UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of ARIZONA PUBLIC SERVICE COMPANY, et al. (Palo Verde Nuclear Generating Station, Units 2 and 3)	Docket Nos. STN 50-529 STN 50-530

JOINT APPLICANTS' RESPONSE TO
WEST VALLEY'S SECOND SET OF INTERROGATORIES

GENERAL OBJECTIONS

1. Joint Applicants object to Petitioner's Instruction No. 19 to the extent it purports to alter the applicable rules and regulations relating to the duty of a party to supplement its responses. See 10 CFR §2.740(e).

2. Joint Applicants object to Interrogatories 2, 3, 4, 7 and 9 on the grounds that, as phrased, they would require identification of documents and correspondence subject to the attorney work product privilege and/or the attorney client privilege. Joint Applicants are in the process of identifying the documents described in the above-referenced interrogatories and to the extent not privileged will identify such documents when review is completed. Due to the number of entities involved and the number of docu-

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ments to be reviewed, Joint Applicants were unable to complete such review prior to the date required for the submission of these responses.

INTERROGATORIES

INTERROGATORY NO. 1. Identify all oral communications concerning any delays in the projected date for fuel loading Unit 2 which occurred:

a. before filing of the Petition;

b. subsequent to filing of the Petition.

ANSWER

1. Joint Applicants object to Interrogatory No. 1 on the grounds that it would be burdensome and oppressive, if even possible, to identify all oral communications concerning any delays, or possible delays, in the projected fuel loading date for Unit 2. Further, such information is irrelevant to the subject matter of this proceeding and to the contentions set forth in the parties' Stipulation of March 30, 1983, and is not likely to lead to the discovery of admissible evidence. The fuel loading date has not been delayed beyond the August, 1984 date previously established, but there obviously are continuous discussions concerning the scheduling of work and materials and the completion of the Unit 2 construction in a timely manner to meet the August, 1984 date. It would be virtually impossible to isolate and identify such communications as requested in this interrogatory.

INTERROGATORY NO. 2. Identify all documents, including but not limited to all reports and correspondence, relating or referring to cooling tower salt emissions, prepared:

a. between completion of the EIS-OS and filing of the Petition (but not including Marley Telecon Memo, dated September 29, 1982, listed in response to Petitioner's First Set of Interrogatories, No. 3(b));

b. subsequent to filing of the Petition.

ANSWER

2.a. None, other than as identified in response to Petitioner's First Set of Interrogatories.

b. Object. See General Objection No. 2.

INTERROGATORY NO. 3. Identify all documents, including but not limited to all reports and correspondence, relating or referring to spray pond salt emissions, prepared:

a. between completion of the EIS-OS and filing of the Petition;

b. subsequent to filing of the Petition.

ANSWER

3.a. None.

b. Object. See General Objection No. 2.

INTERROGATORY NO. 4. Identify all documents, including but not limited to all reports and correspondence, relating or referring to evaporation ponds salt emissions, prepared:

a. between completion of the EIS-OS and filing of the Petition;

b. subsequent to filing of the Petition.

ANSWER

4.a. None.

b. Object. See General Objection No. 2.

INTERROGATORY NO. 5. The Answer to Petitioner's First Set of Interrogatories, No. 9(a), states that 1971 data from Research Cottrell, Inc. were the basis for the salt drift droplet size distribution analysis in the ER.

a. Identify the documents which present those data;

b. State the reasons for choosing Research Cottrell's 1971 size distribution rather than Marley's size distribution.

ANSWER

5.a. The document presenting the data obtained from Research-Cottrell is the "FOG Model Description," July, 1974, by George Fisher.

b. Research-Cottrell's size distribution was chosen because at that time a cooling tower vendor had not been selected.

INTERROGATORY NO. 6. The Answer to Petitioner's First Set of Interrogatories, No. 11, states that the rate of blowdown to

the evaporation ponds exceeds the evaporation rate from the ponds.

a. Identify the documents which support that conclusion;

b. State any other basis for reaching that conclusion.

ANSWER

6.a. Bechtel Proprietary Study No. 13-CS-204; Custodian: Bechtel. The ER-0L and the FSAR also describe the flow rate to the evaporation ponds.

b. The basis for the conclusion stated in answer to Petitioner's Interrogatory No. 11 (First Set) is that the annual blowdown rate exceeds the annual evaporation rate.

INTERROGATORY NO. 7. Identify all documents, including but not limited to reports and correspondence, relating or referring to salt drift deposition patterns, prepared:

a. between completion of the EIS-OS and the filing of the Petition;

b. subsequent to filing of the Petition.

ANSWER

7.a. None

b. Object. See General Objection No. 2.

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INTERROGATORY NO. 8. NUS used its proprietary model, "FOG," to describe salt drift deposition patterns.

a. State when the "FOG" model was first used;

b. Identify all documents concerning application of the "FOG" model to power plants other than PVNGS.

ANSWER

8.a. "FOG" represents a computer model, the development and use of which has extended over several years. The initial version of the model was first utilized in 1972.

b. NUS has employed different versions of the FOG model at several fossil and nuclear plants, some of which have not been built. Joint Applicants object to this interrogatory on the grounds that the identification of these proprietary documents sought by this interrogatory would be oppressive and unduly burdensome and expensive. In addition, the information sought by this interrogatory is irrelevant to the subject matter of the instant proceeding and to the contentions set forth in the parties' Stipulation of March 30, 1983.

INTERROGATORY NO. 9. Identify all documents, including but not limited to reports and correspondence, relating or referring to effects on crops, prepared:

. . . . .

a. between completion of the EIS-OS and filing of the Petition;

b. subsequent to filing of the Petition.

ANSWER

9.a. None.

b. Object. See General Objection No. 2.

INTERROGATORY NO. 10. The Answer to Petitioner's First Set of Interrogatories, No. 29, states that six samplers for radiological monitoring have collected salt data since October, 1982. Identify all documents which present or analyze those salt data.

ANSWER

10. "Report of Analysis," dated 2/22/83, 3/8/83, and 5/5/83, from CEP (Controls for Environmental Pollution) present the data obtained from the samplers described in answer to Petitioner's Interrogatory No. 29 (First Set).

INTERROGATORY NO. 11. The Answer to Petitioner's First Set of Interrogatories, No. 30, describes monitoring devices which are being used or planned to be used. Identify:

a. all documents that relate to the accuracy and reliability of each device;

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b. all documents (other than those identified in response to the preceding interrogatory) that present or analyze salt data collected to date;

c. state when and in what form monitoring data will be reported hereafter from each type of device.

ANSWER

11.a.1. Dustfall Samplers: American Society of Testing and Materials (ASTM) Standard Method for Collection and Analysis of Dustfall (Settleable Particulates) D1739-70, Annual Book of ASTM Standards, Part 26, Philadelphia, PA.

2. Low-Volume Samplers:

(a) "Instruction Manual, Schmidt Model 2-AXP-0, Constant Flow Air Sampler (Preliminary Copy)," Schmidt Instrument Co., P.O. Box 111, San Carlos, California 94070.

(b) "Air Sample Collection (Environmental), PVNGS, Station Manual Procedure No. 75RP-9ZZ19, Rev.O," DRAFT.

(c) Letter from Schmidt Instrument Co. to APS, dated March 29, 1983, regarding calibration of Fischer and Porter Flowrators supplied on Order No. 10011798, Dec. 24, 1982.

(d) Letter from Schmidt Instrument Co. to APS, dated July 29, 1982, regarding accuracy of Schmidt Model A-60 Precision Portable Flowmeter with 2.5 scfm Float.

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(e) Field log books for the air sampler collection filter.

(f) Maintenance and calibration schedule for environmental air samplers.

(g) CEP Proposal No. CEP-83-03035 "Proposal to NUS, Corp. for laboratory services associated with salt deposition and impact monitoring plan for PVNGS, Units 1, 2 & 3,"

(h) Results of laboratory analysis ("Reports of Analysis" identified in answer to Interrogatory No. 10, above.)

3. Camera/Film: NUREG/CR-1231, "Remote Sensing for Detection and Monitoring of Salt Stress on Vegetation: Evaluation and Guidelines," Final Report, Sept. 1976 - March 1979, Published March, 1980. Prepared by Intera Environmental Consultants, Inc. for U.S. Nuclear Regulatory Commission.

b. The only documents currently available are those identified in answer to Interrogatory No. 10 above.

c. Information concerning the reporting of sampling data is contained in the Salt Deposition and Impact Monitoring Plan for PVNGS, Units 1, 2 & 3, February, 1983.

