RAS 4163

RELATED CORRESPONDENCE

March 18, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE, L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

APPLICANT'S OUTLINE OF KEY DETERMINATIONS ON CONTENTION UTAH O -- HYDROLOGY

I. ISSUES

A. This contention concerns the State's assertion that the Private Fuel Storage, L.L.C. ("PFS") Environmental Report ("ER") and Final Environmental Impact Statement ("FEIS") do not contain adequate analyses of potential non-radiological contaminant environmental effects from the construction, operation, and decommissioning of the Private Fuel Storage Facility ("PFSF") regarding: (1) potential non-radiological contaminant pathways from the PFSF sanitary waste systems; (2) potential non-radiological environmental impacts from potential overflow and seepage from the PFSF detention basin; (3) potential for non-radiological surface water and groundwater contamination; and (4) potential impacts on downgradient hydrological resources from non-radiological groundwater contamination.

B. The PFSF ER and FEIS adequately describe the non-radiological environmental impacts on surface water and groundwater that will likely result from PFSF construction, operation, and decommissioning.

C. PFSF procedural controls, the design of the PFSF sanitary waste systems, the small quantities of potential contaminants expected to be stored on the PFSF site, and the relatively low permeability of the soils in the PFSF vicinity will ensure that no significant non-radioactive contamination of the surface water or groundwater will occur as a result of PFSF construction, operation, and decommissioning.

D. There are no credible potential pathways for non-radiological contamination from overflow or seepage from the PFSF detention basin.

E. There are no credible potential pathways for PFSF construction, operation, and decommissioning to have a significant impact on downgradient hydrological resources.

Template = SECY-055

SECY-02

II. CONCLUSIONS OF FACT AND LAW

A. PFSF construction, operation, and decommissioning will have no significant non-radiological impacts on surface water and groundwater or downgradient hydrological resources.

B. PFS has adequately assessed the potential non-radiological environmental impacts from PFSF construction, operation, and decommissioning.

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APPLICANT'S PREFACE OF THE TESTIMONY OF GEORGE H. C. LIANG AND DONALD WAYNE LEWIS ON CONTENTION UTAH O -- HYDROLOGY

I. WITNESSES

A. George H. C. Liang

George H. C. Liang is a Senior Principal Environmental Engineer for Stone & Webster, Inc. ("S&W"), a Shaw Group Company. He was awarded a Ph.D. in Civil Engineering from the University of Connecticut in 1972 and is a registered Professional Engineer in the State of Connecticut. Mr. Liang has extensive experience in the analysis of hydrologic processes, including over 15 years experience in the calculation and evaluation of groundwater dispersion. Through his involvement in various groundwater dispersion evaluations of nuclear facilities performed by S&W during this period, Mr. Liang is intimately familiar with applicable Nuclear Regulatory Commission ("NRC") requirements and standard industry practice for evaluating groundwater dispersion. Mr. Liang has visited and observed the proposed Private Fuel Storage, L.L.C. ("PFS") project site and surrounding area. He is knowledgeable of the location of the proposed PFS Facility ("PFSF"), the hydrologic and meteorological conditions of that area, and the area's topography, surface water and groundwater.

B. Donald Wayne Lewis

Donald Wayne Lewis is employed by S&W as the Lead Mechanical Engineer for the PFSF project, a position he has held since 1996. He received his undergraduate engineering degree from the Montana State University, majoring in Civil/Structural Engineering. Mr. Lewis has 19 years of experience in the nuclear power industry, including 10 years of experience with the design, licensing, construction, and operation of independent spent fuel storage installations (ISFSIs). He is a registered professional engineer in the states of New York, Colorado, Utah, Iowa, and Maine. Mr. Lewis' technical contribution to the PFS project focuses on the mechanical aspects of ISFSI work, including cask handling and transportation equipment and operations, building services (HVAC, plumbing, etc.), and fire protection. For the PFS project, he is also responsible for the preparation of the principal design criteria, design installation, and operating systems portions of the PFSF Safety Analysis Report.

II. TESTIMONY

A. Scope

Mr. Liang and Mr. Lewis will testify to the remaining allegations in Contention Utah O and show: 1) that the PFSF Environmental Report ("ER") and Final Environmental Impact Statement ("FEIS") are adequate with respect to their description of the non-radiological environmental impacts on surface water and groundwater that will result from the construction, operation, and decommissioning of the PFSF and 2) that the construction, operation, and decommissioning of the PFSF will have no significant non-radiological impacts on surface water and groundwater or downgradient hydrological resources.

B. PFSF Overview

Mr. Lewis and Mr. Liang will testify to the design of major PFSF site facilities, the PFSF sanitary waste systems, associated leach fields, and the PFSF detention basin and the characteristics of surface water, ground water and soils in the vicinity of the PFSF site. They will also testify to the design considerations and applicable construction codes and standards and how soil conditions at the PFSF site influenced the design of the leach fields and detention basin. Based on the observed physical conditions and historical data, they will testify to their conclusion that there is no hydrological link between the surface and groundwater beneath the PFSF site.

C. Potential Non-radiological Contaminate Pathways from the PFSF Sanitary Waste Systems

Based on their assessment of the PFSF construction, routine operations, and decommissioning activities, Mr. Lewis and Mr. Liang will testify that the PFSF procedural controls, design of the sanitary waste systems, the small quantities of potential contaminants expected to be stored on the PFSF site, and the relatively low permeability of the soils in the PFSF vicinity will ensure that no significant non-radioactive contamination of the surface water or groundwater will occur as a result of PFSF activities.

D. The PFSF Detention Basin

Based on their assessment of the design, function and location of the PFSF detention basin and the characteristics of the soil in the vicinity of the PFSF site, Mr. Liang and Mr. Lewis will testify that no potential pathways for substantial non-radiological contamination exist from potential overflow or seepage from the PFSF detention basin.

E. The Potential for Non-Radiological Surface Water and Groundwater Contamination

Based on their assessment of the absence of any significant contamination sources, implementation of strict procedures, and use of best management practices, Mr. Lewis and Mr. Liang will testify that there is no potential for significant surface water or groundwater non-radiological contamination from construction, routine operation, or decommissioning of the PFSF.

F. Impact on Downgradient Hydrological Resources

Based on their assessment that there is no credible pathway for non-radiological contamination to reach the surface water or groundwater, Mr. Lewis and Mr. Liang will testify that the construction, operation, and decommissioning of the PFSF will have no significant impact on downgradient hydrological resources.

G. Conclusion

Mr. Lewis and Mr. Liang will testify to their conclusion that, based on all of the available information, non-radiological contamination from construction, operation and decommissioning of the PFSF will have no significant impact on the surface water and groundwater of Skull Valley or downgradient hydrological resources and that there is no technical basis for any of the remaining assertions in Contention Utah O.

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TESTIMONY OF GEORGE H. C. LIANG AND DONALD WAYNE LEWIS ON CONTENTION UTAH O -- HYDROLOGY

I. BACKGROUND -- WITNESSES

A. George H. C. Liang

Q1. Please state your full name.

A1. George H. C. Liang.

Q2. By whom are you employed and what is your position?

A2. I am a Senior Principal Environmental Engineer for Stone & Webster, Inc. ("S&W"), a Shaw Group Company.

Q3. Please summarize your educational and professional qualifications.

A3. My professional and educational experience is summarized in the curriculum vitae attached to this testimony. I was awarded a Ph.D. in Civil Engineering from the University of Connecticut in 1972 and am a registered Professional Engineer in the State of Connecticut. I have extensive experience in the analysis of hydrologic processes, including over 15 years experience in the calculation and evaluation of groundwater dispersion. I have attended university-level continuing education courses on hydrology and groundwater hydrology. Through my involvement in various groundwater dispersion evaluations of nuclear facilities performed by S&W during this period, I am intimately familiar with applicable Nuclear Regulatory Commission ("NRC") requirements and standard industry practice for evaluating groundwater dispersion. I have visited and observed the proposed Private Fuel Storage, L.L.C. ("PFS") project site and surrounding area. I am knowledgeable of the location of the proposed PFS Facility ("PFSF"), the hydrologic and meteorological conditions of that area, and the area's topography, surface water and groundwater.

Q4. What has been your role in the PFSF project relevant to Contention Utah O?

A4. I have been working on the proposed PFSF project since January 1999 in hydrology and groundwater related areas. Analyses that I either participated in or reviewed are the basis of the hydrology sections in the PFSF Safety Analysis Report[1] (SAR) and Environmental Report[2] (ER). In addition, I prepared responses to NRC's Request for Additional Information ("RAI") regarding the ER and SAR related to hydrology issues.

Q5. What is the purpose of your testimony?

A5. The purpose of my testimony is to respond to the remaining allegations in Contention Utah O that PFS has failed to adequately assess the PFSF site hydrology and the environmental effects from the construction, operation, and decommissioning of the PFSF regarding non-radiological contaminant sources, pathways, and impacts.

Q6. To what will you testify?

A6. I am providing this testimony to show: 1) that the PFSF Environmental Report ("ER") and Final Environmental Impact Statement ("FEIS")[3] accurately describe the non-radiological environmental impacts on surface water and groundwater that will result from the construction, operation, and decommissioning of the

[1] PFS, "Private Fuel Storage Facility Safety Analysis Report," Rev. 22 (2001).

[2] PFS, "Environmental Report for the Private Fuel Storage Facility" (1997).

[3] NUREG-1714, "Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility on Tooele County, Utah" (Dec. 2001).

PFSF and 2) that the construction, operation, and decommissioning of the PFSF will have no significant non-radiological impacts on surface water and groundwater. My specific role in this testimony is to provide the scientific basis for PFS' position regarding potential non-radiological impacts to local hydrological resources from the construction, operation and decommissioning of the PFSF.

B. Donald Wayne Lewis

Q7. Please state your full name.

A7. Donald Wayne Lewis

Q8. By whom are you employed and what is your position?

A8. I am currently employed by Stone & Webster, Inc., a Shaw Group Company, as the Lead Mechanical Engineer for the PFSF project. I have held this position since 1996.

Q9. Please summarize your educational and professional qualifications.

