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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 8, 1975

(24)

Daniel M. Head, Esq., Chairman
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

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File -

In the Matter of
Washington Public Power System
(WPPSS Nuclear Project Nos. 1 and 4)
Docket Nos. 50-460 and 50-513

Gentlemen:

In connection with the evidentiary hearing scheduled to commence in the above captioned case on May 13, 1975, I enclose copies of the Staff's testimony on the following issues:

1. Professional Qualifications and Testimony of J. Eric Schuster on geothermal energy,

2. Professional Qualifications and Supplemental Testimony of N. J. Beskid on geothermal energy,

3. Professional Qualifications and Testimony of Jan Norris on update of Section 11 of the FES and Errata of the FES,

4. Professional Qualifications and Testimony of Donald W. Connor on update of Section 8 of the FES,

5. Professional Qualifications and Supplemental Testimony of Thomas H. Cox on LWA-2 Activities.

I also enclose a copy of the Report of NRC Staff on Site Suitability.

Sincerely,

Robert H. Culp

Robert H. Culp
Counsel for NRC Staff

cc: (w/ enclosures)
Alan S. Rosenthal, Esq.
Dr. Donald P. deSylva
James W. Brennan, Esq.
Joseph B. Knotts, Jr., Esq.
John H. Dunnigan, Esq.
Mr. Donald Francis X. Finn
Mr. Joseph F. Lightfoot
Richard Q. Quigley, Esq.
Atomic Safety and Licensing
Appeal Board
Atomic Safety and Licensing
Board Panel
Docketing and Service Section

Professional Qualifications

of

J. Eric Schuster

My name is J. Eric Schuster and since 1970, I have been a geologist with the Division of Geology and Earth Resources, Washington State Department of Natural Resources. My work specialties with the Division of Geology and Earth Resources include the areas of economic geology, petrology, mineralogy and geothermal.

In 1966, I received a Bachelor of Science in Geology (with distinction) from Washington State University. In 1972, I received a Masters of Science in Geology from the University of Wyoming. In 1966, I was a teaching assistant in the Geology Department at Washington State University and in 1969, I was a teaching as istant in the Geology Department at the University of Wyoming. From 1966-1969, my field experience has included field mapping in the Yukon Territory for Watts, Griffis, and McOuat, Consulting Geologists (Summer 1966) and field mapping in Southeast Wyoming for masters thesis (1967-69).

In 1970, I joined the Division of Geology and Earth Resources, Washington State Department of Natural Resources as a Geologist II and I became a Geologist III in 1974. I am a member of Sigma Gamma Epsilon and Sigma Xi professional societies.

I have attached to this statement, a list of my publications including those which deal with geothermal exploration in the State of Washington.

Publications of J. Eric Schuster

Reports and Papers:

1971 - The feasibility of using electronic data processing to simulate the aggregate industry in western King County, Washington: Washington Division of Geology and Earth Resources preliminary report.

1972 - Distribution of copper and the platinum group in mafic rocks of the Sierra Madre, Carbon County, Wyoming; University of Wyoming unpublished M.S. thesis, 109 p.

1972 - Geothermal exploration in Washington; Proceedings of the Third Annual Thermal Power Conference, Washington State University Engineering Extension Service, Pullman, Washington, pp. 225-245.

1973 - Directory of Washington Mining Operations 1971-72; Washington Division of Geology and Earth Resources Information Circular No. 48, 97 p.

1973 - A learning guide on the geology of the Cispus Environmental Center area, Lewis County, Washington; Washington Division of Geology and Earth Resources and Superintendent of Public Instruction, 53 p.

1973 - The search for hot rocks-geothermal exploration, northwest; Pacific Search, May, 1973, pp. 8-11.

1974 - Geothermal energy potential of Washington; Energy Resources of Washington; Washington Division of Geology and Earth Resources Information Circular No. 50, pp. 5-19.

Testimony

of

J. Eric Schuster, Geologist
Washington State Department of Natural Resources
Division of Geology and Earth Resources
Olympia, Washington

Washington Public Power Supply System
Nuclear Project Nos. 1 and 4
Docket Nos. 50-460 and 50-513

Testimony

of

J. Eric Schuster, Geologist

Washington State Department of Natual Resources

Division of Geology and Earth Resources

Olympia, Washington 98504

50-460
50-513

GEOTHERMAL ACTIVITIES IN WASHINGTON, 1973-1974

During 1973 and 1974 the effort to assess and explore for Washington's geothermal resources has been moving along two fronts. The Department of Natural Resources has continued its attempt to collect and disseminate basic knowledge of Washington's geothermal potential by utilizing the staff of the Division of Geology and Earth Resources and sponsoring or cooperating with other individuals or institutions in the application of several geological, geophysical, and geochemical methods, and in publishing reports for general distribution.

On the other hand, the federal government has been moving toward the leasing of federal lands to private enterprise, and this, when finally accomplished will bring about intensive exploration efforts and the drilling of full-sized geothermal test wells. Since the most attractive areas for geothermal energy in Washington are on federal land, we must wait for this leasing and deep drilling on federal land before we will have indisputable proof of the extent and nature of Washington's geothermal resources.

I would now like to turn to the geothermal effort of the Department of Natural Resources and give you a brief review of our activities during the

last two years. During 1973 and 1974, staff members of the Division of Geology and Earth Resources collected nineteen water samples from nine of Washington's hot springs. These were sent to the U.S. Bureau of Mines, the University of Nevada's Desert Research Institute, and the Department of Ecology for chemical analysis. These three agencies had kindly agreed to perform a limited number of analyses for us free of charge. Analytical results have been received for thirteen of these water samples. These data and other chemical data on Washington's mineral and hot springs indicate that several of the springs may have temperatures deep underground that are in the range of 100°C. to somewhat over 200°C.

Geothermal gradient measurements were made in four drill holes in 1973. No successful measurements were made in 1974. High geothermal gradient and flow of heat upward through the earth's crust can give positive indication of the existence of geothermal energy at depth. Because the drilling of heat-flow holes is an expensive undertaking we have had to make our measurements in holes drilled by the mining industry in their search for mineral deposits, and these holes are generally not located in areas most favorable for the discovery of geothermal energy. This, in part, explains why no particularly high geothermal gradients or heat flows have been measured so far in Washington.

Geologic mapping in the southern Cascade Mountains has continued during 1973 and 1974. Geologic mapping is of prime importance to the discovery of geothermal resources because it provides information on the distribution

and nature of igneous rocks that might serve as sources of geothermal heat. Important information on folding, faulting, and hydrothermal alteration is also collected, and this helps evaluate an area for the possible presence of suitable reservoir rocks. The Division of Geology and Earth Resources has preliminary geologic maps from this study available in open-file form.

In 1974 we embarked on two new geophysical studies in the southern Cascades. One of these is an aeromagnetic survey, conducted in cooperation with the U.S. Geological Survey. This survey involved airborne measurement of the earth's magnetic field along flight lines spaced one mile apart over an area of 3,400 square miles. Such a survey yields information on the types of rock present in the area studied and on folding and faulting in those rocks. Therefore, an aeromagnetic survey can be expected to be useful for mineral exploration as well as geothermal exploration. We should have the results of this survey within the next three months.

The other new project is a gravity survey in Skamania County in an area previously identified by geologic mapping as having many small, young volcanoes and lava flows. This survey resulted in the delineation of two linear areas of less-than-normal gravity in the vicinity of the chain of young volcanoes and lava flows. These negative gravity anomalies may mean that intrusive igneous rocks, fault zones, or hydrothermal alteration zones are present at depth.

These results are most encouraging from a geothermal point of view, and led to our submission of a proposal to the National Science Foundation to

drill heat flow holes in the area of the young volcanoes and gravity anomalies. The purpose is to find out if a source of heat still exists that might support a geothermal reservoir. A grant in the amount of $96,300 was awared by the National Science Foundation on April 2, 1975.

Let us now turn to the federal geothermal program. In 1970 Congress passed legislation directing the Secretary of the Interior to lease federal lands for the purpose of geothermal development. Late in 1973 the regulations and Environmental Impact Statement reached their final forms, and applications for leases began to be received in January, 1974. Geothermal lands may be leased in two ways, depending on whether the U.S. Geological Survey has classified the lands as Known Geothermal Resource Areas (KGRA's) or potential geothermal areas. A Known Geothermal Resource Area is one where geothermal resources are already being developed, have been discovered, or where there is a very strong probability that exploitable geothermal resources exist. These lands are leased on a schedule determined by the Secretary of the Interior and by competitive bid only. So far six KGRA's in California, Oregon, Utah and Nevada have been leased. Neither of Washington's KGRA's has been leased, and neither will be leased in the near future since an environmental impact statement has not been prepared.

The potential geothermal resource areas are far more widespread and are those areas where the U.S. Geological Survey believes geothermal resources are likely to occur, but where proof of commercially valuable

geothermal resources is still lacking. These lands may be leased on a first-come first-served basis by submitting a valid application with a $50 processing fee and the first year's rental fee of $1 per acre to the U.S. Bureau of Land Management. An Environmental Analysis Record or Environmental Impact Statement and the consent of the agency that manages the land surface is required before any noncompetitive leases can be issued.

During 1974 the Bureau of Land Management office in Portland received applications to lease noncompetitive geothermal lands in Washington totaling about 1,000 square miles. Most of these lands are in the Gifford Pinchot National Forest. Unfortunately, the Forest Service has not been funded to produce the necessary Environmental Analysis Record or Environmental Impact Statement, and will not be so funded at least until the beginning of the next fiscal year (July, 1975), so I anticipate that it will be at least one year before any noncompetitive geothermal leases are in force on federal land in Washington.

To conclude this brief review of geothermal activity in Washington, I would like to mention that there has been no deep drilling for geothermal resources, no leasing of state lands for geothermal purposes, and there have been no applications for geothermal drilling permits under the Geothermal Act passed by the State Legislature in 1974. However, geothermal information gathered by the Division of Geology and Earth Resources during the last several years has been used by many consulting geologists and companies interested in geothermal exploration in Washington.

PROFESSIONAL QUALIFICATIONS

Nicholas J. Beskid

Argonne National Laboratory

I am a geologist and my present position is that of Scientific Associate with the Environmental Statement Project at Argonne National Laboratory. Since joining the project in February 1974, my attention has been focused on geologic and hydrologic characteristics of nuclear power plant sites (i.e., geology, seismicity, surface water and groundwater). In addition to physical descriptions of assigned sites my contributions to Draft Environmental Impact Statements prepared at Argonne include evaluations of: the environmental impact of site preparation and plant construction, the impacts on water use (surface water and groundwater), impacts on land use, hydrological monitoring programs, and assessment of alternative energy sources particularly geothermal energy. Project assignments have more recently been expanded to include nuclear fuel processing plants and fossil fuel plants.

I have a Bachelor of Science degree in geology from Youngstown State University, Youngstown, Ohio (1969), and a Master of Science degree in geology (geochemistry with a minor in chemistry) from Miami (Ohio) University (1971).

At Miami University I held a graduate teaching assistantship with responsibilities for instructing geology laboratory sections. In addition to graduate studies I participated in a study of strontium isotope ratios in Ohio stream and ground waters. The results of this study are published in a Department of Interior project completion report of which I am co-author.

Previous to my joining the Environmental Statement Project (1971-1973) I performed research on trace substances in the Radiochemistry group of the Radiological and Environmental Research Division at Argonne. This was made

possible thru the Presidential Internship Program for scientists and engineers. This research involved the development of a method of Th-228 determination in biological samples and resulted in several papers of which I am co-author.

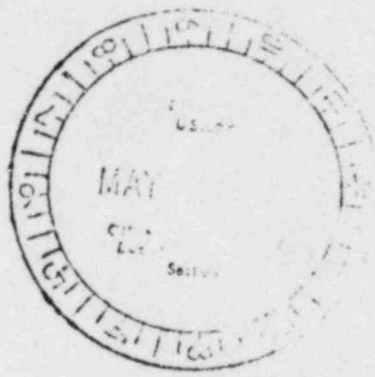
I am a member of the Geological Society of America.