INTERROGATORY NO. 12. The Answer to Petitioner's First Set of Interrogatories, No. 42, identifies 12 month cooling

tower operation as an off design condition considered before completion of the EIS-OS.

a. State whether any additional off design conditions were considered;

b. Describe any such conditions and their influence upon evaluation undertaken in the ER;

c. State whether any off design conditions have been considered since completion of the EIS-OS and filing of the Petition;

d. State whether any off design conditions have been considered subsequent to filing of the Petition;

e. Describe any off design conditions identified in response to c. and d. above and your plans to take them into account in operating PVNGS;

f. Identify all documents that describe or analyze any off design conditions identified in response to this interrogatory.

ANSWER

12.a,b. Joint Applicant's answer to Petitioner's Interrogatory No. 42 (First Set) also identified the off design operating condition of the assumption that the circulating water chemistry concentrations would exceed those expected at 15 cycles of concentration. That assumption led to the over-estimation of the salinity of the salt drift from the cooling towers.

c. None, other than those previously identified.

d. None, other than those previously identified.

e. N/A.

f. ER-CP; ER-OL.

INTERROGATORY NO.13. Identify the documents that serve as as a basis for the figures contained in the ER and EIS concerning the salinity of effluent to be used for cooling at PVNGS.

ANSWER

13. Joint Applicants' Exhibit BB, Water Reclamation Studies, PVNGS, Units 1, 2 and 3, by Bechtel Power Corp.

INTERROGATORY NO. 14. The Answer to Petitioner's First Set of Interrogatories, No. 48, identifies documents relating or referring to PVNGS cooling tower drift elimination.

a. State whether this answer includes documents relating to both the structure and the operation of the drift eliminators;

b. If the Answer fails to include the former, identify all such documents.

ANSWER

14.a,b. The answer to Petitioner's Interrogatory No. 48 (First Set), includes documents relating to both structure and operation of the drift eliminators. In addition, the Marley Cooling Tower Company's Operation and

Maintenance Instructions Manual identified in answer to Petitioner's Interrogatory No. 47 (First Set), relates to the operation and structure of the eliminators.

INTERROGATORY NO. 15. State whether the cooling tower vendor:

a. makes or has made cooling towers of the type being installed at PVNGS incorporating a system that removes more drift than the system chosen for PVNGS; and

b. can make such a system.

ANSWER

15.a. Marley does not make a cooling tower of the type installed at PVNGS which incorporates a drift elimination system that removes more drift than the system being utilized at PVNGS.

b. Marley continuously investigates and researches drift elimination system designs which may prove to be more effective than the system installed at PVNGS. At the present time, however, Marley does not have a system which has proven capable of removing more drift than the system utilized at PVNGS.

INTERROGATORY NO. 16. If your answer to the preceding interrogatory is yes, describe:

a. the drift elimination systems;

b. the places of their use; and

c. state the basis for choosing the drift elimination system used in the PVNGS cooling towers.

ANSWER

16.a.-c. Not Applicable.

INTERROGATORY NO. 17. Identify which of the documents identified in response to Petitioner's First Set of Interrogatories, No. 50, specifically address alternatives to the cooling tower drift elimination system chosen for PVNGS.

ANSWER

17. Letter, Wilson to Van Brunt, December 19, 1975, (Proprietary). Custodian: APS.

INTERROGATORY NO. 18. For each individual identified in response to Petitioner's First Set of Interrogatories now or previously affiliated or involved with:

a. NUS:

b. Bechtel;

c. Marley;

d. APS;

e. University of Arizona Crop Study state:

state:

a. a summary of his formal education;

b. the name and address of each school where he received any special education or training relevant to the subject matter of the interrogatory in response to

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which his name was identified and a description of the training;

c. the name or description of each degree he has received, including the date each was received, and the name of the school from which he received such degree;

d. the books, papers, and articles which he has authored;

e. his employment over the past ten years, including employer, dates, and duties.

18. NUS:

1. George E. Fisher

a.-c. New York University, M.S., Meteorology, 1968; Florida State University, B.S., Meteorology, 1963.

d.(1) "Changes in Levels of Atmospheric Oxygen and Carbon Dioxide Produced by Burning Fossil Fuels and by Changes in Land Usage," 68th Meeting of the Air Pollution Control Association, Boston, Massachusetts, June, 1975.

(2) "Statistical Prediction of Eventual Tracks of Hurricanes," M.S. thesis, New York University, New York, 1968.

e.(1) NUS Corporation, 1973 - 82; Manager of Air Quality Assessments Department.

(2) GEOMET, Inc., 1971-1973; Research Scientist.

(3) The Center for the Environment and Man, Inc., 1965-71; Work in development and application of numerical prediction model for planetary boundary layer and low level cloud prediction techniques.

(4) The National Hurricane Research Laboratory, 1963-65; Collect and analyze meteorological data.

2. Morton I. Goldman

a.-c. Massachusetts Institute of Technology, Sc.D., 1960; Massachusetts Institute of Technology, M.S., Nuclear Engineering, 1958; Massachusetts Institute of Technology, M.S., Sanitary Engineering, 1950; New York University, B.S., Civil Engineering, 1948.

d. See attached.

e.(1) NUS Corporation, 1961 - Present; Technical Director.

(2)(a) U.S. Public Health Service; Division of Radiological Health, 1950-1961; Technical consultation and assistance to federal government.

(b) Nuclear Installations Consultant, 1959-1961; Technical consultations and assistance.

(c) MIT Nuclear Engineering Department, 1956-1959; Reactor Safeguards Committee, Secretary and Radioactive Waste Disposal Project, Project Leader.

(d) ORNL Waste Disposal Research Activity 1954-1956; Soils and Engineering Section, Chief.

(e) Sanitary Engineering Center, 1950-54; Radiological Health Training Section.

(3) MIT Sanitary Engineering Department, 1949-1950; Radioactivity Research Laboratory, Research Assistant.

(4) New York University, Sanitary Engineering 1948-1949; Research Laboratory, Research and Teaching Assistant,

3. Marilyn K. Bland

a.-c. Principia College, Elsah, Illinois, B.A., Biology and Education, 1966; University of Colorado, Institute of Arctic and Alpine Studies, Boulder, Colorado, 1966 (Summer); University of Michigan, Ann Arbor, Michigan, M.S., Botany, 1968; University of Costa Rica, Organization of Tropical Studies, San Jose, Costa Rica, 1968 (Summer); University of Michigan, Ann Arbor, Michigan, Ph.D., Botany, 1972.

d.(1) Bland, M. D. and P. D. Kilburn, 1966, "Bluff prairie vegetation and soil texture." Trans. Ill. State Acad. Sci. 59: 25-28.

(2) Bland, M. K. 1970, "Prairie establishment at the Michigan Botanical Gardens."

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Proc. Symp. on Prairie and Prairie Restoration. Knox College, Galesburg, Ill. pp. 46-47.

(3) Bland, M.K. 1972. "Elsah Bluff prairies: ecological antiques." Historic Elsah Foundation Leaflet No. 3, 11 pp.

e.(1) NUS Corporation, 1972-78; Biologist.

(2) Principia College, 1971-1975; (position/duties presently unknown; will supplement).

(3) Matthaei Botanical Gardens, 1968-1971; (position/duties presently unknown; will supplement).

(4) University of Michigan, 1966-1971; (position/duties presently unknown; will supplement).

4. Ronald R. Stoner

a.-c. Pennsylvania State University, B.S., Meteorology, 1966; Air Pollution Control Administration Training, U.S. Public Health Service Fellowship Course, Pennsylvania State University, 1965; Ohio State University, undergraduate courses in science, 1962-1964.

d.(1) "Tropical Oil Spill Contingency Planning: Requirements and Applications," Conference on Petroleum and the Marine Environment, EUROCEAN, Monaco, 1980.

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(2) "A Software Package for Real Time Offsite Dose Calculations" (coauthor), Nuclear Science Symposium of IEEE, October, 1978.

(3) "The Use of Field Wind Measurements in Applying Atmospheric Diffusion Techniques" (coauthor), APCA Paper No. 70-51, June, 1970.

