one foot vertical. SCA 10-6; Tr. 1342, 1362.

PGE is constructing a coal-fired energy facility near Boardman, also in northeastern Oregon. It has constructed a reservoir there and was filling the reservoir at the time oral testimony was taken regarding the Pebble Springs Dams. The foundation material at the Boardman Coal Plant is similar to that at Pebble Springs, and the design of the two reservoirs is similar. Tr. 1346, 6771.

Because earth-filled dams seep water, a drainage collection system will be constructed. It will consist of permeable gravels and piping to collect and carry away the water that seeps through the core of the dams. The drainage collection system is needed to prevent undue saturation of the shell around the core of the dams, to preclude erosion of dam material, and to prevent excessive pressures within the dams. Exh. A-35, p. 2; Tr. 1344.

When the reservoir is filled and in operation, a substantial wind could cause waves, putting additional stress on the dams. Applicant hired Meteorological Research Incorporated to recommend design criteria for wind speed strength, using historical records of the area, including data from the Boardman and Pebble Springs Weather Stations. Meteorological Research recommended that a maximum wind speed of 100 miles per hour be assumed. Applicant adopted that recommendation and utilizes it in its reservoir plans. A tornado could possibly have a wind force greater than 100 miles per hour. But it is unlikely to cause as much hazard to the dams as a regular 100 mile per hour wind speed because it probably would not encompass the entire reservoir area and would draw water up as it passed, thereby reducing the pressure on the dams. SCA 9-14; Tr. 1328-29.

The maximum reported 1-minute wind speed at Arlington is [illegible] mph. That may be exceeded in the future, and the Pebble Springs Site may get wind speeds greater than at Arlington, but designing the dams to withstand the stresses caused by a 100 mph wind is reasonable. SCA 9-16.

An earthquake could damage the dams. The dams will be designed to withstand ground acceleration of .15g. That value was adopted after a geologic and seismic study of the Pebble Springs Region, including the plant site, was performed by the consulting firm of Shannon and Wilson. Maximum historical ground acceleration at the site is estimated to have been between .05g and .07g. Exh. A-35, p. 4; Tr. 1330.

Dams on the Columbia River are typically designed to withstand seismic events creating ground accelerations of up to .10g. The Pebble Springs Facility itself is designed to shutdown safely if ground acceleration reaches .25g. If ground acceleration exceeds .15g, the spray ponds, which are designed

to withstand ground acceleration of .25g, will be relied upon to provide cooling water for the facility. Tr. 1331-1332.

The seismic design of the dams provides a substantial margin of safety beyond estimated historical seismic events, and is reasonable.

The design plans of the dams were analyzed for adequacy by slip circle analysis, called the Bishop Method. Estimates of margins of safety greater than needed to just meet design criteria were computed for the Pebble Springs Dams. The analysis showed that the greatest margin of safety would be during normal conditions when the reservoir is filled, when the safety factor would be 2.6. The least margin of safety would be during an earthquake creating ground acceleration of .15g, when the margin of safety would be 1.1. That is, the dams would have ten percent reserve strength during such an earthquake. Exh. A-35, p. 2; Tr. 6773.

Various materials were subjected to about a thousand tests to determine their suitability for use in the dams. Shear strength, permeability, and compacted weights of the materials were determined. Tr. 1343, 1386; Exh. A-35, p.4.

No affirmative evidence was presented to show that the proposed dams will not be capable of successfully withstanding expected loads.

The Pebble Springs Dams, if constructed as proposed, will be capable of withstanding, without failure, reasonably expected loads.

2. Dewatering

Specific Standard 345-76-035(2)(b) requires the dams to be capable of "being dewatered and refilled to permit any needed repairs to it or related cooling water systems in a manner consistent with the safety of persons and property interests downstream." The standard is interpreted to mean that the reservoir the dams will be built to create can be drained and refilled without undue damage to property interests or injury to persons downstream. Downstream is interpreted to mean the path the water will take when released from the reservoir.

Applicant does not expect to drain the reservoir during the service life of the plant. Nevertheless, it has designed a dewatering structure in the east dam. The dewatering structure will be manually operated, requiring someone to get in a boat, go to the outlet structure, and perform a physical task which will open a gate and allow the water to escape. SCA 10-6; Tr. 1350.

The water would go from the spillway in the east dam to an unnamed gulch, then to Eight-Mile Canyon, then to Willow Creek, and then to the Columbia River. The banks of the unnamed gulch and Eight-Mile Canyon will overflow during dewatering. Applicant will give notice in surrounding areas prior to dewatering. The surrounding areas contain no human habitation or agricultural lands. Any grazing livestock will be moved to higher ground prior to dewatering. Any scouring of land will be restored by applicant. Willow Creek can accommodate the flow from dewatering the reservoir, assuming it is not already full. Applicant will regulate the flow of water from the reservoir so the banks of Willow Creek will not overflow. The reservoir could be drained at up to 410 cubic feet per second (cfs). It would take 88 days to drain the reservoir, assuming a full reservoir and discharge at 410 cfs. SCA 10-12; Exh. A-35, p. 5; Tr. 1353.

Refilling the reservoir would be accomplished through the piping system from the Columbia River used initially to fill the reservoir. Refilling would occur without adverse impacts on persons or property downstream. Exh. A-35, p. 5.

No affirmative evidence was presented to show that the proposed dams would not be capable of being dewatered and refilled consistent with personal safety and property interests downstream.

The Pebble Springs Dams, if constructed as proposed, will be capable of being dewatered and refilled in a manner consistent with the safety of persons and property interests downstream.

3. Conclusion

It is concluded that applicant has met the requirements of Specific Standard 345-76-035(2).

APPENDIX A

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APPENDIX A (continued)

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*The Bonneville Power Administration (BPA) was not a party to this proceeding, but Mr. Kinsey represented BPA employees who testified at the request of the parties.