GEOTHERMAL FIELD TRIPS

To adequately fulfill my responsibilities in assessing geothermal energy as an alternative energy source, it was necessary that I acquire a thorough familiarization with geothermal energy and its development. In addition to acquiring and studying available literature, I participated in geothermal field trips.

In April 1974, I visited the Geysers Geothermal Power Plant in California for a personal tour of the facilities. I was taken on a tour of the geyser field where I visited several plant sites, drilling sites and an injection well site. I was also shown through power plant #3 including the generator building for units 5 and 6, where I observed the operation of the facilities.

In June 1974, I participated in a week long geothermal field trip sponsored by the Oregon Department of Geology and Mineral Industries to acquaint participants with the relationships between recent volcanism and geothermal manifestations, and to promote geothermal development in Oregon. The trip was planned in such a way as to give us an opportunity to visit most of the KGRA's (Known Geothermal Resource Areas) in Oregon and one in Washington. At each KGRA visited, we discussed the local and regional geology of the area.



Supplemental Testimony

of

N. J. Beskid, Geologist
Argonne National Laboratory

Washington Public Power Supply System
Nuclear Project Nos. 1 and 4
Docket Nos. 50-460 and 50-513

Supplemental Testimony

by

N. J. Beskid, Geologist
Argonne National Laboratory

In the preparation of the discussion of geothermal energy as an alternative energy source to the energy to be produced by the proposed plant (Final Environmental Impact Statement (FES), pp. 9-2 to 9-4) the Staff conducted a geothermal literature search as well as made inquiries to state officials concerning the status of geothermal exploration in those states. Based upon its assessment of geothermal development in the State of Washington, the Staff concluded that geothermal energy was not a viable energy alternative (FES, p. 9-4).

The purpose of this supplemental testimony is to provide an up-date of the discussion of geothermal energy in the FES. In this connection, I submit the following testimony:

A. In a Report to Congress, the General Accounting Office concluded with regard to geothermal resources that "It appears that through 1985 geothermal resources will not offer a major alternative source of energy, and projections to the year 2000 involve great uncertainty. The development of power from geothermal hot water, geopressured zones, and dry rock is hindered by technical and environmental problems." Comptroller General of the United States, Report to the Congress: Problems in Identifying, Developing, and Using Geothermal Resources. March 6, 1975.

B. The Staff is not aware of any public statements made by any exploration company in the States of Oregon or Washington which outline a timetable for energy production from geothermal resources in these states.

C. Drilling is the most reliable method of characterizing geothermal resources and, therefore, a count of the drilling operations in a region would demonstrate the level of geothermal exploration activity. According to the Staff's information, no deep drilling is currently in progress in the State of Oregon.[1/] One author has recently stated that only one well was drilled in 1974 for geothermal exploration in Oregon and this well was abandoned at 2800 feet after encountering difficult drilling conditions.[2/]

1/ Information supplied to the Staff by Department of Geology and Mineral Industries, State of Oregon, April 29, 1975.

2/ Bowen, R. G., The Ore Bin, January, 1975.

JAN A. NORRIS

DIVISION OF REACTOR LICENSING

U. S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

My name is Jan A. Norris, and I am an Environmental Project Manager on the technical staff of Environmental Projects Branch No. 4 of the Division of Reactor Licensing, United States Nuclear Regulatory Commission. As a member of this staff, I am responsible for managing and coordinating the review of applicants' environmental reports and the preparation of NRC Environmental Statements which meet the requirements of the NEPA and the requirements of 10 CFR Part 51, in connection with applications to the Commission for construction permits or operating licenses for nuclear power reactors.

I hold a Bachelor of Science Degree in Civil Engineering from the University of Colorado and a Master of Science Degree in Nuclear Engineering from the University of Washington. I am a Registered Professional Engineer in the State of Colorado, Utah, Wyoming and Washington, Registered Land Surveyor in the State of Colorado and a Certified Fallout Shelter Analyst registered with the Department of Defense.

I have had more than twenty-three years of professional engineering experience. For five years I was a design engineer with Phillips-Carter-Osborn, Consulting Engineers in Denver, Colorado. In that position I was responsible for design of steel and reinforced concrete structures, conducted hydrological and dam system operation studies of the Indus River basin, and participated in design of Coello Power Plant in Bogota, Colombia.

For twelve years beginning in 1956 I was a Consulting Engineer in private practice with offices in Denver, Colorado. As a consultant I was in full charge of all civil and structural work done by the firm. Areas of work involved the design of water and sewage systems, city planning, and structural design for architectural and industrial clients, municipalities and the Federal Government.

In 1970 I joined the structural division of the Nuclear Power Department of the Naval Shipyard in Bremerton, Washington, where I was responsible for structural aspects of the overhaul and refueling availability of the naval nuclear reactors.

In June 1972 I accepted my present position with the U. S. Nuclear Regulatory Commission and am presently serving as Environmental Project Manager for the Washington Public Power Supply Systems Nuclear Project 1 and 4. In addition I am also serving as Environmental Project Manager for the Nine Mile Point Nuclear Station, Unit 2, in Oswego, New York; River Bend Station, Units 1 and 2 in Louisiana; Three Mile Island, Unit 2, in Pennsylvania; and Washington Public Power Supply System, Units 2, 3 and 5 in the State of Washington.

I am a member of the American Society of Civil Engineers, National Society of Professional Engineers and American Nuclear Society. I am an author of several papers and articles published by the American Nuclear Society, and journals of Teratology, and Radiation Research.

In the Matter of

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Project No. 1 and 4
Docket Numbers: 50-460 and 50-513

Update of Section II of the Final Environmental Statement containing staff's responses to comments on the Draft Environmental Statement received from the Federal Energy Administration

by

Jan A. Norris
Environmental Project Manager
Division of Reactor Licensing

The Final Environmental Statement (FES) related to construction of Washington Public Power Supply System Nuclear Project 1 and 4 was issued on March 10, 1975. Comments from the Federal Energy Administration (FEA) were received on February 20, 1975, 28 days after the expiration of the 45 day comment period. Although a copy of the comments was included in Appendix A to the FES (pages A-23 through A-26), timely publication of the FES precluded incorporation of the staff's answers. The following are staff responses to FEA comments.

Geology (FEA - A-23)

The information on geology and seismology in the environmental statement is not intended to be sufficient for an independent assessment of the adequacy of the facility design with respect to the geologic environment. In accordance with Appendix A, 10 CFR 100, such adequacy is determined by the NRC in its safety evaluation of the proposed station. Therefore, the staff believes the descriptions of geology and seismology in the statement are sufficient.

Noble Gases (FEA - A-24)

In its comments on the DES, the Federal Energy Administration (FEA) stated that the NRC staff did not include in Section 5.4.2.3, "..... a discussion of the environmental impact of direct releases of ..... Kryton-85 .....", Further, the FEA observed that Section 5.4.2.3 "..... asserts that the primary food pathway to man is through a process of digestion by dairy cows of radioiodine .... and the resultant exposure of the human thyroid ...."

With respect to the above portion of the comment staff points out that the impact of Kr-85 releases has been evaluated both in terms of radiation dose

to any total body or skin of an individual (DES Table 5.7), as well as, in terms of total body dose to the offsite population (Table 5.10). Krypton-85 contributed about 3% of the total body dose and about 50% of the skin dose presented in Table 5.7 for WNP-1 and 4 operation.

The statement in the DES that the primary food pathway to man involves radioiodine arises from the fact that of the radioactivity released to the atmosphere, the highest dose to an individual offsite is due to radioiodine releases, rather than to noble gases. As is shown in DES Table 5.8, the dose due to radioiodine (and particulate) releases is estimated to be 9.1 mrem/yr, while the highest dose from noble gas releases to any organ of an individual is 1.6 mrem/yr.

The FEA also stated that the staff did not "... consider the residual effect of krypton-85 or any other gaseous effluents upon biota ... other than for grazing ...", and that "Other birds and animals may come close to the sites, and thereby become directly exposed to the gaseous effluents and take on a toxic dose... [which] can be concentrated and move through the food chain ..."

With respect to this portion of the comment, the staff points out that radiation doses to biota have been evaluated in Section 5.4.1.3 of the DES. Radiation doses to man and biota other than man from noble gases are properly evaluated by considering the noble gas as a source of external, rather than internal, radiation. This technique of evaluating exposures to noble gases was promulgated by the International Commission on Radiological Protection in their Report of Committee II on Permissible Dose For Internal Radiation, 1959

[illegible] information from the [illegible] of the dose modelling techniques used by the staff) in which it is stated:

> "In dealing with inert gases, such as A-41 and Xe-133, the calculations are not based on the dose delivered by the concentration of radioactive material inside the body, but rather on the dose a person would receive if he were surrounded by a semispherical infinite cloud of radioactive gas. In this case, one would expect the radiation from the radioactive cloud to deliver a much higher dose than that from the gas held in the lungs or other body organs."

Noble gases are thus not considered to concentrate in the food chain. This assumption is based primarily on their chemical inertness. The dose evaluation presented in Section 5.4.1.3 assumes that the doses received by terrestrial biota are not significantly different from those calculated for man. For most species, this assumption is very conservative, since it requires continuous habitat at the location of interest (e.g., the site boundary). However, even if a particular species is located closer to the plant than the site boundary, it is expected that the dose increase due to higher concentrations of noble gases will be insignificant (i.e., on the order of the natural background dose rate). This conclusion is based on extrapolating the total body dose at the site boundary (1.2 mrem/yr from [illegible]-1, 2 and 4) to [illegible] the plant.

Additionally, FEA questions if " ... sufficient amount of krypton-85 will be stripped from the gaseous waste and placed in controlled containers. If not,

The alternative of installing cryogenic noble gas strippers and facilities to compress and bottle krypton-85 should be discussed."

Regarding the above comment, staff clarifies that the term "stripping," as used in the DES, refers to the process of separating dissolved gases from the primary coolant liquid and does not infer the stripping of the isotope krypton-85 from the gaseous waste. The alternative of installing cryogenic noble gas strippers and facilities to compress and bottle krypton-85 was not considered in the DES because the proposed radwaste systems meet our ALAP criteria and are therefore acceptable.

Radiological Consequences of Postulated Accidents (FEA - A-24)

With regard to that portion of the comment which relates to the distance of neighboring communities to the plant the staff points out that Table 5.11 and Table 7.2 present the integrated doses delivered to the population living within the 50 mile radius of the plant (in case of Table 5.11 projected year 1980 population, and in case of Table 7.2 projected year 2010 population) and accounts for the proximity the cities of Richland, Kennewick and Pasco, Washington.

Regarding the comment relating to consequences of the postulated accidents due to other than airborne transport mechanisms the staff responds as follows.

The doses calculated as consequences of the postulated accidents are based on airborne transport of radioactive materials resulting in both a direct and an inhalation dose. The staff's evaluation of the accident doses assumes that the applicant's environmental monitoring program and appropriate additional

[illegible] in-plant monitoring) would detect the presence of radioactivity in the environment in a timely manner such that remedial action could be taken if necessary to limit exposure from other potential pathways to man.

In response to the comment which refers to radiological consequences of postulated accidents involving transportation of spent fuels by railroad the staff responds as follows.

The transportation accidents involving radioactive materials are discussed in Section 7.2 appearing on page 7-1 of the FES. The transportation of cold fuel to the plant, of irradiated fuel from the reactor to a fuel reprocessing plant, and of solid radioactive wastes from the reactor to burial grounds is within the scope of the NRC report entitled, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," December 1972. The environmental risks of accidents in transportation are summarized in Table 7.3 on page 7-1 of the FES.