(4) "A Flexible Fast Fourier Transform Algorithm," ECOH-6046, Atmospheric Sciences Laboratory, August, 1969.

(5) "Spectra of Atmospheric Fluctuations Over a Frequency Range from 0.02083 to 30 Cycles/Hour" (coauthor), Atmospheric Sciences Laboratory, June, 1969.

(6) "Procedures for Computing Variance Spectra" (coauthor), ECOM-6041, Atmospheric Sciences Laboratory, April, 1969.

e.(1) NUS Corporation, 1969-Present; Principal Environmental Meteorologist.

(2) U.S. Army, Atmospheric Sciences Laboratory, 1967-1969; Research.

(3) Pennsylvania Bureau of Air Pollution Control, 1967; Analyzed local and regional meteorological and air quality sampling data.

(4) U.S. Weather Bureau, ESSA, 1965; Observation and evaluation of meteorological data.

5. Thomas F. Iaccarino

a.-c. Rutgers - The State University, M.S., Meteorology, 1975; Rutgers - The State University, B.S., Meteorology, 1973.

d.(1) "Final Site Selection and Instrument Exposure Criteria Document," NUS-3571, NUS Corporation, Rockville, MD., April, 1980.

(2) "Prevention of Significant Deterioration Application for the Installation of a 26,000 BPSD Petroleum Refinery in Chesapeake, Virginia, NUS-3193, NUS Corporation, Rockville, MD., July, 1978.

(3) "Prevention of Significant Deterioration Application for the Construction of a 184,000 BPSD Petroleum Refinery in Portsmouth, Virginia NUS-3194, August, 1978.

(4) "Monthly Supplementary Control System Report for the Kincaid Generating Station," Report No. 11, June, 1977, Environmental Research and Technology, Inc., August, 1977.

(5) "An Investigation of Sea and Lake Breezes," M.S. thesis, Rutgers - The State University, 1975.

e.(1) NUS Corporation, 1978 - Present; air quality analyst and environment meteorologist.

(2) Environmental Research and Technology, Inc., 1975-78; Senior Staff meteorologist.

(3) Rutgers - The State University, 1974-75; Graduate Assistant.

6. Philip M. Altomare

a.-c. University of Maryland, B.S., in Physics, 1958; University of Maryland, M.S. in Nuclear Engineering, 1967.

d.(1) "The Application of Meteorology in Determining the Enviromental Effects of Evaporative Heat Dissipation Systems," presented at the 64th Annual Meeting of the Air Pollution Control Association, June 27 - July 1, 1971.

(2) "Transport of Vapor and Aerosols Through An Inhomogeneous Atmosphere," presented at the American Meteorological Society's Fourth National Conference on Aerospace Meteorology, May 4-7, 1970.

(3) "A computer Study of Nuclear Characteristics of the University of Maryland Reactor," M.S. thesis, University of Maryland, 1967.

(4) "Analysis of the KIWI-TNT Experiment," (coauthor), presented at the American Nuclear Society meeting, June, 1965.

e.(1) NUS Corporation, 1963-1976; Manage data collection, reduction and model development concerned with atmospheric and thermal pollution program.

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(2) Martin-Marietta Corporation, Nuclear Division, 1959-1963; Reactor Engineer.

(3) United States Department of Interior, Bureau of Mines, 1956-1959; Physicist.

7. John H. Taylor

a.-c. Florida State University, M.S., Meteorology, 1957; Western Kentuckey University, A.B., Mathematics, 1953; University of Chicago, Tropical Meteorology, 1951; University of California at Los Angeles, Meteorology, 1948.

d.(1) "Meteorological Influences on Air Pollution from Rocket Propellents," Invited paper presented at the 49th Annual Meeting of the Air Pollution Control Association, San Francisco, California, 1966.

(2) "The Ice Fog Problem at Eielson Air Force Base, Alaska" (coauthor), AF Survey in Geophysics, No. 176, AFCRL-66-230, Air Force Cambridge Research Laboratory, 1966.

(3) "Diffusion of Rocket Exhaust," Invited paper presented at the Conference of Atmospheric and Industrial Hygiene, National Academy of Science, Washington, D.C., 1964.

(4) "Project Sand Storm: An Experimental Program in Atmospheric Diffusion," Environmental Research Report No. 134, AFCRL-65-649, Air Force Cambridge Research Laboratory, 1965.

(5) "Some Aspects of Diffusion from Quasi-Instantaneous Sources." Presented at the National Conference on Micrometeorology, American Meteorological Society, Salt Lake City, Utah, 1964.

(6) "The Ocean Breeze and Dry Gulch Diffusion Program" (coauthor), Vol. II, Research Report, AFCRL-63-791(II), Air Force Cambridge Research Laboratory, 1963.

(7) "Results of Recent Field Programs in Atmospheric Diffusion" (coauthor), Journal of Meteorology, Vol. 2, No. 1, 1963.

(8) "Design and Development of a Micrometeorological Data Observing and Processing System for Air Pollution Applications at Cape Canaveral and Vandenberg Air Force Base" (coauthor), presented at the Fourth Conference on Applied Meteorology, American Meteorological Society, Hampton, Virginia, 1962.

e.(1) NUS Corporation, 1973-81; Manager, Meteorological Programs Department.

(2) U.S. Air Force, 1943-1973;

(a) Research and Development Director, Headquarters, Air Force Systems Command, Andrews Air Force Base, Maryland, 1969-1973; Chief Systems Inspection Division.

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(b) Pilot, Commander of Operational Units, Viet Nam, Southeast Asia, 1967-1969.

(c) Diffusion Meteorologist, Air Force Cambridge Research Laboratory, Bedford, Massachusetts, 1960-1967; Planned and conducted field experiment in atmospheric diffusion.

(d) Climatological Analyst, Environment Technical Applications Center, Washington, D.C., 1957-1960; Performed climatological studies.

(e) Weather Officer (Forecaster), 1948-1955; Provided aviation forecasts.

(f) USAF Pilot 1944-1973.

8. Henry Firstenberg

a.-c. Columbia University, M.S., Engineering Sciences, 1963; Polytechnic Institute of Brooklyn, B.Ch.E., Chemical Engineering, 1957; City College of New York, graduate courses in Nuclear Engineering, 1959.

d.(1) "Environmental Factors in Siting LNG Facilities" (coauthor), Proceedings of the Fourth International Conference on Liquefied Natural Gas, Algiers, Algeria, June 24-27, 1976.

(2) "Burnout in Fog Flow: A Droplet Diffusion Model" (coauthor), Journal of Heat Transfer (Series C of Transactions ASME), May 1962.

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(3) "Boiling Songs and Associated Mechanical Vibrations, NDA 2131-12, June 30, 1960.

e.(1) NUS Corporation, 1963-1969, 1970-Present; Executive consultant to Environmental Systems Group.

(2) Consultant, 1969-70

(3) United Nuclear Corporation, Development Division (formerly NDA), 1957-1963; Analytical engineer.

9. Michael Septoff

a.-c. New York University, M.S., Meteorology, 1968; City College of New York, B.S., Meteorology and Oceanography, 1966; University of Maryland, graduate courses in meteorology, 1968-Present.

d.(1) "Atmospheric Dispersion at a Coastal Rough-Terrain Nuclear Plant Site" (coauthor), Annual Meeting, American Nuclear Society, San Diego, California, June, 1978.

(2) "Results of an Offshore Dispersion Program Conducted at the San Onofre Nuclear Generating Station," Joint Conference on Applications of Air Pollution Meteorology, Salt Lake City, Utah, November, 1977.

(3) "A Rational Approach to Accident Dose Assessment," 1975 Annual Meeting, American Nuclear Society, New Orleans, Louisiana, June, 1975.

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(4) "A Survey of Cloud Seeding Technology," M.S. thesis, New York University, New York, N.Y., 1968.

e.(1) NUS Corporation, 1970-Present; Principal Meteorologist.

(2) GEOMET, Inc., 1968-1970; Analysis of problems in atmospheric diffusion and air pollution control and abatement programs.

(3) New York University, 1967-1968; Research Assistant.

(4) City College of New York, 1966-1967; Teaching fellowship.

(5) U.S. Weather Bureau, summer, 1966; Participated in experimental use of transmissometer network to test feasibility to measure visibility in fog.