A9. My professional and educational experience is summarized in the curriculum vitae attached to this testimony. I received my undergraduate engineering degree from Montana State University, where I majored in Civil/Structural Engineering. I have 19 years of experience in the nuclear power industry, including 10 years of experience with the design, licensing, construction, and operation of independent spent fuel storage installations ("ISFSIs"). I am currently a registered professional engineer in the states of New York, Colorado, Utah, Iowa, and Maine. My technical contribution focuses on the mechanical aspects of ISFSI work, including cask handling and transportation equipment and operations, building services (HVAC, plumbing, etc.), and fire protection. For the PFSF project, I am also responsible for the preparation of the principal design criteria, design installation, and operating systems portions of the PFSF Safety Analysis Report. I have previously testified in this license application proceeding on the subject of fire protection.

Q10. What has been your role in the PFSF project relevant to Contention Utah O?

A10. As Lead Mechanical Engineer, it is my responsibility to establish the design basis and review all design activities of the mechanical systems at the PFSF, including the sanitary waste system. Specifically, I prepared the sanitary waste system flow diagrams, determined the approximate location of the two drain fields, and determined which buildings would drain to each drain field. The flow diagrams, system physical arrangement drawings, and construction specifications were prepared under my direction, which I reviewed for completeness and accuracy. In addition, during licensing of the PFSF, I established many of the detention basin design criteria. Specifically, I helped determine some of the detention basin design features and calculated the duration of evaporation and percolation of the standing water following a 100-year storm.

Q11. What is the purpose of your testimony?

A11. The purpose of my testimony is to respond to the remaining allegations in Contention Utah O that PFS has failed to adequately assess the PFSF site hydrology and the environmental effects from the construction, operation, and decommissioning of the PFSF regarding non-radiological contaminant sources, pathways, and impacts.

Q12. To what will you testify?

A12. I am providing this testimony to show: 1) that the ER and FEIS for the PFSF adequately and accurately describe the potential impacts on the surface water and groundwater in the vicinity of the PFSF site from non-radiological contaminant sources and pathways resulting from the construction, operation, and decommissioning of the PFSF, and 2) that the construction, operation, and decommissioning of the PFSF do not have the potential for significant non-radiological surface water and groundwater impacts or downgradient hydrological resource impacts. My role in this testimony is to describe the specific PFSF design features to minimize the potential for non-radiological contamination of surface waters and groundwater. I will also describe the potential non-radiological contaminants that will likely be present at the PFSF and discuss the likelihood of non-radiological contamination of surface and ground water occurring during facility construction, operation and decommissioning. I will also generally describe the procedures that will be in place to preclude such contamination.

II. OVERVIEW

A. PFSF General Description

Q13. Please describe the proposed PFSF.

A13. (Lewis) The proposed PFSF is an independent spent fuel storage facility to be located in Skull Valley, Utah. When completed, the Owner-Controlled Area will cover 820 acres. Spent nuclear fuel will be stored inside welded, stainless steel canisters contained in concrete and steel cylindrical storage casks on concrete storage pads within a secure Restricted Area. The general layout of this area is illustrated in ER Figure 2.1–2 (sheet 1 of 2) (PFS Exhibit AA). The area around the storage pads will be surfaced with compacted crushed rock with a gentle slope toward the north to facilitate runoff of surface water from the storage pads to a detention basin.

1. Site Facilities

Q14. Please describe the buildings that will be present at the site.

A14. (Lewis) In addition to the spent fuel cask storage pads, four buildings will be constructed as part of the PFSF. These include the Administration Building, the Operations and Maintenance Building, the Security and Health Physics Building, and the Canister Transfer Building. PFS Exhibit AA shows the relationship of these buildings to other site features.

The Administration Building is located outside of the Restricted Area at the entrance to the 820-acre Owner-Controlled Area. It is a single-story steel-frame building, approximately 80 feet wide, 150 feet long, and 22 feet tall, that will house the full-time administrative, engineering, licensing, and Quality Assurance personnel. It will be located approximately 1,850 feet from the storage pads. A break room, men's and women's restrooms, and janitor's closet will have sinks and/or toilets that drain into the sanitary waste system.

The Operations and Maintenance Building is located close to the Administration Building, approximately 1100 feet from the Restricted Area. This building is a single-story steel-frame building, approximately 80 feet wide, 200 feet long, and 36 feet tall, that will house maintenance shops and spare parts and equipment storage areas to service the vehicles and equipment used at the facility. A break room, men's and women's restrooms and locker rooms, and a janitor's closet will have sinks, toilets, and/or showers that drain into the same sanitary waste system that services the Administration Building. Because of their distance from the other two buildings on site, the Administration Building and the Operations and Maintenance Building will have a common sanitary waste system independent from a second system servicing the Security and Health Physics Building and the Canister Transfer Building.

The Security and Health Physics Building is located at the entrance to the Restricted Area and is a single-story concrete-masonry building, approximately 80 feet wide, 120 feet long and 23 feet tall. The building will control access to the Restricted Area and will house the health physics and security personnel. A staff day room, men's and women's restrooms and locker rooms, first-aid treatment room, and a janitor's closet will have sinks, toilets, and/or showers that drain into a second sanitary waste system that will service the Security and Health Physics Building and the Canister Transfer Building.

The Canister Transfer Building is located within the Restricted Area and is a reinforced-concrete high-bay structure approximately 205 feet wide, 270 feet long, and 92 feet tall. The building will house personnel temporarily during canister receipt and transfer to storage cask activities. Men's and women's restrooms and a janitor's closet will have sinks and/or toilets that will drain to a sanitary waste system, the same system that services the Security and Health Physics Building.

2. Sewer/Wastewater Systems

Q15. Please describe the PFSF sanitary waste systems.

A15. (Lewis) During PFSF construction and decommissioning, all sewage and wastewater will be handled using portable sanitary systems and subsequently trucked offsite. Sewer and wastewater requirements during PFSF operation will be handled by two separate sanitary waste systems. One of these systems will service the Administration Building and the Operations and Maintenance Building and a second system will service the Canister Transfer Building and the Security and Health Physics Building. The distance between these two buildings made the use of a single system and leach field impractical.

Both sanitary wastewater systems will be designed and installed according to the Uniform Plumbing Code ("UPC"). Major system components will include fixtures (sinks, toilets, and showers), piping, septic tanks, and the leach fields. The Canister Transfer Building sanitary waste system may include a lift station to pump waste to the septic tank, if necessary. Current plans call for use of standard materials, such as cast iron and PVC, as piping.

Q16. What is the Uniform Plumbing Code?

A16. (Lewis) The Uniform Plumbing Code, or UPC, prepared by the International Association of Plumbing and Mechanical Officials, is a widely used and accepted standard for material selection, design, construction, and installation of plumbing systems including sanitary drainage systems. Compliance with this code will ensure that the PFSF sanitary waste systems are adequate to accommodate anticipated usage. The 1997 edition of the UPC was the adopted plumbing code for Tooele County when detailed design began on the PFSF in 2000. Typically, the appropriate code edition to apply to a project is the one in effect when detailed design begins.

The UPC was used to design the domestic water and sanitary waste systems of the Canister Transfer Building and the Security and Health Physics Building and to determine the preliminary size of the leach field areas. The code will also be required by PFS to be used by the construction contractor that will design and install the domestic water and sanitary waste systems in the Administration Building and Operations & Maintenance Building.

Q17. How did you determine the size of the PFSF sanitary waste systems?

A17. (Lewis) The UPC specifically mandates the sanitary waste system design requirements. The sanitary waste pipes were sized based on the number and type of fixtures in each building. The minimum number of fixtures was determined in accordance with Uniform Building Code requirements and based on the number of occupants (addressed in ER Section 4.2). The septic tanks were sized for a capacity of 3,500-gallons each. The piping for each sanitary waste system will be installed underground and sloped to facilitate drainage. Based on the number of fixtures and typical soil types encountered onsite, each sanitary waste leach field has been preliminarily sized at 1,400 square feet. The construction contractor will determine the final leach field sizing after percolation tests have been performed.

Q18. Describe the location and design of the sanitary waste system leach fields?

A18. (Lewis) The PFSF leach field serving the Canister Transfer Building and Security and Health Physics Building will be located approximately 125 feet north-northwest of the Security and Health Physics Building. The leach field serving the Administration Building and the Operations & Maintenance Building will be located approximately 275 feet northwest of the Administration Building and approximately 250 feet east of the Operations & Maintenance Building. These locations were chosen because they are downhill from the buildings, which is required for good drainage, and are away from the site water supply well. Each leach field was conservatively designed to process the anticipated wastewater loading discussed in the previous question. Each leach field is anticipated to contain a distribution box and perforated piping to disperse the wastewater evenly over the entire leach field area. These locations and designs meet the clearance distances and capacities in accordance with the UPC. The construction contractor may, however, change the final location of the leach fields based on soil percolation test results.

Q19. What bearing did the soil types have on the size of the PFS sanitary waste system components and leach field?

A19. (Lewis) The PFSF site soil characteristics determine the size leach field needed for absorption of the generated wastewater into the soil. The UPC provides the design criteria for the leach field size based on soil types.

Q20. How did you determine the soil characteristics at the PFS site for the purpose of sizing the sanitary waste systems?

A20. (Lewis) The soil characteristics used in sizing the PFSF sanitary waste leach fields were determined from the site borings that were taken in late 1996 nearest the proposed leach field areas.[4] The boring near the leach field servicing the Canister Transfer Building and Security and Health Physics Building sanitary waste system (boring E-3) determined that the soil consisted mainly of silt extending to a depth of 5 feet below grade and interlayered clay and silty clay 5 to 10 feet below grade. The boring near the leach field servicing the Administration Building and the Operations & Maintenance Building sanitary waste system (boring AR-1) determined that the soil consisted mainly of clayey silt extending to a depth of 5 feet below grade and sand 5 to 10 feet below grade.

Q21. Is there any technical reason a sanitary waste leach field would not work as intended (i.e., properly process waste without pooling or contaminating groundwater) in the soils expected at the PFSF site?