With reference to this portion of the comment which relates to environmental consequences of Class 9 accidents the staff points out that the last two paragraphs on page 7-2 of the FES present a discussion of the environmental risks due to all classes of accidents, including Class 9 accidents. The use of the draft document WASH 1400 in reviewing WCP-1 and 4 plant would be inappropriate at this time because the interim position of the Commission is, in part, that ' ... pending completion and detailed evaluation of the final study ... the contents of the draft study are not an appropriate basis for licensing decisions ..." (Federal Register, Vol. 39, No. 167, pp. 30961-30965, August 27, 1974).

Additionally, in accordance with proposed Annex A to 10 CFR Part 50, the environmental effects of Class 9 accidents need not be evaluated.

Need for Power Generating Capacity (FEA - A-25)

Reasonableness of West Group Forecast (WGF) Forecasts - In the opinion of the staff, the WGF forecast is adequate for four reasons. First, the Loads and Resources Subcommittee of the PNUCC (which prepares the WGF) is an experienced group in forecasting electrical energy and load demand in the Pacific Northwest. Secondly, the forecasting accuracy of the WGF has been good over the period 1958-59 through 1972-73. During this period, the annual average-load forecasts and the percent deviation of the actual from the forecast are shown in the DES and FES as Table 8.2. Third, statistical analysis of these data with the results given in Table 8.3 of the DES and FES was prepared by the staff. According to those results, the root-mean-square error per year of forecast lead time is of the order of one percent per year. Forecasting error was somewhat larger for short-term forecasts. However, the staff notes that forecasting error was smaller for long-term forecasts. The longer-term forecasts have typically been underestimated, as shown by the "mean error" column of Table 8.3.Since the average annual growth rate over the period was about 6.7 percent, the forecast annual-average load value occurred no more than a year earlier or later than initially predicted. Last, the data used by WGF in preparing an energy and load forecast for the WPPS service area includes factors considered to be important in determining future loads by the Federal Power Commission (FPC).[1] The forecasting methodology employed by WGF in preparing an energy and peak load forecast is consistent with the current forecasting methods reviewed by the FPC in the [illegible].[2]

In addition, the staff makes the following observations concerning electrical demand forecasting. Long run forecasting of electrical energy demand and associated growth in peak load may proceed by either projecting the electrical load parameters directly (such as projecting the electrical energy and peak load data, by customer class, and compiling such component information into an overall forecast) or more indirectly, based upon economic theory, relate the economic determinants of electrical energy demand and project the determinants forward in order to estimate future electrical energy demand. With regard to long run forecasting of electrical energy demand, there is no a priori reason to believe that the indirect methodology described above will be any more accurate than the direct methodology most commonly employed by electric utilities.

With regard to forecasting methodology, a survey of twenty-eight environmental reports from different utilities indicates that a variety of different forecasting methodologies are currently employed by electric utilities. The methodologies used are similar to those discussed in Electrical Load Forecasting - A Review, by W. A. Reardon, Pacific Northwest Laboratories, November, 1972, BNWL - 1694. Most commonly, utilities including WPPSS prepare a forecast from a broad data base which includes information obtained from builders, developers, local government planning agencies, trends in sales of appliances, and so forth. Knowledge of new industrial and commercial loads is typically acquired through contact with current or prospective

customers. Significant portions of the input to the preparation of the load forecast are judgmental and not subject to straightforward quantification.

None of the environmental reports surveyed above indicated that the electric utility had prepared its service area load forecast on the basis of an econometric model. Thus, it does not appear that sufficient operational experience has been gained with this forecasting methodology in order to validate its accuracy or reliability versus alternative forecasting methodologies currently employed by utilities.*

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*A draft report by the Washington Thermal Power Plant Site Evaluation Council ("TPPSEC") suggests use of the alternative econometric methodology, "Draft Environmental Impact Statement, Washington Public Power Supply System, Projects WNP-1 and WNP-4," prepared by TPPSEC (March 1974). The staff's comments apply as well to the TPPSEC study.

For the reasons cited above, the Staff concludes that the forecasting methodology prepared by WSF for the WPPS constitutes a reasonable approach consistent with the state of the art practiced by other utilities in long range planning of additional generating capacity.

Financing and Ownership of WNP 1 and 4 - With respect to the question of how the higher generating costs of thermal plants (relative to existing hydro plants) will affect the consumers, WNP-1 generating costs will be transferred to Bonneville Power Administration (BPA) via "net billing" of consumer-owned utilities and exchange agreements with the investor-owned utility participants. The increased cost incurred by BPA will then be reflected in BPA wholesale rates with a resulting increase in average cost of energy to BPA customers. The industrial BPA customers will transfer the cost to ultimate consumer via rate increases. The financing and ownership of WNP-4 are not yet resolved. However, it appears probable that the Applicant will need to have firm contracts from utilities to purchase the WNP-4 output at cost before financing can be arranged. The resulting cost to the utilities can be expected to reach ultimate consumers via rate increases. The rate increases referred to here are general increases. Although changes in rate structures may also occur (e.g., penalties rather than discounts for increased consumption), the staff sees no logical coupling between the two different types of rate changes.

Studies of Electricity Price Responsiveness - With regard to the impact of electricity price on demand, a review of a number of articles and reports concerned with econometric analyses of electricity demand indicates that electricity price can be a significant

determination of electricity demand. [illegible] electricity price elasticities [illegible] or substitute energy price cross elasticities statistically estimated using either current or historical data may not accurately characterize the nature of the future market for electricity. Furthermore, if it were accepted that good predictions of future consumer price responsiveness could be made, an accurate forecast must be made of the future real prices of both electricity and substitute energy.

For instance, the substitute energy form for electrical energy most commonly used in econometric measurements of electricity demand is natural gas. Energy substitution between natural gas and electricity is particularly important in the WPPSS service area for water and space heating applications. The substitutability between energy sources is dependent upon, among other things, the availability of the energy sources such as electricity and natural gas at market prices. If increased supplies of an energy resource such as natural gas are not available to meet increased demand, a significant portion of the excess energy demand may be shifted to electrical or other alternative energy sources.

The staff notes a moratorium on gas connections to new residential, commercial, or industrial customers could be a substantial stimulant to electrical demand. Furthermore, there is significant uncertainty regarding the long term availability of natural gas. There is limited historical experience with this condition in the energy markets of inelastic substitute energy (gas) supply coupled with regulated prices for gas and electricity.

The staff concludes that this condition could reduce the validity of the statistical estimation of own price elasticity (for electricity) and cross-price elasticity (for substitutes for electrical energy) cited above made in time periods when adequate natural gas supplies were available.

Implementing Peak Load Pricing or Time of Day Metering to Reduce Peak Loads - A review of the daily peak load demands for the WPPSS system shows that the highest peaks occur during the week, (exclusive of holidays), the peak demands are reduced on Saturday, and the lowest peak demand occurs on Sunday. Generating requirements are also less on holidays than during the week and load requirements are less at night than during the day. With peak load pricing, the WPPSS electricity users during times of peak use (on a daily basis) are billed at a higher rate to more accurately reflect the higher marginal cost of producing the peak power. The costs of supplying energy at peak periods are higher because high variable cost-low capital costs units (oil, combustion turbine) are used. The base and intermediate load portion of the load is supplied, in general, by high capital, low-cost variable cost generating units (such as nuclear) which operate at higher rates of annual utilization to spread the capital cost over a great many megawatt hours of annual generation. In order to register consumption at different times by electricity users, an additional metering arrangement is typically required.

The effectiveness of peak load pricing as a mechanism for reducing system load peaks depends to a large extent upon the price elasticity of demand for use of the appliance or other load types causing the peaks. For example, the electricity demand for either air conditioning or space heating may turn

principally on outside temperature. In order to make correct estimates of this elasticity, it would be necessary to disaggregate load data and identify the fraction of the load attributable to space conditioning.

Furthermore, to the extent that peaks were flattened, the base or intermediate load requirements may reasonably be expected to rise as the system load factor increases. In theoretical terms, this substitution may be discussed in terms of the cross price elasticity of demand which relates system off-peak electrical energy use to electricity price at the time of system peak. If peak load pricing were implemented, the rate of growth of WPPSSsystem peaks might be reduced. However, improvement in the system load factor might increase the rate of growth of generating requirements for base and intermediate load.

Economic theory indicates that implementation of substantial revisions in rate structure such as peak load pricing could result in some changes in the pattern and growth of electricity demand. The body of literature on quantitative demand analysis for the electricity market does not address the effects of rate structure changes per se although price responsiveness by electricity consumers is generally indicated. Other authors have discussed the potential consequences in theoretical terms of rate structure changes upon demand for electricity. However, a review of the literature on this subject[11-13] does not indicate a commonly agreed upon methodology by economists which the staff could use to estimate devoid of substantial speculation what effect peak load pricing would have upon projected electricity demand within the WPPS service

area. A primary data deficiency is that peak load pricing is not in widespread use in the United States. Consequently, there is currently insufficient information for quantitatively assessing how this measure would affect service area load growth for a utility such as WPPSS.

Inverted rate structure.

In addition, the staff notes that neither the Applicant nor NRC has any authority to alter the rate design by which electrical energy produced by WNP-1 and WNP-4 is sold to ultimate consumers. Utilities such as WPPSS themselves would generally not be able to implement rate re-design measures without a specific legislative authorization. Serious questions of equity among electricity customers and stockholders of the utility would arise. Such questions would arise because utilities are in general required to sell electric energy on a cost of service basis by state regulation of the utility and by the franchise area charter. Any subsidy to one group of customers must be balanced by increased cost to others. The cost includes a fair return on stock-holders equity.

[1] Federal Power Commission, 1970 National Power Survey (Washington: Government Printing Office), Chapter 4, Volume IV, pp. 31-34.

[2] Federal Power Commission, 1970 National Power Survey (Washington: Government Printing Office), Chapter 5, Volume IV, Current Forecasting Methods, pp. 35-41.

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[9] Phyllis H. Kline, Forecasts of Electric Energy and Demand to the Year 2000, A Report by the Task Force Review to the Technical Advisory Committee on Power Supply.

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[11] P. O. Steiner, "Peak Load and Efficient Pricing," Quarterly Journal of Economics 71 (1957): pp. 585-610.

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15 R. Turvey, "Marginal Cost," The Economic Journal 79 (1969): pp. 282-299.

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R. Turvey, "Peak Load Pricing," Journal of Political Economy 76 (1968): pp. 101-113.

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18 H. S. Houthakker, "Electricity Tariffs in Theory and Practice," Economic Journal, March, 1951, pp. 1-25.

In the Matter of

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Project No. 1 and 4
Docket Numbers: 50-460 and 50-513

Errata of the Final
Environmental Statement

by

Jan A. Norris
Environmental Project Manager
Division of Reactor Licensing

1. Page x, [illegible] In the second to the last line add after the word "Commission".

2. Page x, third paragraph. In the third line make the telephone number to read "301-443-5900."

3. Page 7-1, fourth paragraph. In the fifth line after the words "... low occurrence rate.' change the period into a comma and continue the sentence as follows: "and those on the low-potential-consequence end have a higher occurrence rate."

4. Page 9-3, fourth paragraph. On the end of the paragraph change the reference number "10" to read "23."

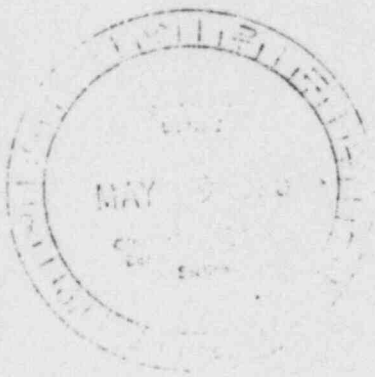
5. Page 9-4, second paragraph. Delete fourth and fifth line in the entirety and change the reference number at the end of the third and last lines from "7" to read "10."