10. Terry A. Ritter

a.-c. Loyola University of Los Angeles, M.S., Sanitary and Environmental Engineering, 1975; Loyola University of Los Angeles, B.S., Civil Engineering, 1967.

d. None.

e.(1) NUS Corporation, 1977 - Present; Management of environmental impact programs and preparation of environmental reports.

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(2) Los Angeles Department of Water and Power, 1967-1969, 1972-1977; Liaison with state and federal regulatory agencies; prepared water quality studies.

(3) U.S. Army, Engineer Command, 1969-1972; Consulting and supervisory engineer.

11. Lawrence T. Klein

a.-c. Polytechnic Institute of Brooklyn, B.Ch.E., Chemical Engineering, 1958; Oak Ridge School of Reactor Technology (ORSORT), Certificate in Nuclear Reactor Science and Technology, 1963.

d. None.

e.(1) NUS Corporation, 1964-1966, 1972-Present; Technical and managerial responsibilities.

(2) General Electric Company, 1966-1972; Requisition and sales; also technical responsibilities.

(3) Tennessee Valley Authority, 1961-1963; Nuclear hazards control engineer.

(4) Martin Company, Nuclear Division, 1959-1961; Analysis of nuclear hazards involved in isotope-powered thermoelectric generators.

(5) U.S. Atomic Energy Commission, 1958-1959; Review and evaluation of research and development programs.

12. Joseph J. Dinunno

a.-c. University of Maryland, M.S., Electrical Engineering, 1954; The Pennsylvania State University, B.S., Electrical Engineering, 1942; Oak Ridge School of Reactor Technology, 1956-1957.

d. None.

e.(1) NUS Corporation, 1972-Present; Technical Director, Environmental Systems Group.

(2) U.S. Atomic Energy Commission, 1959-1972; Various responsibilities associated with the engineering, safety analysis and public protection aspects of nuclear facilities.

(3) U.S. Navy, 1942-1959; Engineer.

(4) Westinghouse Electric Co., 1942; Engineer.

13. Carl G. Mattsson

a.-c. University of Southern California, M.S., Candidate, Environmental Engineering, 1973; Western Washington State College, B.A., Mathematics and Physics, 1967.

d. None.

e.(1) NUS Corporation, 1973-77; Assisted in project coordination and management of siting studies and environmental reports and programs.

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(2) Puget Sound Naval Shipyard, Radiological Engineering Division, 1968-1972; Project leader.

14. Paul V. Morgan

a.-c. University of Pittsburgh, Pittsburgh, Pennsylvania Garduate Studies in Environmental Health, 1967; University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania, M.S., Bygiene, Water Pollution Control, 1961; University of Pittsburgh, Pittsburgh, Pennsylvania, M.S., Microbiology, 1958; University of Pittsburgh, Pittsburgh, Pennsylvania, B.S., Bacteriology, 1950.

d. See attached.

e.(1) NUS Corporation, 1967-80; Management of aquatic and terrestrial ecological programs.

(2) University of Pittsburgh, 1950-1954, 1961-1967; Conducted studies of the environmental impact of nuclear power station.

(3) Mellon Institute of Industrial Research, 1954-1961; Research and field investigation.

BECHTEL

1. W. G. Bingham, Jr.

a.-c. B.S., Engineering, University of California at Los Angeles; Business Management . . . . .

Certificate, University of California; Masters Business Administration, Golden Gate University.

d.(1) "Makeup Water Supply for Dry Site Power Plant," ASME Conference, 82-JPGC-PWR-49.

(2) "Management Science Applications in the Planning and Design of a Water Supply System for Nuclear Power Plants," The Institute for Management Science, February 15, 1979;

(3) "Design Innovations Palo Verde Nuclear Generating Station," ANS Topical Conference, Cleveland, Ohio, August, 1981.

(4) "Design for Plant Maintainability and Operability," Id.

(5) "Utilization of Design Change Control to Reduce Cost and Schedule Impacts on Power Projects," ASME Conference.

(6) "Will Nuclear Power Plant Standardization Reduce the Licensing Impact on Construction," ANS Topical on Nuclear Plant Construction, 1976.

e. Bechtel Power Corporation; Project Engineer and Project Engineering Manager, responsible for all engineering on PVNGS and water reclamation facilities (May 1973-Present).

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2. Robert R. Stiens

a.-c. M.S., Engineering, California State University, Northridge, 1968; B.S., Chemical Engineering, Washington University, St. Louis, Missouri, 1956.

d. "Makeup Water Supply for Dry Site Power Plant," ASME Conference 82-JPGC-PWR-49.

e.(1) Bechtel Power Corporation; Nuclear Group Supervisor, Alvin W. Vogtle Nuclear plant (May 1973-May 1974);

(2) Assistant Project Engineer and Project Engineer responsible for power plant engineering on the PVNGS (1974-Present).

3. Dennis G. Keith

a.-c. B.S., Mathematics, Stanford University, Palo Alto, 1961; U.S. Navy Submarine School, 1961; U.S. Navy Nuclear Power School, 1962; M.S., Operations Research, Stanford University, 1969.

d.(1) "Experience in Licensing a Replicate Plant at the Same Site," American Power Conference, 1978.

(2) "Will Nuclear Power Plant Standardization Reduce the Licensing Impact on Construction," ANSW Topical on Nuclear Power Plant construction, 1976.

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e. Bechtel Power Corporation; May 1973-August, 1977, Nuclear Group Supervisor, Palo Verde Nuclear Generating Station; August 1977-August 1978, Project Coordinator PVNGS Units 4 and 5; August 1978-May 1983, Assistant Project Engineer, responsible for preparation of construction permit licensing documents and review of operating license licensing documents.

4. Paul Barbour

a.-c. B.S., Engineering, University of California, Los Angeles; 1955; M.S., Chemical Engineering, University of Southern California, 1966; M.S., Environmental Engineering, University of Southern California, 1972.

d. None.

e. Bechtel Power Corporation; May 1973-August 1979, Nuclear and Environmental Staff Specialist engaged in analysis, design and evaluation of nuclear and fossil power stations; August 1979-September 1980, Licensing Engineer for San Onofre Units 1, 2 and 3; September 1980-October 1981, Engineering Specialist for SONGS Units 2 and 3; October 1981-December 1982, Deputy Nuclear Group Supervisor for PVNGS; December 1982-Present PVNGS Nuclear Group Supervisor.

5. William W. Boles

a.-c. B.S., Chemical Engineering, Cornell University, Ithaca, New York, 1968.

d. "Power Plant Wastewater Disposal at the Palo Verde Nuclear Generating Station," EPRI Zero Discharge Symposium, 1981.

e.(1) Dow Chemical Company, May 1973-October 1973, Service Engineer;

(2) Bechtel Power Corporation; October 1973-November 1974, Mechanical Staff Engineer for water treatment and management; November 1974-April 1975, Mechanical Engineer, Harry Allen Station; April 1975-September 1977, Mechanical Engineer, Palo Verde Nuclear Generating Station; September 1977-April 1978, Mechanical Group Leader PVNGS Units 4 and 5 responsible for mechanical review of PSAR and ER-CP; April 1978-August 1981, Mechanical Group Leader, PVNGS responsible for contract administration, water treatment, and licensing interfaces; August 1981-Present, Deputy Mechanical Group Supervisor.

6. John W. Kluesener

a.-c. B.S., Chemical Engineering, Northwestern University, 1964; M.S., Water Chemistry, University of Wisconsin, 1969; Ph.D., Water Chemistry, University of Wisconsin, 1972.

d.(1) "A Demonstration of Wastewater Treatment for Reuse in Cooling Towers at Fifteen Cycles of Concentration," AICHE Water Resuse Conference, Chicago, Illinois, May, 1975.

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(2) "Process and Design Considerations for a 90 MGD Wastewater Reclamation Plant," ASCE Convention, Portland, Oregon, April, 1980;

(3) "Management of Power Plant Water and Wastewater in Water Short Regions," American Power Conference, Chicago, Illinois, April, 1980..

e. Bechtel, Inc. (Also Bechtel Civil and Minerals, Inc.), May 1973-Present; Assistant Project Engineer/Assistant Project Manager for the PVNGS Water Reclamation Facilities.