A21. (Lewis) No. As stated before, leach fields have been designed for many, many years and are well understood. Established codes and standards mandate certain requirements for leach field placement. We have no reason to believe that the soils in the vicinity of the PFSF will not comply with these requirements and every reason to believe that the planned wastewater system will perform as designed, as have thousands, if not millions, of similar systems.

3. Detention Basin

Q22. Please describe the PFSF detention basin.

A22. (Lewis) A storm-water detention basin will be constructed at the northern end of the Restricted Area, as shown in PFS Exhibit AA. The purpose of the basin is to detain precipitation runoff from severe storms and prevent possible soil erosion from runoff channeled by the storage pads. The detention basin will be approximately 800 feet long by 200 feet wide by 7 feet deep, which S&W calculated will hold the waters from a single 100-year storm event. The basin serves as a collection point for runoff, allowing the water to collect and then slowly dissipate through evaporation and percolation into the subsoils. The detention basin is designed with a concrete inlet from the cask storage area that precludes erosion of the area surrounding the cask storage area. The basin will be constructed with mechanically compacted soil sideslopes and floor and will cover approximately 8 acres with 10:1 embankments.

Q23. What will prevent damage to the detention basin structure in the unlikely event of runoff volume in excess of design?

A23. (Lewis) A spillway is located on the northern side of the detention basin. Its purpose is to allow overflow that may occur in the very unlikely event of precipitation in excess of the 100-year storm event or a precipitation event that occurs before the water from a previous precipitation event has dissipated. Though it is unlikely that this would occur, the emergency spillway provides relief protection for the detention basin walls by preventing water in the basin from exceeding a maximum depth of 6 feet. The spillway is designed so that if such overflow occurs there will be no damage to the detention basin structure or the spillway and no erosion of the soil around the PFSF.

Footnote continued from previous page

[4] See, SAR Chapter 2, Appendix 2A, Borings E-3 and AR-1.

Q24. What evaporation rate have you assumed for your detention basin analysis and what was the source of this information?

A24. (Lewis) Originally, I assumed an evaporation rate of 0.32 inches per day. I have revised that assumption and now assume an evaporation rate of 0.13 inches per day based on information from Figure 16.1 in Houghton, Handbook of Applied Meteorology, 1985.

Q25. What is the impact of assuming this evaporation rate?

A25. (Lewis) Using an evaporation rate of 0.13 inches per day results in a longer period of standing water in the detention basin following a precipitation event (assuming no pumping as described in Answer 70). Even for this evaporation rate , however, no significant percolation of retained water would occur because of the extremely low percolation (0.09 inches per day) of the detention basin floor. Therefore, assuming a 0.13 inches per day evaporation rate, the water from the 100-year precipitation event (4.77feet) would take approximately 260 days (to dissipate through evaporation and percolation), rather than 140 days with an evaporation rate of 0.32 inches per day.[5] The additional 120 days equates to approximately two feet of additional percolation depth from the earlier calculation. This is clearly insignificant in relation to a groundwater depth of 125 feet.

B. Surface Water and Groundwater Near the PFS Site

Q26. Please describe the surface waters in the vicinity of the PFSF site.

A26. (Liang) The location proposed for the PFSF is an area of western Utah with a semi-arid climate, receiving average annual precipitation of 7 to 12 inches.[6] There are no perennial watercourses, such as lakes, ponds, drinking water storage areas or streams, within 5 miles of the PFSF. No intermittent or perennial streams cross any portion of the PFSF site boundary. No identifiable stream channels exist at any point on the PFSF site. The nearest channel identifiable as an intermit-

[5] Accounting for water loss through the basin floor of 0.09 inches per day.

[6] Hood, J. W. and Waddell, K. M., "Hydrologic Reconnaissance of Skull Valley, Tooele County, UT: Technical Publication No. 18" (1968); See also, ER Table 2.4-3 (recent data confirming historical information).

tent stream is located approximately 1,500 feet northeast of the site. According to information provided by the State of Utah, the nearest perennial stream is the Lower South Lost Creek Spring, located approximately 5 miles northeast of the proposed PFSF site.[7] The nearest perennial surface water body, the Great Salt Lake, is located about 28 miles north of the proposed PFSF site boundary.

Q27. Please describe the groundwater in the vicinity of the PFSF site.

A27. (Liang) The groundwater table beneath the PFSF site in the proposed vicinity of the Canister Transfer Building (elevation 4,350 feet) was encountered in the monitoring well CTB-5 (OW) at a depth of 124.5 feet during an investigation at the PFSF site administered by S&W. Based on this information, the depth to groundwater at the PFS site is approximately 125 feet. Differences in surface elevations across the proposed PFSF site could cause the depth to groundwater to vary somewhat over the site, but only by a few feet.

Q28. Are any wells located in the vicinity of the PFS site?

A28. Yes. There are 9 water wells in use within 5 miles of the site. Based on well data obtained from the State of Utah, Division of Water Rights, and Hood and Waddell, 1968, the depth from the ground surface to groundwater in these wells ranges from 78 feet to 520 feet. The depth of 125 feet observed at the CTB-5 well is entirely consistent with this data.

Q29. What is the quality of the groundwater in the vicinity of the PFSF site?

A29. (Liang) In general, groundwater in Skull Valley in the vicinity of the PFSF site is suitable for irrigation or stock watering without treatment. The main dissolved ions are sodium and chloride (Hood and Waddell, 1968). Total dissolved solids in the central and northern parts of Skull Valley, the location of the PFSF, range from 1,600 to 7,900 mg per liter. In comparison, total dissolved solids in potable water are normally less than 500 mg per liter. Most sources of water in the valley

[7] "State of Utah Contentions on the Construction and Operating License Application by Private Fuel Storage, LLC for an Independent Spent Fuel Storage Facility" (Nov. 27, 1997).

are high in calcium (i.e., would be classified as very "hard") and would need treatment to be suitable for human consumption.

Q30. Please explain how the precipitation in the Stansbury and Cedar Mountains provides groundwater for the PFSF site in Skull Valley.

A30. (Liang) Soils at higher elevations around the Stansbury and Cedar Mountains tend to be highly permeable. Skull Valley typically receives 7 to 12 inches of precipitation per year, while the surrounding mountains generally receive more precipitation, up to 40 inches in Stanbury Mountains and 16 to 20 inches in the lower Cedar Mountains. Because of the semi-arid climate and geologic conditions in and around the mountains, most of the runoff from the mountains either evaporates or infiltrates into alluvial materials near the margins of Skull Valley. Infiltration of runoff from the mountains recharges aquifers in the alluvial fans that extend beneath Skull Valley and is the source of groundwater beneath the PFSF site. Precipitation that falls in the valley does not reach the groundwater because of the depth of the water table, the low permeability of the soil and low amount of precipitation. Each of these characteristics is discussed in further detail below.

Q31. Please explain what happens to the precipitation that falls directly in Skull Valley in the vicinity of the PFSF site.

A31. (Liang) Precipitation events in Skull Valley are normally small and the water remains on or very near the surface where it is evaporated or transpired by vegetation. Larger amounts of precipitation may permeate slightly into the soil. Ultimately, all precipitation returns to the atmosphere either by evaporation or plant uptake and subsequent transpiration. Precipitation falling in Skull Valley does not reach groundwater because of the relatively small amount, low soil permeability, and depth to the water table.

C. Soils Near the PFSF Site

Q32. Please describe the soils in Skull Valley.

A32. (Liang) Soils in the Skull Valley floor are mainly comprised of interlayered silt, silty clay, and clayey silt down to between 25 to 35 feet below existing grade.

Q33. Please describe the borings and laboratory test data you used to determine that the soil at the PFSF site, down to between 25 and 35 feet below existing grade, is mainly comprised of interlayered silt, silty clay, and clayey silt.

A33. (Liang) Geotechnical tests were performed on samples obtained from the borings at the PFSF site. The tests were conducted at the S&W Geotechnical Laboratory in Boston, Massachusetts on 20 boxed split spoon jar samples and 9 undisturbed tube samples from the Skull Valley site. The testing program performed analyses to determine water content, Atterberg limits, percent fines, specific gravity, consolidation, and unconsolidated - undrained triaxial compression. They were conducted in accordance with applicable American Society for Testing and Materials ("ASTM") standards, including the C-136 Test Method for Sieve Analysis of Fine and Coarse Aggregates and D-1140 Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve, and others.

All laboratory equipment and materials used to conduct the testing were calibrated and maintained in accordance with the S&W Standard Nuclear Quality Assurance Program. The results of testing are presented in SAR Appendix 2A, Attachment 2.

Q34. What is the permeability of the soils in the general vicinity of the PFSF site?

A34. (Liang) The silty soils in the vicinity of the PFSF site have relatively a low permeability of 0.071 inches per hour. This value is based on a field pumping test at monitoring well CTB-5, which is located in the planned location of the Canister Transfer Building. The calculated value of 0.071 inches per hour is consistent with the 0.2 inches to 0.6 inches per hour reported in the FEIS.

Q35. Please describe how you determined the permeability of the soil beneath the PFSF site.

A35. (Liang) We performed a field pumping test at monitoring well CTB-5 in 1998. During the field pumping test, the water level within the well was maintained at a fixed height above the equilibrium groundwater level (i.e., top of casing) by injecting water under pressure through a flexible hose. The amount of water injected into the well was monitored over time by means of an in-line flowmeter. The test data acquired were subsequently incorporated into a standard analytic equation for estimating aquifer permeability.[8] Using the field pumping test data, we calculated the permeability to be 0.142 feet per day, or 0.071 inches per hour. The calculated permeability based on the field pumping test data is consistent with the general values of 0.2 to 0.6 inches per hour noted in the FEIS as reported in the literature.[9]

Q36. Why was site specific permeability data, in addition to that from well CTB-5, not collected?

A36. (Liang) Additional site specific permeability data was not necessary. Previous work provided ample information with which to evaluate the site and potential environmental impacts of the proposed facility. The CTB-5 data (0.071 inches per hour) provided great confidence that the generally applicable permeability values reported in the FEIS (0.2 to 0.6 inches per hour) conservatively characterized the site. Of course, activities such as leach field preparation will require verification of actual soil permeability to ensure compliance with the UPC and adequate system function.