6. Page 9-14. Add reference 23: Final Environmental Statement for Geothermal Leasing Program, Vol. IV, Appendix I, page I-313, U. S. Department of Interior, 1973.

7. Page 11-3, Section 11.2. For "Discharge Design," Section where Topic is Addressed change "5.2.3.2" to read "5.2.3."

In the Matter of

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Project No. 1 and 4
Docket Numbers: 50-460 and 50-513



Update of Section 8 of the Final
Environmental Statement

by

Donald W. Connor
Argonne National Laboratory

As a result of new information which became available to the staff from

a. Pacific Northwest Utilities
Conference Committee
WEST GROUP FORECAST
of Power Loads and Resources
July 1975 - June 1985
February 1, 1975

b. LONG-RANGE PROJECTION OF POWER LOADS
AND RESOURCES FOR THERMAL PLANNING
West Group Area
1975-76 through 1994-95
March 28, 1975

the staff has revised and updated Table 8.1, 8.6, 8.7, 8.8, 8.9, Figure 8.2 and Appendix E. Replace pages 8-6, 8-7, 8-10, 8-15, 8-16, 8-17, 8-18, E-1, E-2, E-3, E-4 and E-5 with the enclosed replacement pages.

Year	Annual-Average Native Firm Load (10^6 kW)		% Increase Over Preceding Year		Annual-Average Export Load (10^3 kWa)	Annual-Average Interruptible Load (10^3 kWa)	Total Annual-Average Load (10^3 kWa)
	I[a]	II[b]	I[a]	II[b]			
1958-59	4.678						
1959-60	5.003		8.23				
1960-61	5.247		3.63				
1961-62	5.604		6.80				
1962-63	5.984		6.78				
1963-64	6.505		8.71				
1964-65	6.885		5.76				
1965-66	7.158	7.248	4.135				
1966-67	7.883	7.967	9.97	9.92			
1967-68	8.630	8.722	9.48	9.48			
1968-69	9.532	9.628	10.45	10.39			
1969-70	9.932	10.101	4.20	4.91			
1970-71	10.427	10.537	4.28	4.32			
1971-72	10.576	10.649	1.43	1.06			
1972-73	11.195	11.321	5.85	6.31			
1973-74	11.572	11.703	3.37	3.37			
			Projected Values				
1975-76		13.5		7.6[c]	0.8	1.1	15.4
1976-77		14.3		5.9	0.8	1.2	16.2
1977-78		15.2		6.4	0.7	1.2	17.1
1978-79		16.1		6.2	0.5	1.2	18.0
1979-80		17.0		5.3	0.6	1.2	18.8
1980-81		17.8		4.4	0.6	1.2	19.7
1981-82		18.6		4.4	0.5	1.3	20.4
1982-83		19.4		4.4	0.3	1.3	21.0
1983-84		20.3		4.6	0.2	1.3	21.9
1984-85		21.3		4.7	0.2	1.3	22.8
1985-86		22.2		4.3	0.3	1.3	23.9

Historical values are taken from Tables 1.1-2 and 1.1-3 of the WNP-1, WNP-4 ER, Docket Nos. 460 and 513. These tables are reproduced herein as Table 8.4. Projected values are based on the PNUCC West Group Forecast, Feb. 1, 1975, Summary of Resources and Requirements (reproduced herein as Table 8.13).

[a]For the West Group Area not including BPA service area in southern Idaho.

[b]For the West Group Area including BPA service area in southern Idaho.

[c]Geometric mean annual increase required over the two-year period from 1973-74 to 1975-76 for the 1975-76 projected value to hold.

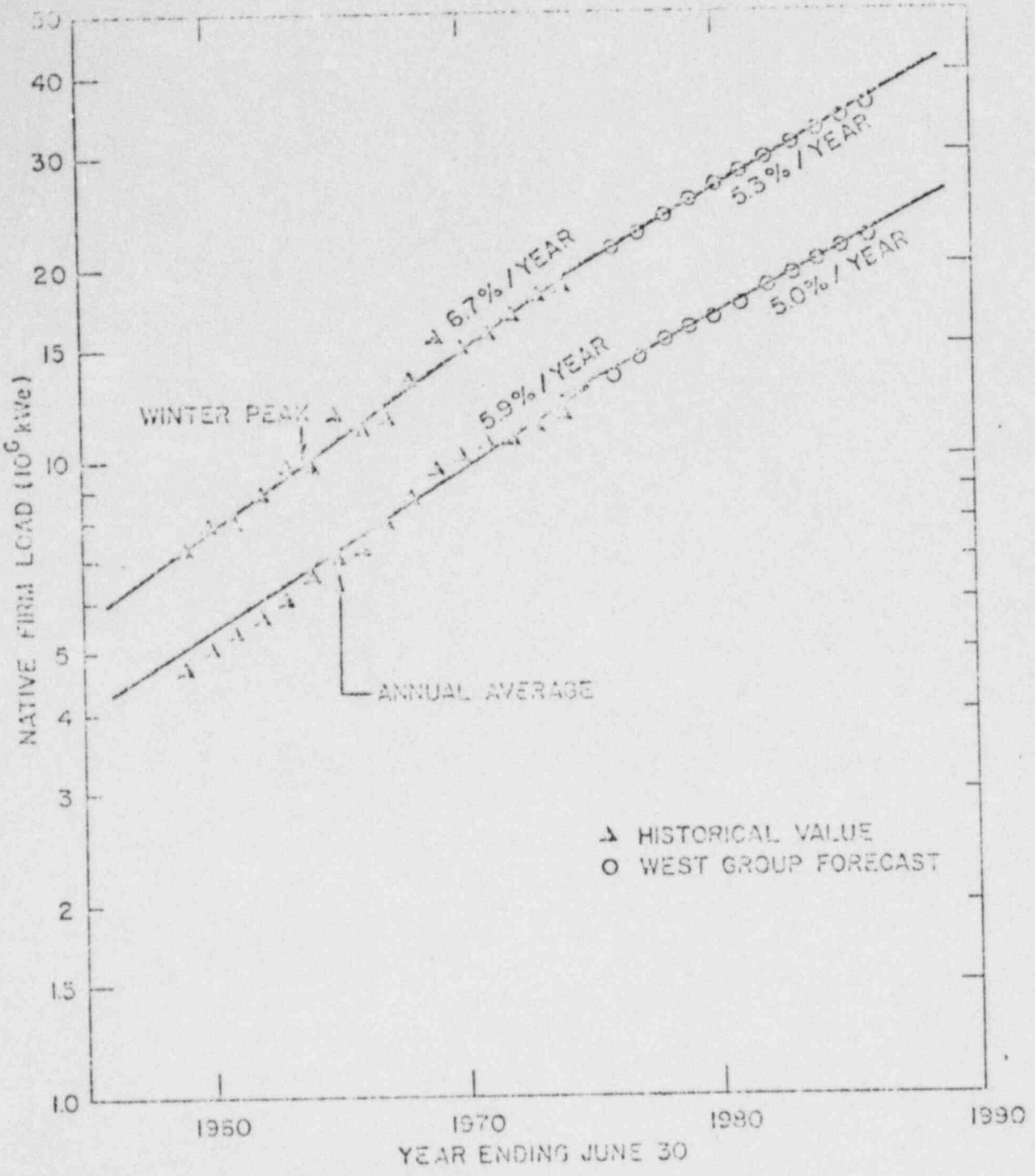


Fig. 8.2. Annual Winter-Peak and Average Native Firm Loads for the Pacific Northwest Region. Values plotted are those given in Tables 8.1 and 8.4.

Table V.1. Historical and Projected Winter-Peak Loads in the Pacific Northwest

Year	Winter-Peak Native Firm Load (10^3 MW)		% Increase Over Preceding Year		Winter-Peak Export Load (10^3 MW)	Winter-Peak Interruptible Load (10^3 MW)	Total Winter-Peak Load (10^3 MW)
	I[a]	II[b]	I[a]	II[b]			
1950-51	7.227						
1951-52	7.803		7.97				
1952-53	7.921		1.51				
1953-54	8.835		11.54				
1954-55	9.754		10.40				
1955-56	9.701		-0.54				
1956-57	11.772		21.35				
1957-58	11.091	11.173	-5.78				
1958-59	11.521	11.613	3.88	3.94			
1959-60	13.212	13.309	14.68	14.60			
1960-61	15.429	15.540	16.78	16.76			
1961-62	14.918	15.033	-3.33	-3.23			
1970-71	15.593	15.725	4.59	4.62			
1971-72	16.734	16.876	7.28	7.32			
1972-73	18.109	18.259	8.22	8.20			
1973-74	18.546	18.707	2.41	2.45			
			Projected Values				
1974-75		21.3		6.7[c]	1.3	1.2	23.7
1975-76		22.5		5.5	2.1	1.2	25.0
1976-77		24.0		6.5	2.2	1.3	26.5
1977-78		25.4		5.8	2.0	1.3	28.0
1978-79		26.8		5.6	2.0	1.3	29.5
1979-80		28.2		5.2	2.1	1.3	30.8
1980-81		29.6		4.8	1.7	1.4	32.3
1981-82		31.0		4.8	1.7	1.4	33.8
1982-83		32.5		4.9	1.5	1.4	35.3
1983-84		34.1		4.8	1.5	1.4	36.9
1984-85		35.7		4.8	1.5	1.4	38.6

[a] Based on Tables 1.1-2 and 1.1-3 of the ER. These tables are reproduced herein as Table V.2 and Appendix E.

[b] For the West Group Area not including BPA service area in southern Idaho.

[c] For the West Group Area including BPA service area in southern Idaho.

[c] Geometric mean annual increase required over the two-year period from 1972-73 to 1974-75 for the 1974-75 projected value to hold.

of petroleum fuels in the U. S.

Against this background, the staff believes it probable that electric energy will replace fossil fuels to an appreciable degree for such purposes as space and process heating. Within the Pacific Northwest, particularly, there are indications that electric space heating is being chosen for most new residences.

8.2.4 Projected Consumption in the Pacific Northwest

In Section 8.2.3, namely, rising real prices, changing social values, [illegible] present of fossil fuels, make the substitution of electric energy [illegible] striking at this time. The staff finds no present means to reduce [illegible]

Nevertheless, new generating plant must be planned years in advance and [illegible] therefore [illegible] basis. Moreover, consumption of electric energy [illegible] 5 to 10 percent per year. The staff believes that it would be especially [illegible] trials that such less growth will occur during the coming decade.

The annual West Group forecast of the NWPCC has been reasonably accurate in the past (see Table 8.3). The staff believes it to be a reasonable basis for the regional [illegible] gas-acting plant. Projections based on the NWPCC appear in Tables 8.1 and 8.6, [illegible]

8.3 ELECTRIC ENERGY SUPPLY

8.3.1 Regional Capacity

According to the projections of Table 8.7, annual-average capability will be somewhat less than load until operating year 1983-84. Moderate reserves (5-8 percent) will be available in later years. Annual-peak capability is projected in Table 8.8 to be adequate from the present through 1985-86.

8.4 RESERVES

Annual-average reserves will be negative under poor water conditions for each year through 1982-83, according to the projections of Table 8.7. In subsequent years, the reserves appear adequate.

Annual-peak reserves will be adequate for the entire period through 1985-86.

8.5 CONCLUSIONS

On the basis of the West Group Forecast (which the staff accepts as reasonable), WNP-1 and WNP-4 will be needed as scheduled by the applicant (1980-81 and 1982-83 operation, respectively) in order to meet expected annual-average load in the Pacific Northwest.