7. Stephen H. Shepherd

a.-c. B.S., Chemistry, B.S., Physics, Willamette University, Salem, Oregon, 1974; M.S., Nuclear Engineering, Oregon State University, 1976; Business Certificate, Golden Gate University, 1982.

d.(1) "The Environmental Impact of Integrated Joint Nuclear - Hydrogen Electrical Generation Parks," ANS Transactions, 1976.

e.(1) United States Department of Agricultural - Forest Service; May 1973-September, 1973; Lookout, Umpqua National Forest.

(2) Agripac, Inc.; July 1974-October 1974; Cannery Worker.

(3) Oregon State University; January 1975-August 1976; Research Assistant.

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(4) Bechtel Power Corporation; September 1976-May 1978, Nuclear and Enviromental Engineer engaged in analysis, design, and evaluation of nuclear power plants; May 1978-December 1982, Nuclear and Environmental Engineer for PVNGS, responsible for preparation of ER-OL and safety analysis; December 1982-May 1983, Deputy Nuclear Group Supervisor for PVNGS, responsible for PVNGS licensing.

8. Nora A. Blum

a.-c. B.S., Civil Engineering, Worchester Polytechnic Institute, Worchester, Massachusetts, 1973; Civil and Environmental Studies, Northeastern University, Boston Massachusetts, 1975-1978.

d.(1) "Seawater Closed Cycle Cooling Systems," Power Engineering, August 1979:

(2) "A Survey of Capital Costs of Closed Cycle Cooling Systems for Steam-Electric Power Plants," American Power Conference, Chicago, Illinois, April, 1979.

(3) "Design and Model Tests of Shorefront Revetment-Ditch System for a Nuclear Power Plant," ASCE Hydraulic Division Specialty Conference, College Station, Texas, August, 1977.

e.(1) Stone and Webster Engineers, Inc.; May 1973-January 1981; Civil and Environmental Engineer assessing environmental impacts.

(2) Bechtel Power Corporation; February 1981-Present; Environmental Group leader responsible for management of L.A. Power Division, Environmental Projects.

9. Peter Su

a.-c. B.S., Civil Engineering, Cheng Kung University, Taiwan, 1963; M.S., Civil Engineering, Colorado State University, Fort Collins, Colorado, 1969; Ph.D., Civil Engineering, Colorado State University, 1972.

d. Unavailable.

e.(1) Bechtel, Inc., May 1973-December, 1981; Geotechnical Specialist engaged in investigation and analysis of geological and civil aspects of Bechtel projects.

(2) Bechtel Power Corp., January 1982-Present; Engineering Specialist engaged in engineering and analysis of civil and mechanical aspects of Bechtel Power Corp. projects.

10. Vasken Najarian

a.-c. B.M.E., American University, Beirut, Lebanon, 1955; M.S.E., University of California at Los Angeles, 1958.

d. None.

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e. Bechtel Power Corp.; May 1973-April 1979, Mechanical Group Supervisor; April 1979-Present, Assistant Project Engineer responsible for mechanical system design.

MARLEY

1. Ivan F. Kuharic

a.-c. Purdue University, West LaFayette, Indiana, 1949, B.S.M.E., Mechanical Engineering.

d.(1) "Analyze Your Bids," Marley Technical Bulletin R-58-P-2 (coauthor).

(2) "Psychrometrics and the Psychrometer," CTI Paper #TP-231A.

(3) Numerous in-house articles dealing with Sound Rating, Fan Selection, Basic Theory and Thermal Performance of Cooling Towers.

e. Marley, 1969-Present; Manager, Ratings and Performance Section; Duties include the thermal and sound ratings of all evaporative cooling products, field tests and investigations, operating characteristics of the products, placement and orientation studies, technical assistance to the Sales Division.

2. O. L. Kinney

a.-c. B.S., Mechanical Engineering, Finley Engineering College, 1964.

d. "Drift Technology for Cooling Towers," (coauthor) The Marley Company, 1973.

e. Marley Cooling Tower Company 1966-Present; Assistant Engineer (1966-68); Engineer (1968-69); Project Engineer (1969-74); Project Engineer I (1974-76); Senior Engineer (1976-77); Design Consultant (1977-80); Senior Design Consultant (1980-Present).

3. Paul A. Lindahl

a.-c. B.S., Nuclear Engineering, Kansas State University, Mannattan, Kansas, 1973.

d. "New Designs in Currently Marketed Cooling Towers," 1977, Summer National Meeting, American Nuclear Society.

e. Marley Cooling Tower Company 1968-Present; Summer engineering intern program of the Marley Cooling Tower Company (1968-73); Project Engineer in Ratings & Performance Section for wet/dry and dry cooling tower rating and product development (1973-75); Responsible also for rating and optimization of mechanical draft concrete towers (1975-82); Responsible for rating and product development and testing of wet/dry and dry cooling towers (1977-Present); Responsible for rating and optimization of natural draft concrete cooling towers (1978-82); Senior Engineer and Engineering Division Coordinator for Major Project Proposals (1979-Present); Section Manager, Product Evaluations Section; Responsible for all major project optimizations, new product evaluations, rating and product

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development for wet/dry and dry cooling towers (1982-Present).

4. Joyce D. Holmberg

a.-c. B.S., Mechanical Engineering, University of Kansas, 1951.

d.(1) Discussion of the paper, "Cooling Tower Fan Performance," by George W. Forman and Neil W. Kelly, Journal of Engineering for Power, Transactions of the ASME, April, 1961.

(2) "Design and Development of Large Cooling Tower Fan and Drive," ASME Paper No. 65-PET-11, September, 1965, by E. R. Allgeyer and J. D. Holmberg.

(3) "Drift Technology for Cooling Towers," (coauthor) The Marley Company, 1973.

(4) "Drift Management in the Chalk Point Cooling Tower," from Symposium on Cooling Tower Environment-1974, College Park, Maryland, March 4, 1974.

(5) "Debut of the Round Mechanical Draft Tower, by J. B. Dickey, Jr., J. D. Holmberg, R. E. Cates and T. W. Bugler III, for American Power Conference, April 23, 1975.

e. Marley Cooling Tower Company 1951-Present; Asst. Project Engineer - fan design (1951-54); Project Engineer - fan design and supervision of

other mechanical component design (1954-57); Research Associate - development of mechanical components (1957-59); Manager, Research & Development - departmental supervision for all product and component development (1959-69); Sciences Director - supervision of the Computer, Analytical, and Laboratory Services Section of the Engineering Division. Also, supervision of work by external consultants and major test projects in outside laboratories (1969-Present).

5. Joe Ben Dickey, Jr.

a.-c. B.S., Civil Engineering, University of Colorado, 1946; 20 hours Business Administration, University of Kansas, 1947.

d.(1) "Evaporative Cooling Towers for Chemical and General Industries," 1978.

(2) "Managing Waste Heat with the Water Cooling Tower," 1970.

(3) "Debut of the Round Mechanical Draft Tower," by J. B. Dickey, Jr., J. D. Holmberg, R. E. Cates and T. W. Bugler, III, 1975.

e. Marley Company, 1947-1980; Project Engineer - Engineering Div. (1947-49); Sr. Application Engineer Sales Division (1949-53); Industrial Sales Manager (1953-65); Asst. Division Manager, Research & Engineering (1965-69); Vice President, Engineering (1969-77); Vice President, Special Projects (1977-1980).

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6. William V. McCoy

a.-c. B.S., Mechanical Engineering, University of Kansas, Lawrence, Kansas, 1948; University of Kansas, Lawrence, Kansas, 1948-51, completed work toward M.S., except thesis.

d. None

e. Marley Company, 1963-Present; Regional Sales Manager - Washington, D.C. (1963); District Sales Manager, L.A., CA (1963-77); Regional Vice President - L.A. Sales (1977-Present).

7. James O. Kadel

a.-c. B.S., Mechanical Engineering, Texas A&M, College Station, Texas, 1951.

d. "Cooling Towers - A Technological Tool to Increase Plant Site Potentials," 1970.

e. Marley Company 1953-Present; Application Engineer - Dricooler Sales (1953-55); Sr. Application Engineer - Industrial Tower Sales (1955-58); Sr. Engineer - Industrial Tower Sales (1958-63); Sr. Project Manager - Industrial Tower Sales (1963-65); Manager, Industrial Tower Sales (1965-68); Asst. General Manager (1968-69); V.P. Major Projects (1969-74); V.P. Sales Div. (1974-77); V.P. Engineering Div. (1977-79); President - Marley International (1979-82); Executive Vice President (1982-Present).