Q37. Are you aware of any technical basis supporting a conclusion that the permeability of the silty clays and sands vary by many orders of magnitude over the PFSF site?

A37. (Liang) No. PFSF site borings and laboratory test data identified a sub-surface profile consisting of three layers: silt, silty clay, and clayey silt. No sand was identified to a depth of between 25 and 35 feet below existing grade. As discussed above, a permeability value of 0.071 inches per hour was established at monitoring well CTB-5. Undermining the State's assertion, this value is within a

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[8] See Canada Centre for Mineral and Energy Technology (CANMET), Pit Slope Manual: Chapter 4 - Groundwater; Mining Research Laboratories (1977); *Energy, Mines and Resources Canada*, CANMET Report 77-13 (1977).

[9] See, e.g., U.S.G.S. Professional Paper 1370-G , "Studies of Geology and Hydrology in the Basin and Range Province, Southwestern United States, for Isolation of High-Level Radioactive Waste: Characterization of the Bonneville Region, Utah and Nevada."

single order of magnitude of the general area permeability value of 0.2 to 0.6 inches per hour. We know of no information supporting a conclusion that the permeability of the PFSF site soils vary by many orders of magnitude.

Q38. Would the presence of interfingered lenses and zones in the vicinity of the PFSF site increase the speed of contaminant downward migration toward the groundwater beyond that indicated by permeability information?

A38. (Liang) No. I am aware that the State's expert has concluded that interfingered lenses and zones must result in higher downward migration than that indicated by the permeability of uniform soils. The presence of interfingered lenses and zones, however, does not mandate this result. Such a conclusion is simply a generalization of one potential result of interfingered lenses and zones. A sequence of soils with varying permeabilities (i.e., interfingered lenses and zones) are as likely to retard downward migration as increase it. A generalization of increased migration at the PFSF site is not supported by existing information.

Q39. What is the difference between "permeability" and "percolation rate"?

A39. (Liang) The coefficient of percolation refers to the average actual velocity of water flowing through the actual pore area of the soil whereas the coefficient of permeability refers to the velocity of flow through the total area of solids plus pore spaces. Since, as a rule, the total area is more conveniently determined in gravitational flow problems, the permeability coefficient is used more often than the percolation coefficient. The area of the pore spaces in a typical cross-section of soil is equal to the total area multiplied the porosity. It follows that the coefficient of permeability of the soil is equal to the coefficient of percolation multiplied by the porosity.[10]

Q40. What does the permeability of the soils near the PFSF site indicate regarding percolation into the groundwater from the valley surface?

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[10] See M.G. Spangler, Soil Engineering, 2nd Ed. (1960).

A40. (Liang) Percolation from the surface to the groundwater is very unlikely. As described above, borings and laboratory test data show that the upper layers of soil at the PFSF site, extending to depths of between 25 and 35 feet below existing grade, is mainly comprised of interlayered silt, silty clay, and clayey silt. As reported in the FEIS, the permeability of a silty soil in Skull Valley ranges from 0.2 to 0.6 inches per hour. The result of the field pumping test at monitoring well CTB-5 of 0.071 inches per hour indicates an even lower permeability in the soil at the PFSF site than the 0.2 to 0.6 inches per hour range.

The small amount of precipitation that does fall in Skull Valley near the PFSF site is held near the surface by the low permeability of the soils in the valley floor. Because this water cannot quickly permeate much below the surface, it is discharged to the atmosphere either by evaporation or plant uptake and subsequent transpiration.[11] Consequently, percolation into the groundwater from the surface near the PFSF site is effectively nonexistent.

D. Lack of Hydrological Connection

Q41. Is there a hydrological connection or link between the ground surface in the vicinity of the PFSF site and the aquifer beneath Skull Valley.

A41. (Liang) There is no hydrological connection between the valley surface in the vicinity of the PFSF site and the aquifer beneath Skull Valley. Hydrological connection between the surface and groundwater depends on permeability of the soils at the surface, the depth to groundwater, and the amount of precipitation or other source of water. Because Skull Valley floor soils and the soils in the PFSF site area have a low permeability, a measured depth to groundwater of 125 feet, and very low precipitation in Skull Valley, surface water evaporates or is transpired before it can reach the groundwater. There is simply no credible mechanism for overcoming these natural physical characteristics and creating a pathway between the surface and groundwater in the vicinity of the PFSF site.

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[11] Dames & Moore, "Superconducting Super Collider, Cedar Mountain Siting Proposal," Proposal Appendix A, Geotechnical Report, Vol. 2, "Geohydrology" (Sep. 1987) at 8 ("Dames & Moore").

Q42. Does PFS intend to construct or rely on a "confining layer" as defined in EPA Guidance?

A42. (Liang) No. The State's expert has cited two EPA documents relevant to hazardous waste landfill and waste containment facilities in support of his analysis of the proposed PFSF design.[12] These documents discuss constructing clay confining layers to minimize infiltration from such facilities and are inapplicable to the PFSF. A "confining layer" is not needed to assure that potential non-radiological contamination from the PFSF detention basin will not reach groundwater. PFS will rely on the lack of any link between the surface and groundwater in the vicinity of the PFSF site as one of several barriers to contamination reaching the groundwater. The low permeability of the soils in the vicinity of the PFSF provide this natural barrier. Other barriers to groundwater contamination include strict procedural controls on storage and use of potential contaminants, maintaining limited quantities of contaminants on site, and spill response processes to cleanup and remove contaminated materials in the unlikely event of a spill, as discussed below.

Q43. Why is PFS not planning to conduct groundwater monitoring at the PFSF site?

A43. (Liang) Groundwater monitoring at the PFSF site is not necessary and would not provide any indication of contamination from the PFSF in any event. Obviously, groundwater monitoring is only useful when the monitored groundwater could possibly be contaminated by materials released from the proposed facility. Here, as described earlier, the groundwater below the PFSF is not hydrologically connected to the surface. Without such a connection, even in the highly unlikely event that a sufficient amount of a contaminant is spilled, is not cleaned up, and reaches the surface soils, contamination cannot permeate to the groundwater 125 feet below because of soil characteristics. Monitoring the groundwater, therefore, would not provide any useful information.

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[12] Requirements for Hazardous Waste Landfill Design, Construction and Closure, EPA/625/4-89/022; Quality Assurance and Quality Control for Waste Container Facilities, EPA/600/R-93/183.

III. RESPONSE TO CONTENTION UTAH O

Q44. What are the State's general claims in Contention Utah O?

A44. (Liang/Lewis) In the remaining portions of Contention Utah O, the State asserts that PFS has failed to adequately assess the environmental effects from the construction, operation, and decommissioning of the PFSF regarding non-radiological contaminant sources, pathways, and impacts, specifically:

1. Potential non-radiological contaminant pathways from the PFSF sewer/wastewater system;
2. Potential non-radiological contaminant pathways from the PFSF detention basin including:
   a) the potential for overflow, and
   b) whether the PFSF FEIS and ER contains appropriate information regarding effluent characteristics and environmental impacts associated with seepage from the detention basin; and
3. Potential for non-radiological groundwater and surface contamination; and
4. Potential impacts on downgradient hydrological resources from non-radiological groundwater contamination.

Q45. Please describe the construction activities that will take place at the PFSF site and how PFS has addressed the potential for non-radiological contamination of ground and surface water during construction.

A45. (Lewis) Construction activities at the PFSF will consist be typical of most industrial construction sites and will consist of site preparation, earth-moving associated with construction of facility features such as the detention basin and flood berm, construction of an access road, four buildings and the concrete pads on which the storage casks will be placed. PFS has committed to the preparation and implementation of best management practices to minimize any potential for precipitation-related erosion during construction. Measures will include erosion and sediment controls, soil stabilization practices, structural controls, and other controls as needed to effectively manage construction-related storm water runoff. PFS will also develop maintenance, inspection, and other practices for the effective management of storm water. A spill response procedure, in accordance with implemented best management practices, will be followed to appropriately respond to an inadvertent spill of oil or fuel from construction machinery. The same measures will be used during subsequent construction of additional PSFS phases. These procedures, in combination with the lack of surface water at the PFSF site, depth (approximately 125 feet) to groundwater beneath the site, low permeability of the soils above the groundwater aquifer, and typically low precipitation, will ensure that construction activities will not lead to contamination of the groundwater beneath the site.

Q46. Please describe the routine facility operations that will take place at the PFS site and how PFS has addressed the potential for contamination during operation.

A46. (Lewis) Routine facility operations will include receipt, inspection and placement of storage casks and maintenance of related vehicles and equipment. All non-radiological substances that could be hazardous to the environment used during these operations, including laboratory chemicals and cleaning supplies, will be marked and stored in designated locations in sealed containers and controlled in accordance with facility procedures as required by regulations to prevent non-radiological contamination. The only substances clearly identified to date that will be used or stored at the PFSF that are listed as hazardous materials under 40 C.F.R. § 355, Appendix A (EPA), 49 C.F.R. § 172, Subpart B (DOT), or 29 C.F.R. § 1910, Subpart H (OSHA) are lubricating oil and diesel fuel. In addition, PFS will maintain and update the plans and procedures implemented during facility construction (see discussion above) during PFSF operations. Additional best management practices will be implemented to meet or exceed applicable requirements as necessary to prevent non-radiological contaminants from entering the environment throughout the PFSF operational life.

Q47. Please describe the decommissioning activities that will take place at the PFS site and how PFS has addressed the potential for non-radiological contamination during decommissioning.

A47. (Lewis) Decommissioning activities will include removal or disposition of the storage pads and the buildings and other improvements. The exact nature of decommissioning has not been established at this time. The types of impacts to surface water and groundwater from decommissioning activities are, however, expected to be similar to those from PFSF construction. PFS will rely on similar best management practices and procedural controls to prevent non-radiological contaminants from entering the environment.

Q48. Could you please describe the tanks that will be used at the PFSF and how PFS has addresses the possibility that liquid stored in a tank could cause contamination at the site?