Table 8.7. Projected Annual-Average Load and Generating Capacity for the Pacific Northwest
(1000 MWe)

	Total Load	Capacity					
		Net Hydro[a]	Thermal	Combustion Turbine	Net Import (Export)	Reserve[b] (Deficit)	Reserve (Deficit)
1974-75	15.3	11.4					
1975-76	14.6	11.9	2.3	0.1	(0.2)	(0.5)	(3.4)
1976-77	15.4	12.0	3.1	0.1	(0.3)	(0.5)	(3.2)
1977-78	16.4	12.0	3.3	0.2	(0.2)	(1.1)	(6.7)
1978-79	17.4	12.0	3.3	0.3	0.0	(1.8)	(10)
1979-80	18.2	12.0	4.1	0.3	0.1	(1.7)	(9.3)
1980-81	19.0	12.1	5.6	0.3	0.0	(1.0)	(5.3)
1981-82	19.9	12.1	6.0	0.3	0.1	(1.4)	(7.0)
1982-83	20.7	12.1	7.9	0.3	0.2	(0.2)	(0.1)
1983-84	21.6	12.1	9.3	0.3	0.3	1.0	0.5
1984-85	22.6	12.1	11.6	0.3	0.3	1.7	7.5
1985-86	23.6	12.1	12.4	0.3	0.3	1.5	6.4

[a]Critical-period (worst-case) hydro capacity less an allowance of about 70 MWe for maintenance.

[b]In typical years, about 700 MWe of additional hydro is available. Also about 500 MWe average additional may be available (at very high cost) if all combustion turbines are operated as baseload plants.

Based on the Summary of resources and requirements of the Pacific Northwest Utilities Conference Committee West Group Forecast, Feb. 1, 1975. The Summary is reproduced herein as Appendix E. Estimates have been adjusted to conform with the present schedule for Pebbles Springs Units 1 and 2 which differs from that of the Summary and to reflect that the "Carty Coal" plant shown in the Summary has not been committed at this time.

Table 8.8. Projected Annual-Peak Load and Generating Capacity for the Pacific Northwest (1000 MWe)

	Native Load	Capacity				Reserves (Capacity Minus Load)	Reserves
		Realizable Hydro[a]	Thermal	Combustion Turbine	Imports (Exports)		
1975-76	22.5	22.5	3.1	.8	(1.3)	2.6	12
1976-77	23.7	23.8	3.8	.8	(1.7)	3.0	13
1977-78	25.2	26.2	4.3	1.0	(1.9)	4.4	17
1978-79	26.7	28.3	4.3	1.0	(1.6)	5.3	20
1979-80	28.1	28.9	5.9	1.0	(1.5)	6.2	22
1980-81	30.5	28.9	8.0	1.0	(1.7)	6.7	22
1981-82	31.0	29.2	8.0	1.0	(1.3)	5.9	19
1982-83	32.4	29.7	11.7	1.0	(1.3)	8.7	27
1983-84	33.9	29.9	13.0	1.0	(1.3)	8.7	26
1984-85	35.5	29.8	13.5	1.0	(1.3)	8.5	24
1985-86	37.2	29.8	16.8	1.0	(1.3)	9.1	24

Basis on the Summary of Resources and Requirements of the Pacific Northwest Utilities Coordinating Committee West Group Forecast, Feb. 1, 1976. The Summary is reproduced herein as Tables 3.13 and 3.14. Estimates have been adjusted to conform with the applicant's schedule for Pebble Springs Units 1 and 2 which differs from that of the Summary and to reflect that the "Liberty Coal" plant shown in the Summary has not been committed by the applicant.

[a]Critical-period (worst-case) hydro values.

However, the availability of surplus generating capacity in the operating year 1982-1983 rests on the timely completion of several other large units (WNP-3, Skagit No. 1, Pebble Springs No. 1 and 2). The probability of significant delay in one or another of these units is substantial, according to the experience of recent years. As shown in Table 8.9, the effect of (general) one-year schedule slippage would be a net deficit in annual-average capacity in 1982-83 and a very small reserve in 1983-84. Moreover, delayed construction of WNP-4 would sacrifice the saving in construction costs associated with "back-to-back" construction of similar units which the staff estimates to be of the order of $100 million. On balance, therefore, the staff believes that the proposed schedule is prudent and reasonable.

Table 8.9 Effect of Schedule Slippage on Adequacy of Projected Regional Annual-Average Capacity

	Projected Surplus or (Deficit)		Surplus or (Deficit) with 1 year Slippage	
	%	MWe	%	MWe
1981-82	(7.0)	(1.4)	(9.0)	(1.8)
1982-83	(0.1)	(0.2)	(10.0)	(2.1)
1983-84	0.5	1.0	(4.6)	(1.0)
1984-85	7.5	1.7	0	0
1985-86	6.4	1.5	3.0	0.7

References

1. FPC News, Vol. 7, No. 31, Aug. 2, 1974, p. 1.

2. J. Moyers, "The Value of Thermal Insulation in Residential Construction: Economics and Conservation of Energy," ORNL-NSF-EP-9, Oak Ridge National Laboratory, December 1971.

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4. J. Moyers, "The Room Air Conditioner as an Energy Consumer," ORNL-NSF-EP-59, Oak Ridge National Laboratory, October 1973.

APPENDIX E - SUMMARY OF RESOURCES AND REQUIREMENTS

West Group Area of [illegible] Power Pool

Figures are January Peak and Critical Period Average Energy in Megawatts

March 28, 1975

E-2

Critical Period - Months	1975-76 Ja.	Aug. 42-1/2	1976-77 Ja.	Aug. 42-1/2	1977-78 Ja.	Aug. 42-1/2	1978-79 Ja.	Aug. 42-1/2	1979-80 Ja.	Aug. 42-1/2
[illegible]										
1. Area Loads 1/	22,455	11,5[illegible]	23,664	15,1[illegible]	25,198	16,754	[illegible]	17,5[illegible]	31,166	18,153
2. Exports 2/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. Total Loads	24,163	15,319	25,276	[illegible]	27,370	17,024	28,739	17,[illegible]	30,132	18,711
[illegible]										
4. Hydro 3/	23,193	11,672	24,6[illegible]	12,014	27,173	17,092	29,640	17,110	31,235	17,159
5. Imports 4/	[illegible]	[illegible]	343	[illegible]	342	550	341	[illegible]	[illegible]	[illegible]
6. Existing Small Thermal & Misc. 5/	297	123	2[illegible]7	[illegible]	257	123	257	[illegible]	257	123
7. Combustion Turbines 6/	1,065	208	1,065	[illegible]	1,155	[illegible]	1,155	[illegible]	1,155	[illegible]
8. [illegible] extension & [illegible] #1 7/	-	531	-	531	-	260	-	-	-	-
9. [illegible] #1 & 2	1,450	1,0[illegible]	1,450	[illegible]	1,450	1,060	1,450	1,072	1,400	1,090
10. [illegible]	1,150	563	1,150	[illegible]	1,150	[illegible]	1,150	[illegible]	1,150	[illegible]
11. [illegible] #2, 3, & 4	-	[illegible]	560	[illegible]	1,000	[illegible]	1,0[illegible]	[illegible]	1,333	[illegible]
12. [illegible] #1, 2, 3, & 4	1[illegible]1	117	330	[illegible]	330	237	330	[illegible]	800	[illegible]
13. [illegible]	-	-	-	-	-	-	-	-	1,150	437
14. [illegible]	-	-	-	-	-	-	-	-	-	-
15. [illegible]	-	-	-	-	-	-	-	-	-	-
16. [illegible]	-	-	-	-	-	-	-	-	-	-
17. [illegible] #1 & 2	-	-	-	-	-	-	-	-	-	-
18. [illegible] #1 & 2	-	-	-	-	-	-	-	-	-	-
19. [illegible]	-	-	-	-	-	-	-	-	-	-
20. [illegible] Resources	27,5[illegible]	14,876	[illegible]5,763	15,361	32,777	16,695	35,473	16,711	37,967	17,190
21. Reserve Requirements 8/	(2,[illegible])	([illegible])	(3,07[illegible])	([illegible])	(3,5[illegible])	([illegible])	(3,[illegible])	([illegible])	(4,[illegible])	([illegible])
22. Hydro Maintenance 9/	-	(32)	-	([illegible])	-	([illegible])	-	([illegible])	-	([illegible])
23. Stabilization Factor 10/	([illegible])	-	([illegible])	-	([illegible])	-	([illegible])	-	([illegible])	-
24. Net Firm Resources	24,208	14,605	25,604	15,377	28,367	15,651	30,504	15,761	32,443	16,737
25. Surplus or (Deficit) (24 - 3)	45	(714)	106	(727)	997	(1,373)	1,764	(2,145)	2,311	(1,581)
[illegible]										
26. Potential Hydro 11/	-	-	-	-	-	-	-	-	-	-
[illegible] Thermal 12/										
27. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
28. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
29. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
30. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
31. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
32. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
33. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
34. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
35. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
36. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
[illegible]										
37. [illegible]	-	-	-	-	-	-	-	-	-	-
38. Total Potential Resources	-	-	-	-	-	-	-	-	-	-
39. Total Area Resources (38 + 24)	24,208	14,605	25,604	15,377	28,367	15,651	30,504	15,761	32,443	16,737
40. Area Surplus (Deficit) (39 - 3)	45	(714)	106	(727)	997	(1,373)	1,769	(2,145)	2,311	(1,581)
41. DSI Industrial Interruptible Loads 13/	1,091	1,016	1,113	1,076	1,164	1,091	1,141	[illegible]	1,359	1,174

Critical Period - Months	1980-81 Ja.	Aug. 42-1/2	1981-82 Ja.	Aug. 42-1/2	1982-83 Ja.	Aug. 42-1/2	1983-84 Ja.	Aug. 42-1/2	1984-85 Ja.	Aug. 42-1/2
[illegible]										
1. Area Loads 1/	29,1[illegible]	18,[illegible]	30,2[illegible]	17,636	[illegible]	20,506	33,674	21,[illegible]	35,457	22,[illegible]
2. Exports 2/	[illegible]	[illegible]	[illegible]	432	[illegible]	[illegible]	1,225	[illegible]	[illegible]	[illegible]
3. Total Loads	31,571	19,163	[illegible]	[illegible],268	34,645	20,931	3[illegible],377	21,7[illegible]	[illegible]	22,[illegible]
[illegible]										
4. Hydro 3/	30,231	17,163	[illegible],675	17,169	[illegible]	17,290	31,703	17,256	[illegible]	[illegible]
5. Imports 4/	440	559	[illegible]	561	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6. Existing Small Thermal & Misc. 5/	[illegible]	123	[illegible]	123	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7. Combustion Turbines 6/	1,155	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]
8. [illegible] extension & [illegible] #1 7/	-	-	-	-	[illegible]	505	[illegible]	[illegible]	[illegible]	[illegible]
9. [illegible] #1 & 2	1,400	1,0[illegible]	1,400	1,090	[illegible]	1,0[illegible]	1,4[illegible]	1,0[illegible]	[illegible]	[illegible]
10. [illegible]	1,150	[illegible]	1,150	542	[illegible]	[illegible]	1,150	[illegible]	[illegible]	[illegible]
11. [illegible] #2, 3, & 4	1,3[illegible]	[illegible]	1,333	1,000	[illegible]	[illegible]	[illegible]	1,000	[illegible]	[illegible]
12. [illegible] #1, 2, 3, & 4	1,3[illegible]	945	[illegible]	1,070	[illegible]	[illegible]	[illegible]	1,0[illegible]	[illegible]	[illegible]
13. [illegible]	1,[illegible]	364	[illegible]	605	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14. [illegible]	[illegible]	300	[illegible]	375	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15. [illegible]	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16. [illegible]	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]
17. [illegible] #1 & 2	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18. [illegible] #1 & 2	-	-	-	-	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19. [illegible]	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]
20. [illegible] Resources	[illegible]	18,[illegible]	[illegible],734	18,[illegible]	[illegible]	20,[illegible]	44,727	22,[illegible]	[illegible]	23,[illegible]
21. Reserve Requirements 8/	(5,[illegible])	([illegible])	([illegible])	([illegible])	([illegible])	([illegible])	([illegible])	([illegible])	([illegible])	([illegible])
22. Hydro Maintenance 9/	-	([illegible])	-	(73)	-	([illegible])	-	(22)	-	([illegible])
23. Stabilization Factor 10/	([illegible])	-	([illegible])	-	([illegible])	-	([illegible])	-	([illegible])	-
24. Net Firm Resources	32,862	17,323	32,628	17,904	36,696	20,127	3[illegible]	21,[illegible]	39,037	23,4[illegible]
25. Surplus or (Deficit) (24 - 3)	1,291	(1,840)	53	(1,364)	2,051	(804)	1,505	5	[illegible]	73[illegible]
[illegible]										
26. Potential Hydro 11/	-	-	-	-	-	-	-	-	-	-
[illegible] Thermal 12/										
27. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
28. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
29. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
30. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
31. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
32. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
33. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
34. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
35. [illegible] June 19[illegible]	-	-	-	-	-	-	-	-	-	-
36. [illegible] July 19[illegible]	-	-	-	-	-	-	-	-	-	-
[illegible]										
37. [illegible]	-	-	-	-	-	-	-	-	-	-
38. Total Potential Resources	-	-	-	-	-	-	-	-	-	-
39. Total Area Resources (38 + 24)	32,862	17,323	32,628	17,904	36,696	20,127	36,[illegible]	21,[illegible]	39,037	23,4[illegible]
40. Area Surplus (Deficit) (39 - 3)	1,291	(1,840)	53	(1,364)	2,051	(804)	1,505	5	[illegible]	73[illegible]
41. DSI Industrial Interruptible Loads 13/	1,199	1,134	1,222	1,155	1,233	1,154	1,2[illegible]	1,2[illegible]	1,274	1,235