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8. Richard D. Landon

a.-c. University of Missouri, Columbia, B.S., Chemical Engineering, 1964; University of Missouri, Columbia, M.S., Chemical Engineering, 1974; Stanford University, California, Certificate of Completion, Stanford Executive Program, 1982.

d.(1) "Plume Abatement and Water Conservation with the Wet/Dry Cooling Tower," American Power Conference, 1973, by Richard D. Landon and James R. Houx, Jr.

(2) "Reducing Environmental Impact with Cooling Tower Innovations," Pacific Coast Electrical Association, 1975, by Richard D. Landon.

(3) "San Juan - Water Conservation Reality," Cooling Tower Institute - 1982, by Richard D. Landon.

e. Marley Cooling Tower Co. (1973-Present); Sr. Vice President, Domestic Operations (1982-Present); Vice President, Administration (1981-82); Asst. Vice President, Major Projects (1974-81); Manager, Power Projects (1973-74).

9. A. R. Thompson

a.-c. University of Kansas, B.S.M.E., Mechanical Engineering, 1949;

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d.(1) "Principles of Cooling Tower Applications," Fourth Annual All-Industry Air Conditioning Conference, Chicago, Illinois, 1956.

(2) "A Water Pollution Control Device - Cooling Towers," Chemical Engineering, October 14, 1968.

(3) "Cooling Tower Seminar - University of Wisconsin Extension School, October, 1973.

(4) "Cooling Towers - Energy Considerations in Applications," presented April 22, 1976, at the Energy-Industry Facilities Conference sponsored by the Dept. of Engineering, University of Wisconsin Extension, Madison, Wisconsin.

e. The Marley Company (1960-Present); Regional Manager (1960-76); Area Vice President, Eastern Marketing Area (1976); Vice President and General Sales Manager, Marley Cooling Tower Co., Mission, Kansas (1976-83); Sr. Vice President - Marketing and Sales, The Marley Cooling Tower Co., Mission, Kansas (1983-Present).

APS

See attached resumes for following APS personnel:

1. W. L. Hurst.
2. J. M. Allen.
3. E. E. VanBrunt.
4. A. C. Rogers.
5. J. P. Mann.

6. D. B. Karner.

7. W. F. Quinn.

INTERROGATORY NO. 19. Has any expert or technician conducted, or will any expert or technician conduct, any tests, examinations, or inspections in connection with this proceeding? If so, please identify each such person.

ANSWER

19. The following persons or entities have conducted or will conduct tests, examinations or inspections in connection with this proceeding:

1. CEP (Controls for Environmental Pollution, Inc.) P.O. Box 5351, 1925 Rosina, Santa Fe, New Mexico 87502.

2. ESC (Environmental Systems Corp.), 200 Tech Center Drive, Knoxville, Tennessee 37912.

3. William E. Dunn; 108 S. Prospect Ave., Champaign, Illinois 61820.

4. University of Arizona, as described in proposal previously provided to Petitioner, including Dr. Charles Curtis, Dr. Delbert McCune and Dr. Leon Bernstein.

5. CDM (Camp, Dresser & McKee), 11455 West 48th Avenue, Wheat Ridge, Colorado 80033.

6. NUS Corporation, 910 Clopper Road, Gaithersburg, Maryland 20878.

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INTERROGATORY NO. 20. If your answer to the preceding interrogatory is yes, identify any record or report of his findings including:

a. the date of submission or expected submission of each such report;

b. the person to whom it was or is expected to be submitted;

c. the person who has or is expected to have custody of each such report;

d. the subject matter and finding of each such report.

ANSWER

20.a.-d. The only reports prepared thus far are those from CEP relating to the Low Volume Samplers and a preliminary evaluation of the FOG model by Dr. Dunn. The other individuals or entities identified in response to Interrogatory No. 19 are expected to submit reports, but Joint Applicants do not have precise dates on which such reports will be completed. It is anticipated, however, that ESC will have completed its final report by June 30, 1983, and that Dr. Dunn will have completed his report by June 30, 1983. The expected date of the University of Arizona's report on the effects of salt drift on crop productivity has been previously provided to Petitioner. CEP's and CDM's reports are expected monthly. NUS' reports are expected

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annually. The University of Arizona will also be making reports biannually.

All of the reports will be submitted to Snell & Wilmer. The CEP reports will relate to the data collected by the Low Volume Samplers; ESC's report will deal with the quantity of salt drift emitted from and the salt drift droplet size distribution associated with the PVNGS cooling towers; Dr. Dunn's report will relate to validation of the FOG Model and predictions of salt drift deposition; CDM reports will analyze dustfall samples and cooling tower basin water; the University of Arizona report on the effects of salt drift on crop productivity will be as described in the proposal previously provided to Petitioner; the University of Arizona's other reports will relate to analyses of soil and vegetation samples; and the NUS reports will relate to the review of data collected as part of the Salt Deposition and Impact Monitoring Plan.

INTERROGATORY NO. 21. State the amount each expert identified in response to Petitioner's First Set of Interrogatories, No. 56, is to be paid or has been paid and the basis on which his compensation is to be determined.

ANSWER

21. The basis for the compensation of experts identified in response to Petitioner's First Set of Interrogatories is an hourly rate. The amount of the compensa-

tion is irrelevant to the subject matter of these proceedings, and Joint Applicants therefore object to this interrogatory on that basis.

INTERROGATORY NO. 22. Identify each exhibit which you propose to utilize at the hearing.

ANSWER

22. Joint Applicants have not yet identified the exhibits it will utilize at the hearing.

INTERROGATORY NO. 23. Identify each person other than Joint Applicants' attorneys, who prepared answers to these and the preceding set of interrogatories and the specific interrogatories on which each such person worked.

ANSWER

Joint Applicants object to this interrogatory on the grounds that it is burdensome and oppressive.

RESPECTFULLY SUBMITTED this 18th day of May, 1983.

SNELL & WILMER

By _____
Arthur C. Gehr
Warren E. Platt
Charles A. Bischoff
Vaughn A. Crawford
3100 Valley Bank Center
Phoenix, Arizona 85073

VAC/21/F

MORTON I. GOLDMAN — PUBLICATIONS

"Nuclear Waste Management," by Task Committee on Nuclear Effects, M. I. Goldman, Chairman; *Journal of the Environmental Engineering Division*, Proceedings of the American Society of Civil Engineers, Vol. 108, No. EE1, February 1982.

"Regulatory Issues In Uranium Supply," presented at Nuclear Engineering Seminar, University of Maryland, College Park, Md., November 10, 1981.

"Radon: The Ubiquitous Pollutant," presented at Atomic Industrial Forum Conference on Environmental Regulation of the Nuclear Industry: A New Decade, San Francisco, Calif., May 20, 1980.

"Management of Wastes From Energy Production: Nuclear and Coal," presented to American Nuclear Society Student Chapter, University of Maryland, College Park, Md., April 22, 1980.

"Energy: What About the Waste?" *Chemical Engineering Progress*, American Institute of Chemical Engineers, N.Y., November 1979.

"Nuclear Facilities Siting," by Task Committee on Nuclear Effects, M. I. Goldman, Vice Chairman; *Journal of the Environmental Engineering Division*, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE3, June 1979.

"The Nuclear Fuel Cycle: An Overview and Outlook," Civil Engineering and Nuclear Power Conference, American Society of Civil Engineers National Convention, Boston, Mass., April 2, 1979.

"Radiological Implications of Coal and Nuclear Fuels," presented at American Institute of Chemical Engineers Convention, Miami Beach, Fla., November 15, 1978.

"The Low-Level Radiation Issue—Radon from Uranium Production Facilities: Status Report," presented at Atomic Industrial Forum Conference on Environmental Regulation: Looking Ahead, Monterey, Calif., June 11, 1978.

"Our Energy Situation Today," Democratic Federation of Women's Clubs National Convention, Phoenix, Ariz., May 28, 1977.

"The Environmental Impact of a Nuclear Moratorium," presented at Environmental and Water Resources, Tenn., March 23, 1976.