A48. (Lewis) There will be no below grade or buried tanks at the PFSF. All liquids stored on site (e.g., fuel and water) will be stored in aboveground tanks. The PFSF will have two tanks that will store low-grade sulfur No. 2-D diesel fuel. One tank will be located approximately 200 feet northeast of the Canister Transfer Building and the other tank will be located approximately 225 feet northeast of the Operations & Maintenance Building. Each tank will have a capacity of 1000 gallons. The tanks consist of a primary tank enclosed within a secondary tank to provide double containment. The primary tank will be constructed of steel in accordance with UL-142, "Above Ground Tanks for Flammable and Combustible Liquids." The secondary tank will be a concrete encasement that is designed to provide secondary spill containment in accordance with NFPA 30, "Flammable and Combustible Liquids Code," and meets the requirements of UL-2085, "Insulated Secondary Containment of Aboveground Storage Tanks." This code requires that the tank meet two-hour liquid-pool furnace fire tests, vehicle impact, and projectile resistance criteria.

The PFSF will also have a diesel fuel storage tank for the diesel operated fire pump and a diesel fuel storage tank for the diesel generator. The precise capacity of these tanks has not been determined, but will be approximately 200 gallons each. The tanks are mounted in a sub-base under the engines and have secondary containment in accordance with NFPA 30, "Flammable and Combustible Liquids Code." The tanks will be constructed of steel and meet the requirements of UL-80, "Safety Steel Tanks for Oil-Burner Fuel."

All of the tanks that will store diesel fuel at the PFSF are designed with a monitoring device to detect any leakage into the secondary tank. Should a leak in the primary tank occur, it will be drained. The secondary tank will contain any leaking diesel fuel and protect the surrounding soil until the primary tank is drained. Leaking tanks will be repaired or replaced in accordance with applicable codes and standards.

The PFSF will have four tanks that will store liquid propane for the Canister Transfer Building heating system. The tanks will be located approximately 1,800 feet south of the Canister Transfer Building and approximately 1,000 feet west-southwest of the Operations & Maintenance Building. Each tank will have a capacity of 5,000 gallons. The tanks and attached components will meet the requirements of NFPA 58, "Liquefied Petroleum Gas Code." The tanks will be constructed of steel for a pressure rating of 250 psig and designed, constructed, tested, and stamped in accordance with the stringent requirements of ASME Section VIII, Division 1, "Rules for Construction of Pressure Vessels." The outlet piping of each of the tanks will have excess flow valves to shutoff flow in the event of a pipe rupture. In the highly unlikely event that the propane tanks leak, the propane will vaporize when it is depressurized and not create any ground contamination.

Q49. Could you describe how the lubricating oils would be used and stored at the PFSF?

A49. (Lewis) Lubricating oils will be used at PFSF in, and to maintain, facility equipment such as cask transporters and construction vehicles. Other equipment, such as air compressors, may also require specialized oils for operation. Such lubricants will either be in use in facility equipment or limited quantities sufficient for routine equipment servicing (estimated at approximately 500 gallons) kept sealed in metal drums in designated storage areas within the Operating and Maintenance Building. There will be no floor drains in any of these storage locations.

Q50. Please describe how potential contamination from vehicles used on the PFSF site will be precluded.

A50. (Lewis) During diesel fueling operations, absorbent materials will be placed under the refueling nozzles and hoses to minimize contamination of the soil from a spill of diesel fuel. Diesel fuel will either be contained in facility vehicle tanks or in double-containment, aboveground storage tanks at the fuel dispensing stations. Spills from vehicle fuel tank leaks during operation will be isolated and cleaned up as directed by PFSF operating procedures.

Q51. What would happen if any soil at the PFSF were to become contaminated with spilled diesel fuel or other hazardous materials?

A51. (Lewis) PFSF personnel will follow the actions specified in the Best Management Practices Plan and applicable implementing procedures. As a minimum, soil contaminated with diesel fuel or other hazardous substances will be quickly removed and hauled to an appropriate commercial facility for treatment or disposal preventing contamination from reaching the groundwater.

Q52. Are any other hazardous substances likely to be located at the PFSF?

A52. (Lewis) Other possible hazardous substances include substances such as laboratory chemicals, cleaning solvents, painting products, pesticides and herbicides, and other chemicals common to any industrial facility of this size. These materials will be present only in limited quantities (e.g., small bottles, aerosol cans, and half-, one- and five-gallon containers) and only if needed. Each will be confined to designated areas and stored in labeled containers. Procedures will be in place to ensure that all applicable rules and regulations concerning use and storage of hazardous substances are properly implemented and adhered to. PFSF will also use common janitorial cleaners, which are not classified as hazardous materials. These cleaners will be stored in marked, sealed containers in designated janitor closets in quantities typical of a facility of this size (i.e., aerosol cans, and half-, one- and five-gallon containers).

Q53. If a spill of non-radiological hazardous material were to occur at the PFSF site, would the characteristics of the soil affect the time that PFSF personnel would have to respond to the spill and prevent contamination of the groundwater?

A53. (Liang) Yes. The low permeability of the soil at the PFSF facility will provide adequate time for PFSF personnel to respond and prevent groundwater contamination. Even at the highest permeability assumed (0.6 inches per hour), it would take more than 4 days without any mitigating action for a liquid contaminant to reach a depth of 5 feet, which is easily within reach of remediation equipment (but still over 100 feet above the groundwater). Using the actual measured permeability of 0.07 inches per hour, it would take over 7 days for a liquid contaminant to reach a depth of 1 foot. In either case, PFSF personnel would have ample time to respond and remove the material before it traveled within 100 feet of the groundwater under the site.

Q54. Could you please describe in greater detail how the Erosion Control Plan will direct precipitation runoff to the detention basin and prevent offsite precipitation from running into the basin?

A54. (Lewis) The PFSF Erosion Control Plan (ER at 9.1-5) will identify actions to minimize the potential for precipitation-related erosion. These actions include directing precipitation in the Restricted Area to the stormwater detention basin located north of the storage area. Drainage ditches and diversion channels will be used to divert water to the basin. Earthen berms, designed for the probable maximum flood (PMF), will prevent stormwater from running onto the PFSF site and entering the detention basin.

Q55. Could you describe the types of procedures that the PFSF will use to ensure that all rules and regulations concerning use and storage of hazardous substances are followed?

A55. (Lewis) PFS will implement pollution prevention and waste minimization procedures that incorporate Resource Conservation and Recovery Act (RCRA) pollution prevention goals as identified in 40 CFR 261, and Occupational Safety and Health Act (OSHA) requirements associated with hazardous materials, in accordance with 29 CFR Parts 1910 and 1926. Equipment maintenance and repair will be procedurally controlled to prevent the discharge of oils, grease, hydraulic fluids, etc. As required by OSHA regulations, Material Safety Data Sheets (MSDS) will be filed onsite for all hazardous materials used at the PFSF, along with information on safe handling, storage, and disposal practices. PFSF procedures will assure hazardous materials are placed only in appropriately constructed, properly labeled, containers and stored only in authorized storage locations. Procedures for conducting inventories, inspections for unauthorized materials, and surveillances of procedural compliance will also be developed and implemented. PFSF workers using hazardous materials will be trained in the proper use of the spill response kits in accordance with OSHA requirements.

Q56. What kind of training or instruction will PFSF employees and the construction and decommissioning contractors receive to ensure that they comply with all applicable procedures?

A56. (Lewis) Every PFSF employee will receive initial training, which will consist of general employee training (GET) and job-specific training to provide individuals with the skill and knowledge required to perform their particular duties and responsibilities. GET will include training on procedural compliance, emergency procedures, and environmental protection policies and procedures. Training on environmental protection will include proper handling of hazardous materials on site. PFSF employees assigned tasks involving hazardous materials will receive job- and material-specific training in pre-job briefings prior to performing the tasks. Training of personnel working for construction and decommissioning contractors will comply with applicable laws and regulations governing the hazardous materials required to perform the contracted work.

A. Potential Non-radiological Contaminant Pathways from the PFSF Sanitary Waste Systems

Q57. Please describe the State's claims with respect to the potential for contamination from the sanitary waste systems.

A57. (Liang/Lewis) Basis 1 of the contention asserts that environmental effects associated with non-radiological contaminant sources and pathways from the sanitary waste systems have not been adequately assessed. As we discuss below, however, PFS has appropriately addressed the potential environmental affects from non-radiological contamination.

Q58. Please describe the possible entry points for contaminants into the PFSF sanitary waste systems.

A58. (Lewis) As discussed above, the sewage systems at the PFSF will consist of two independent sanitary waste systems for the sinks, toilets, and showers onsite. Each sanitary waste system will drain sewage to a separate septic tank and leach field. One system will service the Canister Transfer Building and the Security and Health Physics Building and the second will service the Administration Building and the Operating and Maintenance Building. There will be no access to these systems except through the sinks (approximately 25), toilets and urinals (approximately 20), showers (approximately 4), and water fountains (approximately 7). In addition, there will be several "cleanouts" throughout the systems to provide access for maintenance, all of which will be closed during routine system operation. Floor drains will not be used in the buildings.

Q59. How has PFS addressed the potential for contamination from the sanitary waste systems?

A59. (Lewis) Normal janitorial cleaners, common to any industrial facility of this size, will be used at the PFSF. Such cleaning compounds are typically biodegradable and are not classified as materials hazardous to the environment. They will be introduced into the sanitary waste systems, as a part of normal cleaning of sinks and toilets, where they will be decomposed by natural mechanisms. As I described earlier, the septic tanks and leach fields will be designed in accordance with the Uniform Plumbing Code to utilize natural filtering processes to purify disposed sewage, including janitorial cleaning compounds.

Q60. Could you describe how the filtering process in the soil would work to purify the disposed sewage and cleaning compounds?