See following page for footnotes

1/ Area loads are estimated January peak and critical period average energy firm loads of private utility and public agency systems, Federal agencies, and BPA industrial customers. BPA industrial customer loads also include interruptible loads. Loads also include area transmission losses.

2/ Exports include deliveries to California utilities under the CSPE agreement, peak/energy exchange contracts with PSW, transfers of Centralia power to Central Valley Project, WWP Co. contracts with Idaho and Montana Power Companies, PSP&L Co. contracts with Montana Power Co. and Salt River Project, PP&L Co. transfers to PP&L Co. Wyoming Division, BPA contracts with Montana Power Co. for geographic preference, wheeling payments, Hanford-NPR exchange, Hanford-NPR extension, and WWP No. 1 deliveries.

3/ Hydro resources include those shown in the 1974 West Group Forecast report plus High Ross Addition in July 1978 and additional peaking capability to reflect realistic peaking conditions for the Columbia plants.

4/ Imports include energy returned to the PNW from peak/energy exchange contracts with PSW utilities, PGE Co. contract with Southern California Edison Co., PP&L Co. transfers from PP&L Co. Wyoming Division, PSP&L Co. contract with Montana Power Co., WWP Co. contracts with Montana, Idaho, and Utah Power Companies, and BPA imports from Montana Power Co. for delivery to U.S. Indian Irrigation District.

5/ Existing small thermal and miscellaneous includes old existing steam plants, small diesel generators, and miscellaneous small industrial purchases.

6/ Combustion turbines include PP&L's Libby unit, PGE's Bethel, Harborton, and Beaver units, PSP&L's Whidbey Island and Whitehorn units, and WWP's Othello unit.

7/ Hanford-NPR extension capabilities are based on production of 4.5 billion kilowatt-hours per year through 1976-77 and 1.5 billion kilowatt-hours for the period July through October of 1977-78. The plant was assumed shut down thereafter. The plant was not considered dependable as a peaking resource. WWP No. 1 is a new project not related to Hanford-NPR.

8/ Reserve requirements on peak are based on 12 percent of the total area loads for the first year, increasing at a rate of one percent per year up to 20 percent, and remaining at 20 percent thereafter. Reserve requirements on energy are based on one-half year's load growth of utility-type loads.

[illegible] during the critical storage period are the same as shown in the 1975 West Group Forecast report. Peak hydro maintenance is included with the peak forced outage reserves.

10/ Realization factor is the adjustment to the Federal hydro peaking capability to reflect inability of the Federal system to achieve its full peaking capability at any one specific instance.

11/ Potential hydro resources shown on Table 5 (of the Long-Range Projection, not shown here) reflect projects most likely to be constructed in the future. Fifty percent of this capability (excluding pumped storage) was apportioned over the period 1987-93 through 1994-95. Pumped storage projects were installed where needed to meet area capacity requirements.

12/ Potential thermal resources are future projects needed to meet the additional area requirements after use of the potential hydro resources. These projects are installed in January or July as determined on the basis of energy requirements. Project size was chosen at a maximum of 1,200 megawatts.

13/ BPA industrial loads are interruptible loads served directly by BPA and are included in Line 1 above. These loads do not include the associated line losses.

THOMAS H. COX

DIVISION OF REACTOR LICENSING

U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

I am a Licensing Project Manager on the technical staff of the Light Water Reactors Branch 2-3, Division of Reactor Licensing, U.S. Nuclear Regulatory Commission. My function is to evaluate and coordinate the radiological safety review performed by the Division of Technical Review on specific licensing applications for the construction and operation of nuclear facilities. I have the project management responsibility for the technical management and coördination of the safety reviews for the applications assigned to me.

I accepted an appointment with the technical staff of the U.S. Atomic Energy Commission in August 1973 and presently have project management responsibility for the radiological safety and site suitability reviews of the WPPSS Nuclear Projects No. 1 and 4. In this regard, I have supervised the preparation of the Division of Reactor Licensing's Safety Evaluation Report documenting the NRC staff's radiological safety review.

In 1958, I received a Bachelor of Science in Mechanical Engineering degree from the Johns Hopkins University. In 1966, I received the Master of Science in Mechanical Engineering degree from Drexel Institute of Technology. I successfully completed additional graduate studies in Management Science at the Johns Hopkins University in 1967.

I have a total of 15 years of professional experience, all in the nuclear engineering field. For ten years, I was employed by the Nuclear Division of the Martin-Marietta Corporation, where I worked in increasingly responsible capacities on a number of nuclear power generating projects for military applications, including the PM series of reactor plants and the MH-1A barge mounted nuclear electric plant. Following this, I was employed by Hittman Associates, Inc. where I supervised an engineering design section and fulfilled project management responsibility for various projects originating within the section. These projects included radioactive waste processing equipment and transport casks for shipment of nuclear wastes to disposal sites.

Subsequent to employment at Hittman Associates, I was employed by the Reactor Fuels Division of Nuclear Fuel Services, Inc., where I was supervisor of the engineering design group responsible for the mechanical engineering design of fuel assemblies for reload supply to commercial light water reactor plants.

I am the author or co-author of several technical publications.

U. S. NUCLEAR REGULATORY COMMISSION

WASHINGTON NUCLEAR PROJECTS NO. 1 AND 4

DOCKET NOS. 50-460 and 50-513

SUPPLEMENTAL TESTIMONY OF THE NRC STAFF

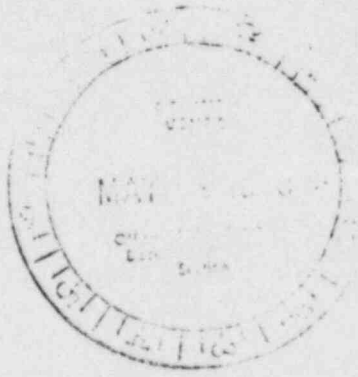
On

LWA-2 Activities

By

Thomas H. Cox

Licensing Project Manager



A. INTRODUCTION

By letter to the Commission dated January 31, 1975, the applicant in this proceeding, the Washington Public Power Supply System (WPPSS or Applicant), requested a limited work authorization (LWA) pursuant to 10 CFR §50.10(c). In addition to requesting authorization to conduct activities pursuant to 10 CFR §50.10(e)(1), Applicant requested authorization to conduct subsurface soil preparation at the bottom of the excavations for certain safety-related structures. This subsurface soil preparation would be subject to the Quality Assurance provisions of 10 CFR §50 Appendix B, and, hence to the provisions of 10 CFR §50.10(e)(3). §50.10(e)(3) states that before the Director of Regulation may authorize such activity, it is necessary for the Atomic Safety and Licensing Board (Board) to determine that there are no unresolved safety issues relating to this work activity that would constitute good cause for withholding authorization. The safety-related activity which Applicant has requested pursuant to §50.10(e)(3) is hereinafter referred to as LWA-2 activity.

B. LWA-2 ACTIVITIES REQUESTED BY APPLICANT

Applicant has requested authorization for the following LWA-2 activity:

Construction of Structures, Systems and Components which are Subject to the Provisions of 10 CFR 50, Appendix B

Excavation for the Containment and General Services Building will include work subject to Appendix B. The work consists of:

(1) Verification that the excavation has exposed the very dense, sandy gravel zone (the Ringold Formation) upon which the mudmat will be poured.

(2) Density checks of any pockets of insufficiently dense material uncovered in the gravel zone, and removal of this material and backfilling if necessary (Applicant's PSAR Chapter No. 2, Appendix 2P).

(3) Proof rolling prior to placement of the mudmats, under the Containment and General Services Building (together with the taking of density checks before and after proof rolling). Applicant's response to NRC Staff Question 3.58 contained in PSAR, Volume 8.

This testimony pertains to safety issues relating to the above LWA-2 work item.

C. STAFF REVIEW AND CONCLUSION THAT NO UNRESOLVED SAFETY ISSUES RELATE TO THE PROPOSED LWA-2 ACTIVITY

The NRC staff position stated in Regulatory Guide 1.29, "Seismic Design Classification", is that the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 should be applied to all activities affecting the safety-related functions of the primary and secondary reactor containment. Since Applicant seeks authorization for preparation of the subsurface founding soil at the bottom of the excavation for certain safety-related structures, this subsurface preparation is subject to the provisions of Appendix B to 10 CFR Part 50. Applicant has not requested any other activities which are subject to the provisions of Appendix B.

The NRC staff has completed its safety review with regard to the above described LWA-2 activity and has concluded that there are no unresolved safety issues relating to this activity that would constitute good cause for withholding the authorization to conduct this activity. In this testimony, I set forth those safety issues which have been identified to date by the staff as outstanding, or unresolved, that could possibly relate to the proposed LWA-2 activity. For these issues I provide a basis for the conclusion that these unresolved safety issues do not relate to the proposed activity, and therefore do not constitute good cause for withholding authorization for the requested activity.

Finally, I discuss Applicant's Quality Assurance Program which is applicable to the activities proposed under an LWA-2.

The following unresolved safety issues have been identified to date by the staff and are contained in the staff's Safety Evaluation Report (SER) which is now in preparation and will soon be published.

1. The staff has not completed review of Applicant's analyses to demonstrate compliance with the Final Acceptance Criteria for the ECCS. Based on the staff's review to date, it is not expected that component hardware changes will be required of Applicant to meet the Final Acceptance Criteria. Even if such changes were required, the use of alternate designs, if necessary, would not require changes in the proposed founding soil density for the Containment and General Services Building (C&GSB).

   I conclude that there is no relationship of the required Final Acceptance Criteria analyses to the proposed LWA-2 activity that would constitute good cause for withholding authorization for the requested activity.

2. The staff has not completed the review of Applicant's analyses of pressure responses within all containment interior compartments or of the pressure response within the overall containment, for a hypothetical loss-of-coolant accident. The design of the containment is similar to designs for other facilities that have been

reviewed and found acceptable by the staff. The staff's review experience is that design changes, if they should be needed, would be limited to the containment structure itself. Any or all of the anticipated changes that might be required will not have any effect on the required density of the founding soil underneath the C&GSB. I conclude that this unresolved safety issue does not relate to the proposed LWA-2 activity and therefore does not constitute good cause for withholding authorization for the requested activity.