"The Energy Environment," presented at Nuclear Engineering Seminar, University of Maryland, College Park, Md., March 16, 1976.

"Environmental Impact of Energy Sources" (coauthor), *Chemical Engineering*, Vol. 81, No. 22, Deskbook Issue, October 21, 1974.

"Cost-Benefit Analyses of Environmental Impact," Lecture, Continuing Education in Engineering, University Extension, and the College of Engineering, University of California, Berkeley, Calif., Course: Environmental Analysis and Environmental Monitoring for Nuclear Power Generation, September 13, 1974.

"The Environmental Impact of Nuclear Systems," Mechanical Engineering Colloquium, Worcester Polytechnic Institute, Worcester, Mass., November 6, 1973.

"Benefits and Risks to Nuclear Power in the United States of the 'As Low As Practicable' Philosophy," Proceedings of the Third International Congress of the International Radiation Protection Association, Washington, D.C., September 11, 1973.

"Environmental Effects of Electric Power Generation," National Science Teachers Association, Annual Convention, Detroit, Michigan, April 2, 1973. Reprint: *AWARE* Magazine, Community Performance Publications, Inc., Madison, Wis., August 1973.

"Environmental Assessments for Nuclear Power Plants in the United States," The Sixth Conference on Nuclear Safety Research, Tokyo, Japan, May 10, 1973.

"The Economic Consequences of Environmental Protection" (coauthor), presented at the International Colloquium—Nuclear Energy and Environment, A.I.M., Liege, Belgium, January 22-25, 1973.

"Environmental Effects of Nuclear Power Generation," presented at the Workshop on "The Nuclear Controversy in the USA," April 30 to May 3, 1972, Lucerne, Switzerland, sponsored by the Swiss Association for Atomic Energy in cooperation with the Atomic Industrial Forum, Inc.

"Radioactive Waste Management and Radiation Exposure," *Nuclear Technology*, Vol. 14, pp. 157-162, May 1972.

"New Environmental Reports—A Growing Nuclear Headache" (coauthor), *Electric Light and Power*, March 1972.

"New Developments in Nuclear Power Plant Waste Treatment" (coauthor), *ANS Transactions*, Vol. 14, No. 1, p. 327, June 1971.

"The Role of Nuclear Power in a Protected Environment," *Proceedings of the Southern Conf. on Environmental Radiation Protection from Nuclear Power Plants*, St. Petersburg, Fla., April 22, 1971.

"A Survey of Technological Responses by Electric Utilities to Environmental Problems," presented at the Atomic Industrial Forum Ar. ual Conf., Washington, D.C., November 18, 1970.

"Nuclear Facility Siting in the United States," *Proceedings: Fifth Annual Health Physics Society Midyear Topical Symposium*, Idaho Falls, Idaho, Vol. 1, pp. 10-16, November 4, 1970.

"The Environment and Nuclear Power Generation," *Proceedings: The Joint Power Generation Conf.*, Pittsburgh, Pa., September 30, 1970.

"Nuclear Power and the Environment—Communications or Technical Problems," *Transactions of American Nuclear Society 16th Annual Mtg.*, Los Angeles, Calif., June 29, 1970.

"Environmental Considerations at Nuclear Power Plants," and "Management of Nuclear Fuel Reprocessing Wastes," *Proceedings of a Student Conference on Nuclear Power and the Environment*, Univ. of Wisconsin, Madison, Wis., April 3-4, 1970.

"Waste Management at Nuclear Power Plants—A New Challenge," *Proceedings of Joint Power Conference*, Charlotte, N.C., September 24, 1969.

"United States Practice in Management of Radioactive Wastes at Nuclear Power Plants," Appendix 4, International Atomic Energy Agency, *Safety Series No. 28—Management of Radioactive Wastes at Nuclear Power Plants*, Vienna, Austria, December 1968.

"Management of Gaseous Wastes from Nuclear Power Stations," *Proceedings of a Symposium on Treatment of Airborne Radioactive Wastes*, International Atomic Energy Agency, N.Y., August 26-30, 1968.

"Safety Aspects of Ground Testing for Large Nuclear Rockets," *Nuclear Applications*, Vol. 2, April 1966.

"Establishing Safety Design Criteria for Power Reactor Sites" (coauthor), *Proceedings of ANS National Topical Meeting*, Los Angeles, Calif., February 1966.

"Treatment on Site-Ion Exchange and Absorption," Chapter 11 of *Low-Level Radioactive Wastes*, USAEC, 1964.

"Environmental Safety Aspects of Nuclear Rocket Flight Operations" (coauthor), *Proceedings of Aerospace Nuclear Safety Conference*, October 1-4, 1963, SC-DC-3553.

"Control of Airborne Radioactive Pollutants," presented at the Atlanta Environmental Engineering Conference, American Society of Civil Engineers, February 27, 1963.

"Environmental Monitoring at Nuclear Facilities" (coauthor), Nuclear Congress, Paper No. 73, 1962.

"The Fixation in Vitreous Matrices of High-Activity Fission Products" (coauthor), *Proceedings of the Second International Conference on Peaceful Uses of Atomic Energy*, Vol. 18, No. 27, 1958.

"Studies on Radioisotope Removal by Water Treatment Processes" (coauthor), *J. Am. Water Works Assn.* Vol. 43, No. 615, 1951.

PAUL V. MORGAN - PUBLICATIONS

PUBLICATIONS AND PRESENTATIONS

Morgan, P. V., "A Survey of the Heterotrophic Bacteria in the Sanctuary Lake of the Pymatuning Reservoir," Master's Thesis, University of Pittsburgh, 1958.

Shapiro, M. A., J. F. Ficke, P. V. Morgan, R. D. Spear and C. C. Kisiel, "Some Factors of Importance in Evaluating Sites for Nuclear Industry as Determined by a Limnological Study of the Upper Ohio River," Verh. Int. Ver. Limnol., Vol. 15, pp. 299-306, 1962.

Morgan, P. V. and Henry C. Bramer, "Thermal Pollution as a Factor in Power Plant Site Selection," American Power Conference, Vol. 31, pp. 724-732, 1969.

Morgan, P. V., "Basic Data Requirements to Evaluate Water Quality Control Programs," National Symposium on Data and Instrumentation for Water Quality Management, Conference of State Sanitary Engineers, the University of Wisconsin, Madison Wisconsin, 1970.

Morgan, P. V., B. R. Johnson, H. C. Bramer and W. L. Duncan, "Design of Water Qualtiy Surveillance Systems - Phase I - Systems Analysis Framework," Publication 16090 DBJ 08/70, of the Federal Water Quality Administration, 1970.

Morgan, P. V. and W. E. Bodnar, "Ecological Considerations for Beaver Valley Power Station," Ponnsylvania Electric Association, 1971.

Morgan, P. V., "How Shall We Measure Waste Water Parameters" - Panel - Automation of Waste Water Treatment Plants, American Institute of Chemical Engineers, San Francisco, California, 1971.

Morgan, P. V., B. R. Johnson, R. P. Goldstein and L. J. Perez, "Data Acquisition Systems for the Design of Thermal Discharge Structures," Water Quality Instrumentation, Vol. [illegible] Instrument Society of America, 1974.

Morgan, P. V., "Data Acquisition Systems for Remote Underwater Monitoring Platforms," International Exposition and Seminar on Water Resources Instrumentation, Chicago, 1974.

Dahlberg, M. D. and P. V. Morgan, "Calculation of Impact of Zooplankton Entrainment by Power Plants," Amer. Fish. Soc., Hawaii, 1974.

NUCLEAR PROJECTS PERSONNEL RESUME

W. L. Hurst

Supervisor - Civil

Nuclear Engineering

Responsible for reviewing architectural, civil and structural engineering designs, specifications and construction contracts, along with coordinating geology, seismology and hydrology activities.

Educational Background	Professional Level Experience
UNIVERSITY OF MISSOURI, BSCE (1967)	Stone & Webster Engineering Corp. Field Engineer (1967-1970) Structural Field QC Engineer (1970-1972) Gilbert Assoc., Inc. Resident Civil QA Engineer (1972-1974) Arizona Public Service Company Civil Engineer, Nuclear Services (1974-1975) Senior Civil Engineer, Nuclear Services (1975-1979) Supervising Engineer, Nuclear Services (1979-1982) Supervisor Nuclear Engineering (1982- Present)

STATION PERSONNEL RESUME

J. M. Allen

(Sheet 1 of 2)

TECHNICAL SUPPORT MANAGER

Responsible for Engineering Department, Radiation Protection and Chemistry Section, Licensing Department, Shift Technical Advisor/Independent Safety Engineering Group, and the Water Reclamation Facility.