A60. (Lewis) Use of a septic tank with a leach field is one of the oldest and most widespread methods of sewage treatment in the United States, and the process by which they function is documented in several sources. Wastewater passes through the septic tank where most of the solids settle to the bottom of the tank and undergo decay by anaerobic digestion. Sewage contents typically include nitrogen compounds, suspended solids, organic and inorganic materials, and bacteria. These are removed from the wastewater in the soil by microorganisms, which provide natural wastewater treatment. Clarified effluent flows out the septic tank and is distributed into the soil through perforated pipe. Because of the semi-arid location of the PFSF and the great depth to the groundwater, a significant amount (perhaps all) of the PFSF effluent will be used by plants or evaporate from the soil surface. The remaining effluent, if any, would percolate outward or downward to a depth determined by the soil characteristics.[13] The 125 feet to groundwater at the PFSF site will ensure that any effluent that may reach the groundwater will be thoroughly filtered of any contaminants.

Q61. How has PFS addressed the potential for contamination from the sanitary waste system by materials other than sewage and janitorial cleaners and the potential for hazardous materials to enter the environment through the sanitary waste system?

A61. (Lewis) As discussed above, the only substances that will be used at the PFSF that are identified by applicable federal regulation as hazardous to the environment will be lubricating oils and diesel fuel. Small amounts of other substances, such as cleaning solvents, painting products, pesticides and herbicides, may also be on site from time to time. All such substances will be stored or contained within sealed and properly labeled containers and will be located in designated areas away from building areas with openings to the sanitary waste system. Lubricating oils will only be stored in the Oil Storage Room in the Operations & Maintenance Building or two Canister Transfer Building store rooms, and only if in a NFPA 30 approved flammable and combustible liquid storage cabinet. Painting supplies, pesticides, and herbicides (if onsite) will be stored only in the Operations & Maintenance Building warehouse. Cleaning supply storage will be limited to the janitor's closets in each building.

Laboratory areas will be provided with appropriate receptacles for disposal of laboratory chemicals and similar materials. Proper procedures will be developed and implemented to ensure that workers comply with all applicable rules and

[13] See EPA 932-F-99-075, "Decentralized Systems Technology Fact Sheet, Septic Tank – Soil Absorption Systems" Sep. 1999).

regulations regarding the handling and storage of hazardous substance. The combination of the small quantities of substances on site and procedures in place for the proper storage and handling of these substances will make non-radiological contamination highly unlikely. PFS will also implement procedures to ensure that, if inadvertent contamination should occur, rapid and effective actions to prevent or minimize release to the environment are performed in accordance with applicable PFSF operating procedures.

Q62. Could hazardous materials inadvertently get into the sinks or drains in the Operations and Maintenance Building?

A62. (Lewis) It is highly unlikely. The Operations and Maintenance Building will be used to perform routine maintenance on equipment, such as cask transporters, used at the facility. There are no floor drains in the Operations and Maintenance Building that would route hazardous liquids, such as spilled diesel fuel or lubricating oil, to the sanitary waste system. The sanitary waste system in this building will only be used to dispose of sewage generated in the sinks, toilets, or showers located in the lunch room, men's and women's restrooms and locker rooms, and janitor's closets. Any material spilled inside the building will be cleaned and disposed of in accordance with PFSF procedures.

Q63. Are there any connections between the sanitary waste system and the detention basin?

A63. (Lewis) No.

Q64. Do the sanitary waste systems handle precipitation runoff from any source on the PFSF site?

A64. (Lewis) No.

Q65. Are there any drains connected to the sanitary waste systems in the storage pad area or in the diesel or lubricating oil storage areas?

A65. (Lewis) No.

Q66. In your opinion, is there any credible pathway for non-radiological contaminants to have a significant environmental impact during construction, operation, or decommissioning of the PFSF?

A66. (Lewis) No. During construction and decommissioning, the sanitary waste systems will not yet be in service or will be removed from service. The lack of physical connection to areas where hazardous materials could be spilled, the non-hazardous nature and limited amounts of other materials, and strict procedural controls assure that hazardous materials will not be introduced into the sanitary waste systems during routine operations. In the highly unlikely event that small amounts of contaminants did enter a sanitary waste system, the natural filtering action of the soils would prevent them from entering the groundwater.

B. The PFSF Detention Basin

Q67. What are the State's claims with respect to the PFSF detention basin?

A67. (Liang/Lewis) Basis 2 of the Contention asserts that the non-radiological environmental impacts of the detention basin have not been adequately considered in two specific respects. First, the State claims that the potential for overflow from the detention basin has not been addressed. Second, the State asserts that potential non-radiological contamination is not addressed because there is no information on either the characteristics of any overflow or seepage from the detention basin.

Q68. How does PFS address the State's claims?

A68. (Lewis) The detention basin is not expected to have freestanding water, except possibly following a severe precipitation event. Most of the relatively small volume of water impacting the cask storage area during a typical rainstorm will be absorbed into the 8-inch thick compacted gravel surface surrounding the storage pads and will not drain to the detention basin. Only during a substantial rain event is water expected to drain from the cask storage area to the detention basin. As discussed below, the detention basin is sized to hold the amount of water that would be generated within the cask storage area following a 100-year storm event.

As discussed previously, the absence of large quantities of chemicals precludes chemical contamination at the PFSF, including the detention basin. In the unlikely event of an accidental spill of petroleum product or other potential contaminant, which I also discussed above, engineered containment features and PFSF operating procedures will preclude their introduction into the detention basin as well. Therefore, since there are no credible scenarios for any type of contamination being introduced into the detention basin, there is no need for an effluent monitoring system. Diesel fuel spilled from leaking or ruptured locomotive fuel tanks would drain into the swale located on the north side of the railroad tracks. The swale is designed to contain a total loss of diesel fuel from a locomotive coincident with a 100 year design rainfall. Cleanup of the contamination in the swale will be performed in accordance with PFSF operating procedures and will prevent contamination from such spills from reaching the groundwater.

Q69. Specifically, how does PFS address the potential for the overflow of the detention basin?

A69. (Lewis) As noted earlier, the detention basin is sized to contain the runoff of the storage site from a 100-year storm event. The depth of water in the detention basin following a 100-year storm event is calculated to be a maximum of 4.8 feet. Water that collects in the detention basin will dissipate by evaporation and percolation into the subsoils. In the unlikely event of a 100-year storm event, the time for the water that has collected in the basin to be removed via evaporation and ground percolation is conservatively estimated to be approximately 260 days, based on assumptions of an evaporation rate of 0.13 inches per day[14] and a percolation rate of 0.09 inches per day.[15] The percolation rate for the detention basin was based on soils found in the borings nearest the detention basin (boring B-1 and C-1). This percolation rate is not based on the permeability determined from the field pumping test at monitoring well CTB-5 because at depth of 125 feet the permeability data was obtained in silty sand, which has a higher permeability. The site borings show that the upper layers of soil consist of clayey silt extending all the way down to a depth of 25 feet below current grade. Clayey silt has a

[14] David D. Houghton, Handbook of Applied Meteorology (1985).

[15] William T. Lamb & Robert V. Whitman, Soil Mechanics (1969).

much lower permeability than silty sand and will tend to slow the percolation of the water into the soil. If significant standing water occurs in the detention basin, temporary pumps will be used to drain the detention basin via the spillway to eliminate long-term freestanding water. This action will minimize the already unlikely possibility of overflowing the detention basin, as well as precluding the growth of significant vegetation and attracting wildlife.

Q70. What would happen if there were a storm more severe than the 100-year storm or the basin was already nearly full at the time of a 100-year storm?

A70. (Lewis) Though it is highly unlikely that either of these events would occur, the emergency spillway would provide relief protection for the detention basin walls by releasing water from the basin. The water released through the spillway would mix with the other waters flowing through the valley as a result of the 100 year rain. To the extent that any amount of contaminant was in the detention basin water, this mixing would further dilute the contaminant making any potential environmental harm even more unlikely.

Q71. How does PFS address the potential for contamination from basin overflow and seepage?

A71. (Lewis) As discussed above, introduction of contaminants into the detention basin is highly unlikely. The absence of large quantities of chemicals and PFSF operating procedures for using the small quantities of chemicals stored at the PFSF will prevent any substantive quantities of contaminants from entering the basin in the first place. Further, because of the lack of significant precipitation and low permeability of the basin floor and the underlying soils, the potential for significant contaminant seepage out of the detention basin is not credible. Only during a substantial rain event would water be expected to accumulate in the detention basin. Two significant rain events within a short time (e.g., less than the 140-days needed to completely empty the basin after a 100-year rain event, assuming no pumping) is extremely unlikely, if not incredible. Finally, even if there were contaminants in the detention basin and even if contaminated water overflowed from the detention basin, the low permeability of the surface soils would provide ample time for PFSF to perform cleanup and removal of the contamination before it reached any significant depth.

Q72. How do you address the possibility that contaminants from locations other than the spent fuel cask storage area might be washed onto the site and into the detention basin during a rainstorm?

A72. (Lewis) The PFSF will have engineered containment features (e.g., the drainage ditches that run along the north and south sides of the railroad tracks at the PFSF) that will contain potential non-radiological contaminants, such as diesel fuel that could be spilled from a transportation vehicle. The south drainage ditch is connected to the north drainage ditch via a culvert located at the west end of the drainage ditches. While these drainage ditches eventually drain into the detention basin, the drainage system design includes weirs that can be shut in the event of a contamination event (i.e., a spill of diesel fuel). A weir is located just north of the culvert discharge into the north drainage ditch. The weir consists of gates that can be closed to prevent any potentially non-radiological contaminants from draining to the detention basin during cleanup of a spill. Contaminated material will be removed and properly disposed of in accordance with applicable requirements.

Q73. How would the soil in the vicinity of the PFSF affect the potential for groundwater contamination resulting from detention basin overflow or seepage?

A73. (Liang) As discussed earlier, based on borings and laboratory test data, the upper layers of soil, extending to depths of between 25 and 35 feet below existing grade, mainly are comprised of interlayered silt, silty clay, and clayey silt. With this type of soil acting as a natural barrier below the bottom of the basin, water seepage will be very slow, allowing for appropriate actions to be taken before any water reached the groundwater.