3. The staff has recently been informed that Applicant will propose changes in either the emergency spray pond design or the design of the plant components and systems that reject heat to the pond in the event of an accident requiring use of the pond. The staff has already found Applicant's original spray pond design acceptable, and expects that this issue can be satisfactorily resolved. Resolution of this issue will in no way affect requirements on the founding soils under the C&GSB, since the emergency spray pond is located at some distance from the C&GSB. I conclude that this unresolved safety issue does not relate to the proposed LWA-2 activity and therefore does not constitute good cause for withholding authorization for the requested activity.

4. A number of electrical instrumentation and control system issues are unresolved at this date. These issues concern component and system design and are related to qualification testing of components, local versus remote operation of systems or components and design for separation, independence and diversity of redundant systems. Design of the WNP-1,4 electrical systems and components is similar to designs for other facilities that have been reviewed and found acceptable by the staff. The staff's review experience leads to the conclusion that design changes, if required, would be limited to systems and components within the safety-related structures and would not require changes in the minimum required soil density under the C&GSB.

Based upon the unresolved safety issues discussed above, all of which are unrelated to the proposed LWA-2 activity, I conclude that there are no unresolved safety issues that constitute good cause for withholding authorization for the requested LWA-2 activity.

D. QUALITY ASSURANCE

The NRC staff has completed its review of the Quality Assurance program for construction of the proposed facility. Within the WPPSS corporate organization, the functional responsibility for quality assurance is assigned to the Manager of Quality Assurance who reports directly to the Manager, Technical Division, assuring the organizational freedom to identify problems affecting quality and insuring that

solutions are obtained and implemented. This organizational structure assures freedom from cost and schedule pressures.

The authority of the Quality Assurance Manager to carry out the Quality Assurance program, including stop work authority, is contained in a statement by the WPPSS Managing Director, the highest corporate officer in WPPSS. This statement is documented in the WPPSS Quality Assurance Program Manual which is the official WPPSS policy document regarding quality assurance. The staff found this assignment of authority acceptable.

A Manager of Quality Systems and a Project Quality Assurance Manager work for the Manager of Quality Assurance. The Manager of Quality Systems is responsible for developing and establishing the QA program and for monitoring its implementation and effectiveness. The Project Quality Assurance Manager is responsible for managing and coordinating project quality assurance activities to assure implementation of the QA program and for functional direction of the architect-engineer-constructors QA program and activities.

WPPSS requires that both the Manager Quality Assurance-Projects and Manager Quality Systems have the equivalent of a BS degree in Engineering (or related field) plus five years experience in quality assurance activities. To achieve the necessary background and experience for WPPSS staff personnel, an indoctrination and training program has been established. Individuals involved in the QA program will be involved in formal training programs and on-the-job training by WPPSS supervisory personnel.

The staff has found (1) that WPPSS has adequately described the authorities and duties of persons and organizations performing quality assurance functions, (2) that the QA organization is independent of organizations performing quality related activities, (3) that the organization has sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify implementation of solutions.

The staff reviewed the QA program proposed by WPPSS. The QA policies and procedures used to administer the QA program are contained in the WPPSS Quality Assurance Program Manual. WPPSS provided a brief description of each of the procedures and a cross index to the related criteria of Appendix B to 10 § 50 in the PSAR. Based on our review of this information, we have concluded that each criterion of Appendix B to 10 CFR § 50 has been specifically included in written procedures within the WPPSS QA program. The structures, systems, and components that are subject to this program have been identified in the PSAR.

A comprehensive system of planned and documented audits is used by the applicant to verify compliance with all aspects of the QA program and to assess its effectiveness. The implementation of each applicable criteria of 10 CFR § 50, Appendix B is audited annually.

Audits are performed in accordance with written procedures or checklists by appropriately trained personnel having no direct responsibilities in the area audited. Audit results are documented and reported to appropriate levels of management for corrective action. Responses to WPPSS's audit findings are verified for implementation and effectiveness during follow-up audits. The staff has found that Applicant's audit activities are satisfactory.

The staff has found that Applicant has adequately described a QA program which embodies sufficient policies, procedures, and instructions to fully implement 10 CFR § 50 Appendix B for safety-related structures, systems, and components.

The staff has concluded that Applicant's QA program for this facility is being implemented by a QA organization with sufficient authority and organizational freedom, and contains adequate policies procedures, and instructions to meet the requirements of Appendix B to 10 CFR § 50.

The NRC staff has also examined Applicant's Quality Assurance program at Applicant's facilities in Richland, Washington and found: (1) Applicant has provided and implemented a Quality Assurance program commensurate with the project status and (2) this program, including Applicant's corrective measures, is adequate and conforms to the commitments in the application.

Subsequent to the request for an LWA-2, the NRC Office of Inspection and Enforcement (OIE) examined those portions of the Quality Assurance program which will be applicable to the requested LWA-2 activity. The OIE has found that Applicant is implementing a Quality Assurance program which is consistent with 10 CFR § 50, Appendix B, and the commitments in the application.

The OIE will perform additional inspections to examine the continued implementation of the Quality Assurance program as it applies to LWA-2 activity if authorized.

Since both the program and the implementation are acceptable at this time, and since the OIE will perform additional inspections to assure continued acceptable implementation, I conclude that there are no unresolved quality assurance matters that would be good cause for withholding authorization.

E. CONCLUSION

The staff has reviewed all of the safety-related issues with regard to the LWA-2 activity proposed by Applicant, and has found that, for the reasons stated above, there are no unresolved safety issues related to this activity which would constitute good cause for withholding authorization for this activity.

U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON NUCLEAR PROJECT NOS. 1 AND 4
DOCKET NOS. 50-460,513
REPORT OF NRC STAFF ON SITE SUITABILITY

In accordance with 10 CFR Part 10(e), the NRC staff has reviewed the applicants proposed site location for the WNP-1 and 4 units to determine whether the site is suitable for two light water reactor generating plants of the general type proposed. The WNP-1,4 site is in Benton County, Washington, 2.5 miles west of the Columbia River and approximately 8 miles north of the city of Richland, Washington. The site area is one mile east of the WNP-2 nuclear powered generating unit now under construction.

WNP-1 and WNP-4 are each designed for a rated thermal output of 3619 MW and a net electrical output of about 1218 MW. The site evaluation has been conducted on the basis of an ultimate thermal power capability of 3760 MW from each reactor. The nuclear steam supply systems, including the initial cores, will be purchased from the Babcock & Wilcox Company. The turbine generators will be purchased from the Westinghouse Electric Company.

Our review included the reactor site criteria given in the Commission's regulation concerning site suitability as related to radiological health and safety (10 CFR Part 100). The factors considered are the population distribution and density, the use characteristics of the site environs including whether there are nearby industrial, military or transport facilities that could influence the acceptability of the site and the physical characteristics of the site. Each of these factors has been considered in

detail by NRC staff specialists qualified in the technical disciplines involved. The staff evaluated information provided by the applicant, made visits to the site, and performed independent studies and calculations. On the basis of these efforts, we have reached the conclusions presented in the following sections of this report.

A. POPULATION DENSITY AND USE CHARACTERISTICS

The exclusion area consists of the envelope of the two circles each having a radius of 1950 meters (1.2 miles) and centered on each of the proposed containments. The applicant is making arrangements with the U. S. Energy Research and Development Administration (formerly part of the U.S.A.E.C.) for the lease of 972 acres of land lying within the exclusion area, and upon which the principal station structures are to be located. In addition, the applicant currently is leasing 1089 acres for the WNP-2 unit, which is contiguously located. Part of the exclusion area lies outside the leased acreage and remains under the ownership of the Energy Research and Development Administration (ERDA). The applicant has committed to obtain a written agreement from ERDA, similar to one obtained for WNP-2, wherein the AEC stated that it recognized the existence of an exclusion area and would undertake no activities within this area which would interfere with or restrict the applicants right to fully comply with this condition of the license. With the possession of such a lease and letter of intent from ERDA, we conclude that there will be reasonable assurance that the

applicant has the authority, within the meaning of 10 CFR Part 100.3(a), to determine all activities within the designated exclusion area. We will require that WPPSS obtain, prior to issuance of an LWA, such lease as described above and obtain from ERDA a written agreement or letter of intent with regard to the WPPSS authority to control all activities within the unleased portions of the exclusion area.

The exclusion area is traversed by the mainline track of the Hanford Reservation railroad system, a railroad spur line leading to the FFTF facility, and access roads leading to the WNP-2 and WNP-1 and 4 facilities. None of these routes are open to the general public. The WNP-2 unit, presently under construction, is located within the exclusion area as is the proposed H. J. Ashe substation and the existing Wye burial ground, a nine acre radioactive waste burial facility, located about a mile away. The only activities unrelated to plant operations within the exclusion area will be travel along the above routes and activities at the above-mentioned facilities.

The applicant has selected a low population zone (LPZ) radius of four miles. According to the 1970 census, 38 persons resided within the LPZ. In addition to the resident population, the present transient population within the LPZ consists of about 450 agricultural and industrial workers. This is projected to increase up to a maximum of 900 workers, because of the work force associated with the WNP-2 and FFTF facilities. In addition, about 2000 workers pass through the LPZ twice per day traveling to and from their jobs in other areas of the Hanford reservation. The nearest population

center with more than about 25000 persons is the city of Richland, Washington, located 8 miles south of the site. Richland had a 1970 population of 26,290 persons. The population center distance is at least one and one-third times the LPZ distance, as required by 10 CFR Part 100.

The 1970 population density within 10 miles of the site was less than six people per square mile, and is projected to increase to 23 people per square mile by the year 2020. Within 30 miles of the site, the 1970 population density was about 35 people per square mile and is projected to increase to 67 people per square mile by the year 2020. Since the nearest large city is more than 30 miles away, no special considerations need to be given to distance from this large city.

We conclude that the specified exclusion distance and low population zone radius are of sufficient size that there is reasonable assurance that suitable engineered safety features can be provided to satisfy the exposure guidelines of 10 CFR Part 100. The population center distance meets the requirements of 10 CFR Part 100 with respect to its distance from the outer radius of the low population zone. We have not identified any unusual characteristics, with respect to the low population zone, that would prevent the development of appropriate emergency response procedures.

B. NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

No nearby industrial, transportation, or military facilities and associated activities have been identified which would preclude the design, construction and operation of the planned nuclear facility at the WNP-1 and WNP-4 site in a manner that will protect the health and safety of the public.

The nearest transportation facility is the mainline track of the Hanford Reservation railroad system which passes about 2500 feet southwest of the site. Transportation routes include Hanford Reservation Route 4 located 1.5 miles southwest of the site, the Columbia River located 2.5 miles east of the site, and State Highway 240, located 7 miles southwest. Because of the distances of these routes from the site, we conclude that no significant hazard to the proposed facility exists from these sources that could not be provided for in the design of the proposed facility.

There are no airports or commercial airways within 10 miles of the site. The nearest airport, the North Richland airport, is located about 11 miles south of the site. The field has hard surface runways, but no commercial facilities.

The nearest airport with commercial facilities is the Pasco Airport located about 15 miles southeast of the site. In addition, the Hanford Reservation presently lies in an aircraft restricted zone (R-6715) with no private or commercial traffic permitted at altitudes below 10,000 feet without special permission. On the basis of the distances of the existing airfields from the site and previous staff studies, we conclude that the WNP-1 and WNP-4 units need not be designed with special provisions to protect them against the effects of an aircraft crash.

There are no military bases or high speed, low altitude military training routes within 10 miles of the site. The nearest military facilities are the Othello Air Force station located about 30 miles northeast of the

site and the Yakima Firing Range located more than 30 miles northwest of the site. Because of the remoteness of these facilities from the site, we conclude that the activities at these facilities need not be considered in the design of WNP-1,4.