Educational Background	Professional Level Experience
SOUTHERN OREGON COLLEGE B. S. Mathematics (1967) UNIVERSITY OF SANTA CLARA Engineering (1968) UNIVERSITY OF MARYLAND Engineering (1969) UNIVERSITY OF WASHINGTON M. S. Engineering (Nuclear) (1970) Professional Engineer, Control Systems (California)	Philco Ford Space Re-Entry Systems, Palo Alto, California Systems Analyst for space systems (1967-1968) U. S. Atomic Energy Commission - Division of Reactor Development and Technology I&C Engineer - assignments included Power Burst Facility, Loss of Fluid Test and EBR-II (1968-1970) Sacramento Municipal Utility District, Sacramento, California Assistant Plant I&C Engineer for the Rancho Seco Nuclear Generating Station (1970-1973) Salt River Project Senior I&C Engineer, Nuclear Services (1973-1976) Lead I&C Engineer, Nuclear Services (1976) Nuclear Engineering Supervisor (1976-1978)

STATION PERSONNEL RESUME

J. M. Allen

(Sheet 2 of 2)

TECHNICAL SUPPORT MANAGER

Educational Background	Professional Level Experience
	Arizona Public Service Company Nuclear Engineering Supervisor, Nuclear Services (1978-1979) Nuclear Engineering Manager, Nuclear Engineering (1979-1982) Technical Support Manager PVNGS (1982-Present)

HEADQUARTERS PERSONNEL RESUMES

E. E. Van Brunt, Jr.

APS Vice President

Responsible for engineering construction and quality assurance for PVNGS

Educational Background	Professional Level Experience
Lehigh University B.S. in ME Rensalaer Polytechnic Institute M.S. in Engineering Science - major in Nuclear Engineering	Pratt & Whitney Aircraft Company Nuclear engineer worked on aircraft-nuclear propulsion project (1957-1961) Ebasco Services, Inc. (1961-1972) Project Manager - St. Lucie Project Engineer - Millstone Unit 1 Project Manager - Power Burst Facility Nuclear Engineer - Advance Test Reactor Arizona Public Service Company Manager Nuclear Services Project Director for ANPP (1972-1974) APS Vice President Nuclear Services (Project Director) (1974-1976) APS Vice President Construction Projects, also Project Director (1976-1978) Vice President, Nuclear Projects Management (1978-present)

NUCLEAR PROJECTS PERSONNEL RESUME

A. Carter Rogers

Nuclear Engineering Manager

Nuclear Engineering

Responsible for the civil engineering, mechanical engineering, nuclear engineering and fuel management sections in the Nuclear Services Department

Educational Background	Professional Level Experience
UNIVERSITY OF CONNECTICUT M.S. in Chemical Engineering (1968) UNIVERSITY OF MISSOURI B.S. in Chemical Engineering (1961)	U. S. ARMY OFFICER (1961-1964) Pratt & Whitney Aircraft Fuel Cell Development (1964-1966) Combustion Engineering Nuclear Design Engineer (1966-1967) Project Engineer for Plant Engineering (1967-1970) Senior Project Engineer (1970-1972) Responsible for St. Lucie, and for floating nuclear power plant studies. Supported NSSS turnkey proposals by directing nuclear island work in Switzerland, Mexico and Finland Arizona Public Service Company Senior Consulting Engineering, Nuclear Services (1972-1976) Nuclear Engineering Supervisor, Nuclear Services (1976-1979) Nuclear Engineering Manager, Nuclear Services (1979-Present)

NUCLEAR PROJECTS PERSONNEL RESUME

J. R. Mann

Senior Health Physics Consultant

Nuclear Engineering

Responsible for Health Physics and Environmental Unit.

Educational Background	Professional Level Experience
THE COLORADO COLLEGE B.S. Physics (1951) VANDERBILT UNIVERSITY M.S. Radiation Physics (USAEC Health Physics Fellowship Program) (1962) Certified Health Physicist (1975) Certified Power Reactor Health Physicist (1980)	Dow Chemical Company - Rocky Flats Plant - Denver, Colorado Health Physics, Electronics Engineer (1954-1959) Health Physics - Radiation Engineer (1961-1965) Health Physics - Radiation Dosimetry Manager (1965-1973) U. S. Atomic Energy Commission Regulatory Operations, Region I Radiation Specialist, Operating Nuclear Power Plant Inspector (1973-1974) Arizona Public Service Company Senior Health Physicist, Nuclear Projects (1974-1980) Senior Health Physics Consultant (1980-1982)

HEADQUARTERS PERSONNEL RESUMES

D. B. Karner

Supervising Engineer - Licensing

Nuclear Services

Responsible for the direction of licensing activities for PVNGS

Educational Background	Professional Level Experience
Arizona State University BSEE (1973) University of Arizona MSNE (1974)	Arizona Public Service Company Instrumentation & Control Engineer, Nuclear Services (1974-1977) Senior Licensing Engineer, Nuclear Services (1977-1979) Supervising Engineer, Nuclear Services (1979- 1980)

NUCLEAR PROJECTS PERSONNEL RESUME

William F. Quinn
Supervisor - Nuclear Safety & Licensing
Nuclear Engineering

Responsible for licensing activities leading to obtaining an Operating License for PVNGS and for the safety of PVNGS in regard to meeting regulatory agency requirements.

Educational Background	Professional Level Experience
Arizona State University BS in Engineering Science (1976) (Structural Engineering)	U. S. Marine Corps - 1969-1971 Arizona Public Service Company Structural Engineer I (1976-1977) Responsible for structural design review of ancilliary and major PVNGS structures, review of civil/ structural specifications, and review of soils engineering activities for PVNGS. Structural Engineer II (1977-1978) Responsible for structural and soils engineering design review for PVNGS 1-3 including providing consultant direction for soils/ geology studies required for CP licensing activities on proposed PVNGS Units 4 & 5. Licensing Engineer II, III (1978-1980) Responsible for PVNGS 1, 2 & 3 licensing activities, FSAR preparation, TMI requirements and interfacing with NRC and for CP licensing activities for proposed PVNGS Units 4 & 5. Supervising Engineer, Licensing (1980-1981) Responsible for supervising Licensing group for PVNGS OL activities including review of regulatory requirements.

NUCLEAR PROJECTS PERSONNEL RESUME

William F. Quinn
Supervisor - Nuclear Safety & Licensing
Nuclear Engineering

(Cont'd)

Educational Background	Professional Level Experience
	Supervising Nuclear Safety and Licensing Engineer (1981-1982) Responsible for PVNGS licensing and PVNGS safety in regard to meeting regulatory agency requirements. Chairman - PVNGS Safety Audit Committee (May 1982-Present) Supervisor - Nuclear Safety and Licensing (May 1982 - present) Responsible for PVNGS licensing and PVNGS safety in regard to meeting regulatory agency requirements.

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

V E R I F I C A T I O N

I, VAUGHN CRAWFORD, being duly sworn, depose and say that I am Counsel for Joint Applicants in the referenced action; that I have read the foregoing answers to Interrogatories; that the information contained therein was gathered under my supervision; that said answers are based on information provided by Joint Applicants' experts; and that they are true to the best of my knowledge and to the best of the knowledge of the persons who helped in their compilation.

VAUGHN CRAWFORD

SUBSCRIBED AND SWORN to before me this 18th day of May, 1983.

NOTARY PUBLIC

My commission expires:

My Commission Expires March 22, 1985

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ARIZONA PUBLIC SERVICE COMPANY, et al.	)	Docket Nos. STN 50-529 STN 50-530
	)	
(Palo Verde Nuclear Generating Station Units 2 and 3)	)	

- CERTIFICATE OF SERVICE

I hereby certify that copies of "Joint Applicants' Response to West Valley Agricultural Protection Council, Inc.'s Second Set of Interrogatories Directed to Joint Applicants" have been served upon the following listed persons by deposit in the United States mail, properly addressed and with postage prepaid, this 18th day of May, 1983.

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Washington, D.C. 20555

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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