As also discussed earlier, the source of groundwater flow at the PFSF is mainly derived from precipitation that falls at the higher elevations of the Stansbury and Cedar Mountains. The lack of direct hydrological link between the surface and groundwater at the site results in surface water from precipitation at the site migrating horizontally northward and eventually dissipating from evaporation, transpiration and capillary action. Therefore, even if hazardous chemical contaminants were deposited on the surface at the PFSF, the lack of a direct hydrological link would effectively prevent them from ever reaching the groundwater below. The contaminants will either remain suspended in the soil, be adsorbed, or (if volatile) ultimately evaporate into the atmosphere.

Q74. When you say that the soil will act as a "natural barrier" to the movement of contaminants downward in the direction of the groundwater, what do you mean?

A74. (Liang) The low permeability of the soil will retard contaminants from moving downward into the soil. Indeed, the low amount of precipitation and complete lack of surface water will provide little, if any, driving force for any contaminants to reach depths below that at which they are released. Ultimately, particulate contaminants will remain deposited in the soil, while volatile contaminants may slowly rise to the surface and evaporate. While the permeability of the soil at the surface of the PFSF site may or may not be as low as the permeability of a man-made barrier (e.g., liners that might be used at a hazardous waste disposal facility), because of the depth to the groundwater at the PFSF site, lack of surface water, and the low rate of precipitation, it will nevertheless prevent any spilled contaminants from reaching the groundwater.

Q75. Could holes that PFS has drilled during the evaluation of the site or that PFS will drill during construction provide a pathway for contaminants to seep from the detention basin into the groundwater?

A75. (Liang) No. Borings and cone penetration tests (locations shown in SAR Figure 2.6-2 and 2.6-19) were not performed within the location proposed for the detention basin; therefore, there are no potential pathways for water in the basin to drain through to underlying soils.

Q76. Would holes drilled elsewhere on the PFSF site provide a path for contamination to reach the groundwater?

A76. (Liang) No. All boreholes in the proposed Canister Transfer Building area at the PFSF site were grouted with cement. Some other boreholes were backfilled with soil, but they were generally less than 50 feet in depth and did not intercept the ground water. Further, no boreholes were drilled in the area of the detention basin, which is the most likely location for the standing water necessary for improperly sealed boreholes to act as conduits.

C. The Potential for Non-Radiological Surface Water and Groundwater Contamination

Q77. What are the State's claims with respect to the potential for non-radiological surface water and groundwater contamination?

A77. (Liang/Lewis) Basis 3 of the contention asserts that the environmental impact discussion is incomplete because the discussion of the potential for non-radiological surface water and groundwater contamination is inadequate.

Q78. How do you respond to the State's claims?

A78. (Liang/Lewis) As discussed above, we have clearly demonstrated that there is no credible pathway for either surface water or groundwater contamination of any kind to occur from construction, routine operations, or decommissioning of the PFSF. Non-radiological contamination is precluded by the absence of any significant contaminant sources, strict adherence to procedures, and the use of best management practices that minimize the potential for contaminant releases to occur and quickly contain and clean up any contaminant releases that might occur. The lack of contaminant sources and pathways and absence of nearby surface water preclude the possibility of surface water contamination from the PFSF. The low permeability of the near-surface soils and the general lack of precipitation in this semi-arid environment also ensure that there is no opportunity for any inadvertent contamination to spread to the groundwater.

Q79. How do you respond specifically to the State's claim with respect to runoff from the PFSF site or the PFSF detention basin?

A79. (Liang) Operation of the detention basin will have only a very local, sporadic effect on the subsurface hydrology. The design of the PFSF and the PFSF Erosion Control Plan will significantly minimize or prevent surface changes due to sporadic runoff. As discussed above, the water from the detention basin will not affect the groundwater because there is no direct hydrological link between surface water and the groundwater at the proposed PFSF site.

Q80. How do you respond to the State's claim of non-radiological surface water and groundwater contamination from the PFSF wastewater system?

A80. (Lewis/Liang) The design and operation of septic systems is a mature technology and the PFSF system contains nothing novel or untried. Applicable design and construction codes and standards will ensure that discharged wastewater does not pool at the surface or reach the groundwater during the life of the PFSF. As described earlier, the leach fields will be conservatively designed for the expected amount of wastewater to allow natural filtration to remove biological and other materials from the wastewater. The water portion of the sewage will be transpired by vegetation or evaporate similar to runoff from the detention basin. The remaining material, including whatever small amounts of contaminants present will either decompose, be adsorbed, or (if volatile) evaporate at the surface. There will be no impact on either surface or ground water from the PFSF sanitary waste system.

D. Impact on Downgradient Hydrological Resources

Q81. What are the State's claims with respect to the PFSF impact on downgradient hydrological resources?

A81. (Liang/Lewis) The State asserts that the environmental effects of the potential impact of non-radiological groundwater contamination on downgradient hydrological resources has not been addressed.

Q82. How do you respond to the State?

A82. (Liang/Lewis) As discussed above, PFSF construction, operation, and decommissioning will not have a significant impact on the water resources on or near the site. Diesel fuel and lubricants will be stored in approved containers and designated locations, used only in strict compliance with procedure, with leaks and spills quickly contained and cleaned up. The PFSF will maintain only small amounts of other potentially hazardous materials, which will be closely controlled and carefully stored. The concentration and quantities of chemicals onsite will be so low as to eliminate the possibility of an uncontrolled release of a substantive amount of contaminants. No hazardous material will be introduced into the sewage system. Contamination from vehicles used onsite will be precluded using normal industrial practices, and any unexpected contamination will be immediately removed from the site. Further, soil characteristics, lack of surface water, and depth to groundwater will prevent contaminants from spreading downgradient, even in the highly unlikely event contamination somehow spread offsite. As there is no credible pathway for non-radiological contamination to reach the groundwater, the PFSF will have no significant impact on downgradient hydrological resources.

IV. CONCLUSION

Q83. What are your conclusions regarding the remaining assertions in Contention Utah O?

A83. (Lewis/Liang) We conclude that PFS has adequately assessed the physical characteristics of water and soil in Skull Valley, engineering barriers, and procedural controls regarding potential environmental affects on surface water and groundwater from non-radiological contamination as a result of the construction, operation, and decommissioning of the PFSF. In our opinion, based on all of the available information, non-radiological contamination from construction, operation and decommissioning of the PFSF will have no significant impact on the surface water and groundwater of Skull Valley or downgradient hydrological resources. We further conclude, therefore, that there is no technical basis for any of the remaining assertions in Contention Utah O.

DONALD WAYNE LEWIS **LEAD ENGINEER**
MECHANICAL DIVISION

EDUCATION

Montana State University - Bachelor of Science, Civil Engineering - 1980
Daniel International Corp. - Course in ASME Section III - 1982
Daniel International Corp. - Course in Welding - 1983

REGISTRATIONS

Professional Engineer - New York (1988)
Colorado (1997)
Maine (1999)
Utah (2001)
Iowa (2002)

EXPERIENCE SUMMARY

Mr. Lewis has 20 years of engineering experience in the power generation industry, and has participated in all phases of power plant engineering from design through construction, pre-operational testing to on-line modifications.

Mr. Lewis has experience on several nuclear facilities. Assignments include the design of spent nuclear fuel storage facilities, plant systems design modifications, and on-site engineering of mechanical systems installation. Spent fuel storage facility design involved preparation of the design of mechanical aspects and related licensing of the facilities, including an on-site assignment as project engineer for the client for construction of one of the facilities. Plant systems modification assignments involved resolving system design problems, preparing design changes and supporting analyses, revising drawings and preparing specifications. On-site engineering of mechanical systems installation involved resolving pipe and equipment installation conflicts, reviewing and revising design drawings, ensuring code compliance, procuring system components, and developing start-up procedures.

Mr. Lewis has experience on four coal-fired boiler plants. Assignments included the design of mechanical systems on a flue gas scrubber project, development of system descriptions and operating instructions; and the evaluation of a coal to natural gas conversion design. Work involved design of piping systems, component selection and sizing, preparing calculations and specifications, reviewing proposal submittals, initiating process flow and layout drawings; writing plant operation instructions; and preparing cost analyses.

Mr. Lewis is currently assigned to two spent fuel storage projects: the Duane Arnold Energy Center and Private Fuel Storage Facility where he is Lead Mechanical Engineer, responsible for mechanical design and licensing of the facilities.

DETAILED EXPERIENCE RECORD
LEWIS, DONALD WAYNE

STONE & WEBSTER ENGINEERING CORPORATION, DENVER, COLORADO
(Apr 1988 - Present)
Appointments:
Lead Engineer, Mechanical Division - Jan 1998
Senior Mechanical Engineer, Mechanical Division - Nov 1990
Mechanical Engineer, Mechanical Division - Jan 1989

Duane Arnold Energy Center, Cedar Rapids, Iowa – Nuclear Management Company
(July 2000 - Present)
LEAD MECHANICAL ENGINEER

Indian Point 1, Buchanan, New York – Entergy Nuclear Northeast
(April 2001 – January 2002)
PROJECT ENGINEER

Indian Point 2 Nuclear Plant, Buchanan, NY – Consolidated Edison
(January 1999 - January 2000)
PROJECT ENGINEER

Maine Yankee Atomic Plant, Wiscasset, ME – Maine Yankee Power Company
(November 1998 – October 2001)
LEAD MECHANICAL ENGINEER

Yucca Mountain Project, Las Vegas, NV - U.S. Department of Energy
(June 1998 - August 1998)
SYSTEMS ENGINEER

Rocky Flats Environ. Tech. Site, Golden, CO - Rocky Flats Engineers & Contractors, L.L.C.
(May 1998 - Sept 1998)
RADIOLOGICAL CONSULTANT

Prairie Island Generating Plant, Red Wing, MN - Northern States Power Company
(Oct 1997 - Present)
PROJECT ENGINEER

National Wind Technology Center, Golden, CO - National Renewable Energy Laboratory
(Oct 1997 - Apr 1998)
SENIOR MECHANICAL ENGINEER

Rocky Flats Environmental Technology Site, Golden, CO - BNFL
(July 1997 - Oct1997)

SENIOR MECHANICAL ENGINEER

Private Fuel Storage Facility, Goshute Indian Res., UT - Private Fuel Storage
(Oct 1996 - Present)
LEAD MECHANICAL ENGINEER