The only industrial facilities located within 5 miles of the site are those associated with other activities on the Hanford Reservation. These include the WNP-2 unit , presently under construction, located about 1 mile away, the Fast Flux Test Facility (FFTF) located about 3 miles away, a substation located about 1 mile away, and 2 small solid radioactive waste disposal burial sites, the nearer of which is located about a mile away. Because of the distances of these facilities from the site, and the types and quantities of materials stored there, we conclude that the effect of an industrial accident or an inadvertent release need not be considered in the design of the WNP-1 and 4 units.

We concluded earlier, at the time of the WNP-2 review, that an accident occurring at the FFTF would not result in doses which would prevent the safe shutdown of the WNP-2 unit. There is reasonable assurance that suitable control room designs can be provided for WNP-1 and 4, and based upon the greater distance from FFTF than from WNP-2, we conclude that there is reasonable assurance that design basis accidents at the FFTF would not result in doses which would prevent a safe shutdown of the WNP-1 and WNP-4 units. The WNP-2 unit has a postulated design basis accident source term which is similar to those postulated for WNP-1 and 4, and in view of the separation distance, interaction of these facilities is not a consideration.

There are no gas or petroleum pipelines or commercial storage facilities within 5 miles of the site.

On the basis of the above considerations, we conclude that there are no nearby activities that would preclude site acceptability.

C. GEOLOGY AND SEISMOLOGY

The site is located on the ERDA Hanford Reservation, which is within the Pasco Basin, a physiographic and tectonic subdivision of the Columbia River Plateau Physiographic Province and the Columbia River Tectonic Province, respectively. The Pasco Basin is bordered on the north by Saddle Mountain; on the west by the Yakima and Umtanum Ridges; and the southwest and south by the Rattlesnake Hills and the Horse Heaven Hills. These features are anticlinal folds within the upper basalt flow units. The eastern boundary is formed by the White Bluffs, which locally is the east bank of the Columbia River. Topographic relief in the Pasco Basin varies from maximum elevations exceeding 3,500 feet atop Rattlesnake Mountain to a minimum elevation of +340 in the Columbia River channel at Richland where the river flows out of the Basin. The site lies at elevation +446 on flat terrain that slopes gently to the northeast about 2 1/2 miles west of the Columbia River. The Pasco Basin has subsided relative to the Columbia River Plateau continuously since its formation which began with volcanic activity in early Miocene.

Several anticlines including the Umtanum Ridge-Gable Mountain-Gable Butte complex, and Saddle Mountain, are faulted. The faults, where identifiable, are high angle thrust faults of limited extent which

originated where folding was inadequate to relieve the regional stresses. Some normal faulting has also been identified in the region.

The faults parallel the anticlinal structures and are generally found on the north, overturned side. Some, such as the thrust fault on the Gable Mountain anticline, are subparallel and cut across the fold axis. Most of the faults are at least older than late Pleistocene. Bingham et. al. (1970) determined that the faults on Gable Mountain Anticline are probably more than 100,000 years old. Faults within the Pasco Basin are associated with steeply overturned asymetrical anticlines. The applicant has demonstrated, both in geological investigations for the WNP-2 unit and for this investigation that there are no sharply asymetrical anticlines or other geological structures that could localize earthquakes in the immediate site vicinity, or that could cause surface displacement at the site.

The largest geologic structure of significance to the site is represented by the Rattlesnake-Wallula lineament. The lineament trends northwest southeast and borders the Pasco Basin on the southwest and south. It is about 80 miles long and is located 13 miles southwest of the site. The lineament is a belt of en-echelon, doubly plunging anticlines comprising the Rattlesnake Hills anticline to the west and the Wallula Gap fault zone to the east. Faulting associated with the Rattlesnake-Wallula lineament and other mapped faults around and within the Pasco Basin, appear to be related to near surface folding that occurred contemporaneously with the downwarping of the Columbia River Plateau

and the Pasco Basin. Thus, this structure is not likely to be directly related to basement structure nor is it apt to be continuously faulted along its entire length. We have concluded that the Rattlesnake-Wallula lineament is the most significant structure for determination of the safe shutdown earthquake.

The site is mantled by 10 feet or less of aeolian deposits overlying 50 to 90 feet of Pasco gravels. The glacio-fluvial Pasco gravels consist primarily of medium dense to very dense gravelly sands. Beneath the Pasco gravels is the Ringold formation, which is composed of three units: an upper weakly indurated siltstone and sandstone, a middle conglomerate member, and a lower siltstone and claystone member. The upper unit is absent in the site area and the Category 1 foundations will be founded either directly on the conglomerate or on engineered backfill on the conglomerate. The Ringold extends to a depth of about 480 feet. Beneath the Ringold are at least 5,000 feet of basalt flows and tuffaceous interbeds.

Historical seismicity within the Columbia Basin Tectonic Province indicates that the province is characterized by the infrequent occurence of low to moderate intensity earthquakes. The largest event had a maximum intensity of VII and occurred in the Milton-Freewater area of northern Oregon in 1936. Several smaller events are also geographically clustered in the same area about 60 miles from the site. A second cluster near Ellenburg, Washington consists only of smaller events. The remaining earthquakes have been geographically scattered through the province, the largest being an intensity VI-VII [1/]

1/ Intensities quoted in this report are based on the Modified Mercalli scale.

event which occurred near Umatilla, Oregon in 1893. We consider it possible that similar earthquakes could occur anywhere in the province.

By virtue of its extent and proximity to the site, the Rattlesnake-Wallula lineament must be considered to be the greatest potential generator of earthquakes of significance to the site. It appears likely that the intensity VII 1936 Milton-Freewater event was associated with this structure.

The SSE for the WNP-1, 4 site is based on the following considerations:

1) The maximum random earthquake in the Columbia Basin Tectonic Province can be as great as intensity VII and can result in that intensity at the site;

2) The Rattlesnake - Wallula lineament represents the most significant seismically active structure. We view it as having the potential of generating earthquakes of intensity VIII at a distance of little more than 10 miles from the site.

Based on the above, we have concluded that an intensity of VII-VIII is a conservative site intensity for representing the SEE. Thus we consider a horizontal acceleration of 0.25g used as the zero period limit of appropriate response spectra to be a conservative SSE. This acceleration is to be applied at the foundations of Category I structures. Under Appendix A to 10 CFR Part 100, we consider a value of 0.125g, equal to one half of the SSE, to be a conservative Operating Basis Earthquake.

The applicant plans to excavate to a depth of about 60 feet and recompact the material to an 85% average relative density in zones that support or influence Category 1 foundations. The applicant has demonstrated that the proposed fill material will have an adequate resistance to liquefaction, due to the postulated earthquake, when compacted to a relative density of 75 per cent. The applicant's proposed specification for the Category I fill, 85 per cent average relative density, no more than 10 per cent of the fill below 85 per cent relative density, and a minimum of 75 per cent relative density, will assure the stability of supported Category I structures subjected to the postulated earthquake. The sandy gravel, silt, and clay below a depth of 60 feet are dense and well consolidated, and will provide competent support for Category I structures. The applicant has requested a limited work authorization to excavate for Category I structures (containment and general services building). The excavation will be made down to the bearing horizon (conglomerate member of the Ringold Formation). Density tests will be made within the conglomerate, and any pockets of insufficiently dense material will be removed and replaced with compacted backfill. All structural backfill will be placed according to the proposed specifications stated above. We conclude that the applicant's investigations have been adequate to define the properties of foundation soils, that the methods and parameters used in the design of foundations are appropriate and sufficiently conservative, and that there are no unresolved safety issues related to this excavation and structural backfill activity.

Based on the applicant's documented design criteria, preliminary designs and plans for the utilization of the WNP-1, 4 site, we conclude that there are no real or potential geologic, seismic or foundation engineering related problems that would preclude site acceptability.

D. METEOROLOGY

The site, located in the Columbia Basin area of western Washington about eight miles north of Richland on the Hanford Reservation, is in a region where atmospheric dispersion conditions are about average for the western United States.

A description of meteorological conditions at the site, including the climatology of the region, local meteorology conditions, and expected severe weather, is presented in Section 2.6 of the Final Environmental Statement for the facility.[1/]

The WNP-1, 4 facility design is consistent with the NRC staff Tornado Model (240 miles/hour maximum wind speed) which is sufficient for this region of the United States.

The applicant has calculated atmospheric dispersion characteristics based on data collected at the Hanford Meteorological Station 15 miles to the northwest, during the 16-year period from 1955 through 1970.

An evaluation of short-term accidental releases from plant buildings and vents, assuming a ground-level release was made using the meteorological data described above and the diffusion model used by the staff. A comparison of the short-term (0-2 hour) atmospheric dispersion values estimated for the WNP-1 site with similar values calculated by the staff for over 40 other sites indicates that the dispersion conditions at the WNP-1, 4 site

1/ "Final Environmental Statement Related to Construction of Washington Public Power Supply System Nuclear Projects 1 and 4", Docket Nos. 50-460 and 50-513, March 1975, USNRC, National Technical Information Service, Springfield, Virginia 22161.

are better than 85% of the other sites. Site dispersion estimates will be confirmed using a full year of onsite data to be provided by the applicant upon completion of an annual data collection cycle at the tower now in operation on the WNP-1, 4 site.

We conclude that there are no meteorological characteristics that would preclude site acceptability.

E. HYDROLOGY

The site is located in the southeast area of the Hanford Reservation in Benton County, Washington, 8 miles north of the city limits of Richland, about 2.5 miles west of the Columbia River and 45 miles downstream of the Grant County PUD Priest Rapids Dam. Plant grade for safety-related buildings will be 446 feet above mean sea level datum (feet MSL) or above, which is about 100 feet above the Columbia River floodplain elevation near the site. The Columbia River, upstream of the site, has been extensively developed and regulated over the past 35 years. The regulation is for various purposes including flood control, navigation, hydroelectric power, irrigation and municipal and industrial water supply. The administrative minimum regulated flow at the site is 36,000 cfs.

The applicant has concluded, and we agree, that flooding of safety-related structures at the site will not be a problem. The river intake structure, which is not safety-related, can be flooded by rare floods in excess of the Columbia River flood of record at the site. The applicant has used extensive documented studies by the Seattle District Corps of Engineers

as a basis for its evaluation of potential Columbia River flooding due to a probable maximum flood (PMF) and to dam failures. The estimated peak stage at the site, due to an assumed partial failure of Grand Coulee Dam, would be 424.5 feet MSL, including 1.0 foot of stage for wind wave activity. Safety-related structures and equipment are protected to at least 448 feet above MSL, thus, providing a margin of at least 20 feet between the maximum wave runup level and the flood protection level.

Groundwater movement is in an easterly direction from the plant site and toward the Columbia River. There are no groundwater users between the plant and the river and reversal of the groundwater gradient is highly improbable since the site is on federally owned and controlled land and any groundwater development would be federally controlled. Since the groundwater table has a significant gradient toward the river, is below foundation levels, and there is no groundwater withdrawal between the site and the river, it is concluded that in the event of a postulated accidental liquid radwaste spill, the groundwater will not be a potential pathway to man. Even if a postulated spill were to be transported by the groundwater to the river, staff analyses show that concentrations at the river would be far below 10 CFR Part 20 limits.

The applicant has proposed to use a design basis water level of 420 feet above MSL for design of subsurface portions of safety-related structures. Since normal ground water levels in the site vicinity are at most 370 feet above MSL, we consider the applicant's design basis to be conservative and acceptable.

Based on the applicant's evaluation, the staff's independent analyses of flooding, water supply and groundwater considerations and a review of similar considerations at licensed nuclear power plant sites, the staff concludes that there are no hydrologic factors that would preclude acceptability of the site.

F. CONCLUSION

On the basis of our analysis and evaluation, we have concluded that there is reasonable assurance that the proposed site is a suitable location for the construction and operation of two nuclear power reactors of the general size and type proposed from the standpoint of radiological health and safety considerations under the Atomic Energy Act and rules and regulations promulgated by the Nuclear Regulatory Commission pursuant thereto.