Goodhue County ISFSI, Frontenac, MN - Northern States Power Company
(Aug 1995 - Sept 1996)
PROJECT ENGINEER

Navajo Generating Station, Page AZ - Salt River Project
(Sept 1993 - Nov 1995)
SENIOR MECHANICAL ENGINEER

Prairie Island Generating Plant, Red Wing, MN - Northern States Power Company
(Jan 1992 - Aug 1993)
SENIOR MECHANICAL ENGINEER

Neil Simpson Station, Gillette, WY - Black Hills Power Company
(Sept 1991 - Dec 1991)
SENIOR MECHANICAL ENGINEER

North Omaha Station, Omaha, NE - Omaha Public Power District
(July 1991 - Aug 1991)
SENIOR MECHANICAL ENGINEER

Fort Calhoun Power Station, Ft Calhoun, NE - Omaha Public Power District
(Apr 1988 - June 1990) (Nov 1990 - Aug 1991)
SENIOR MECHANICAL ENGINEER

Prairie Island Generating Plant-Unit 2, Red Wing, MN - Northern States Power Company
(July 1990 - Oct 1990)
LEAD MECHANICAL ENGINEER

EG&G Rocky Flats Inc., Golden, CO - U. S. Department of Energy
(July 1990)
MECHANICAL ENGINEER

U. S. Department of Energy, Hanford, WA
(June 1990)
MECHANICAL ENGINEER

STONE & WEBSTER ENGINEERING CORP., CHERRY HILL, NEW JERSEY
(Sept 1983 - Mar 1988)
Appointments:

Engineer, Mechanical Division - Aug 1987
Construction Engineer - Oct 1985
Senior Field Engineer - Oct 1984
Field Engineer - Sept 1983

Nine Mile Point Nuclear Station, Unit 2, Lycoming, NY - Niagara Mohawk Power Corporation
(Sept 1983 - Mar 1988)
ENGINEER, Mechanical Division (Aug 1987 - Mar 1988)
ENGINEER, Construction Division (Sept 1983 - July 1987)

Oswego Steam Station Units 5 & 6, Oswego, NY - Niagara Mohawk Power Corporation
(Dec 1986)
CONSTRUCTION ENGINEER

DANIEL INTERNATIONAL CORPORATION, GREENVILLE, SOUTH CAROLINA
(June 1982 - Aug 1983)

Wolf Creek Nuclear Plant, New Strawn, KS - Kansas Gas & Electric
CONSTRUCTION ENGINEER II

J.A. JONES CONSTRUCTION COMPANY, CHARLOTTE, NORTH CAROLINA
(Oct 1981 - Apr 1982)

Washington Nuclear Plant No. 1, Handford, WA - Washington Public Power Supply System
FIELD ENGINEER

WRIGHT SCHUCHART HARBOR-BOECON-GERI, RICHLAND, WASHINGTON
(Mar 1981 - Oct 1981)

Washington Nuclear Plant No. 2, Handford, WA - Washington Public Power Supply System
ASSOCIATE STRUCTURAL ENGINEER

MONTANA STATE HIGHWAY DEPARTMENT, HELENA, MONTANA
(July 1979 - Sept 1979, July 1980 - Mar 1981)
CIVIL ENGINEER I (Traffic Division, Jan 1981 - Mar 1981)
ENGINEER AIDE (July 1979 - Sept 1979)

Experience Summary

Dr. Liang is a Senior Principal Environmental Engineer in the Environmental Sciences & Engineering Department. He has over 26 years of experience in siting, environmental assessment, developing and managing environmental protection programs, and licensing of power plants and industrial facilities. He also has extensive experience in mathematical modeling, numerical analysis, and computer applications in environmental engineering/design related problems. He is currently a Program Manager and has previously been a Lead Environmental Engineer on major projects in nuclear/fossil power plants and industrial projects, which involved environmental impact studies, federal/state/local permitting applications, managing engineering/design, procurement and installation of water and wastewater treatment systems, conceptual design of the heat dissipation/chemical discharge system, studies of alternative cooling systems, groundwater dispersion, hydrological analysis of power plant sites and thermal/water quality impact analysis of power plant discharge.

As Supervisor of Water Quality and Hydrology, Dr. Liang has supervised many water quality and hydrology related tasks for power plant projects. He established the technical guideline for flood analysis at power plant sites. He managed the environmental impact assessment of a fluidized bed power plant site and prepared its permit application. He established the exclusion criteria for siting a Low-Level Radioactive Waste disposal facility in Maine, to assure compliance with federal and state requirements. He evaluated existing permit requirements to determine the potential environmental impacts of rerating a nuclear power plant. Dr. Liang completed the conceptual design of a surface run-off detention pond for a proposed NPR site in Idaho, a cooling pond for a proposed power plant site in Florida, a multiport diffuser for a cogen plant in New York and a combined cycle power plant in England, U.K. He has developed the water quality monitoring program and conducted the hydrothermal/water quality modeling for numerous power plant projects.

Dr. Liang has been a lead environmental engineer on major projects in nuclear, fossil, and industrial plants.

Dr. Liang has been an expert in mathematical modeling of surface water, groundwater, water quality, hydrological and hydrothermal analysis.

Dr. Liang has been intimately familiar with EPA's National Pollution Discharge Elimination System (NPDES) permit application regulations and the requirements of section 401 of the Water Quality Act (WQA), which amended Clear Water Act (CWA) section 402(1)(2). He has assisted many major utility clients as well as independent power producers in obtaining the NPDES permit.

Dr. Liang has participated in numerous siting studies for various type of power generation projects and Low Level Radioactive Waste disposal facilities. He has designed and supervised many environmental monitoring programs for siting studies, and prepared permit applications and supporting documentations.

As a member of ICE team, Dr. Liang has participated in evaluating DOE's Environmental Restoration and Waste Management Five-Year plan. He has assisted DOE in environmental cleanup activities at Handford site, and managed environmental studies for the U.S. AMTL research reactor decommissioning project.

Dr. Liang developed a comprehensive environmental protection program at a nuclear power plant construction site. He monitored project construction activities for regulatory compliance in air and water quality, noise, wetlands and wildlife refuge protection, and solid waste disposal. Dr. Liang integrated the environmental protection program with the quality assurance and safety/health programs to measure program performance. He provided the impetus to implement similar programs at other nuclear power plant sites.

Dr. Liang has performed a technical review of the existing environmental operating limit permits and supporting documentation (316a and 316b demonstrations) and assessed the impact of the power uprate on the plant's ultimate heat sink.

In 1994, Dr. Liang managed a consulting services project for improving the technical ability of 22 senior engineers from East China Electric Power Design Institute, dealing with the requirements for a Conventional Island design associated with a nuclear power plant.

Since 1995, Dr. Liang has been working as Lenders' engineer for several fossil power plant projects in China. Working as an Independent Technical Consultant (ITC), he has been responsible for the due diligence effort which includes technical review of engineering/design of the major plant systems, review and evaluation of fuel sources and cost, project performance parameters and guarantees, environmental parameters for compliance with PRC's regulations and World Bank guidelines; construction progress monitoring for funding drawdown certification, start-up/test procedure review, and witnessing the 72-hour and 24-hour test runs, and certification of completion of several fossil power plant projects in China.

Recently Dr. Liang has been in charge of developing EPC cost data base for fossil power plant in China.

Education

Ph.D., Civil Engineering - University of Connecticut, Storrs, Connecticut - 1972
M.S., Civil Engineering - University of Connecticut, Storrs, Connecticut - 1967
National Taiwan University, Taipei, Taiwan, Republic of China

Training

China Forum - since 1995, a lunch-time seminar series, meeting once every other month, covered the topics of information, challenges, strategies, recent development, and successful projects in marketing in China, sponsored by the Office of International Trade & Investment, the Commonwealth of Massachusetts, Foley, Hoag & Eliot LLP, and others.
The Princeton Course/Groundwater Pollution and Hydrology - 1993
Hazardous Materials Management, American Management Association - 1991
Site Selection and Design of Sediment and Detention Basins, Southern New England Environmental Regulation Course, Executive Enterprise, Inc. - 1987
MIT Video Course on Finite Element Methods, Massachusetts Institute of Technology - 1984
Water Resources Lecture Series - Rainfall/Run-off Modeling using HEC-1, Stone & Webster Engineering Corporation - 1982
Sediment Transport in Rivers and Estuaries, University of Southern California - 1974

Licenses, Registrations, and Certifications

Professional Engineer - Connecticut, 09789 - 1975 Active

Professional Affiliations

American Geophysical Union, Member
The Society of the Sigma Xi, Member

Publications

Liang, G.H.C.. "New Technologies in Sulfur Removal in the Refining Process in a Refinery." National Conference for Environmental Managers of Petrochemical Plants, May 1995

Liang, G.H.C., "Use of Groundwater Analytical/Numerical Models for Evaluating Pollution Control Measures at Hazardous Waste Disposal Facilities." New England/Republic of China Technical Exchange Symposium, May 1990.

Liang, G.H.C.. "Summary of Hydrographic and Hydrothermal Studies at Millstone Nuclear Power Station, 1969-1985." Millstone Ecological Advisory Committee Meeting, Waterford, Connecticut. 1986.

Liang, G.H.C.; Lee, V.M.; and Torbin, R.; "A Data Acquisition and Analysis Technique for a Sediment Transport Field Study Program." COASTAL ZONE 78, San Francisco, California, 1978.

Liang, G.H.C. and Lin, J.D., "Effect of Pressure Gradient on Wind-waves in a Laboratory Channel." 2nd U.S.National Conference in Wind Engineering Research, Colorado State University, Fort Collins, Colorado, 1975.

Liang, G.H.C., "Wind-generated Waves With and Without Pressure Gradients." University of Connecticut, Storrs, Connecticut, 1972.

Liang, G.H.C. and Lin, J.D., "Laboratory Win-waves Generated With and Without Pressure Gradients." American Geophysical Union Fall Annual Meeting, San Francisco, California, 1972.

Liang, G.H.C., "Numerical Calculation of the Source Term for a Vertical Line Source Under Linearized Free Surface." University of Connecticut, Storrs, Connecticut, 1967.

AA

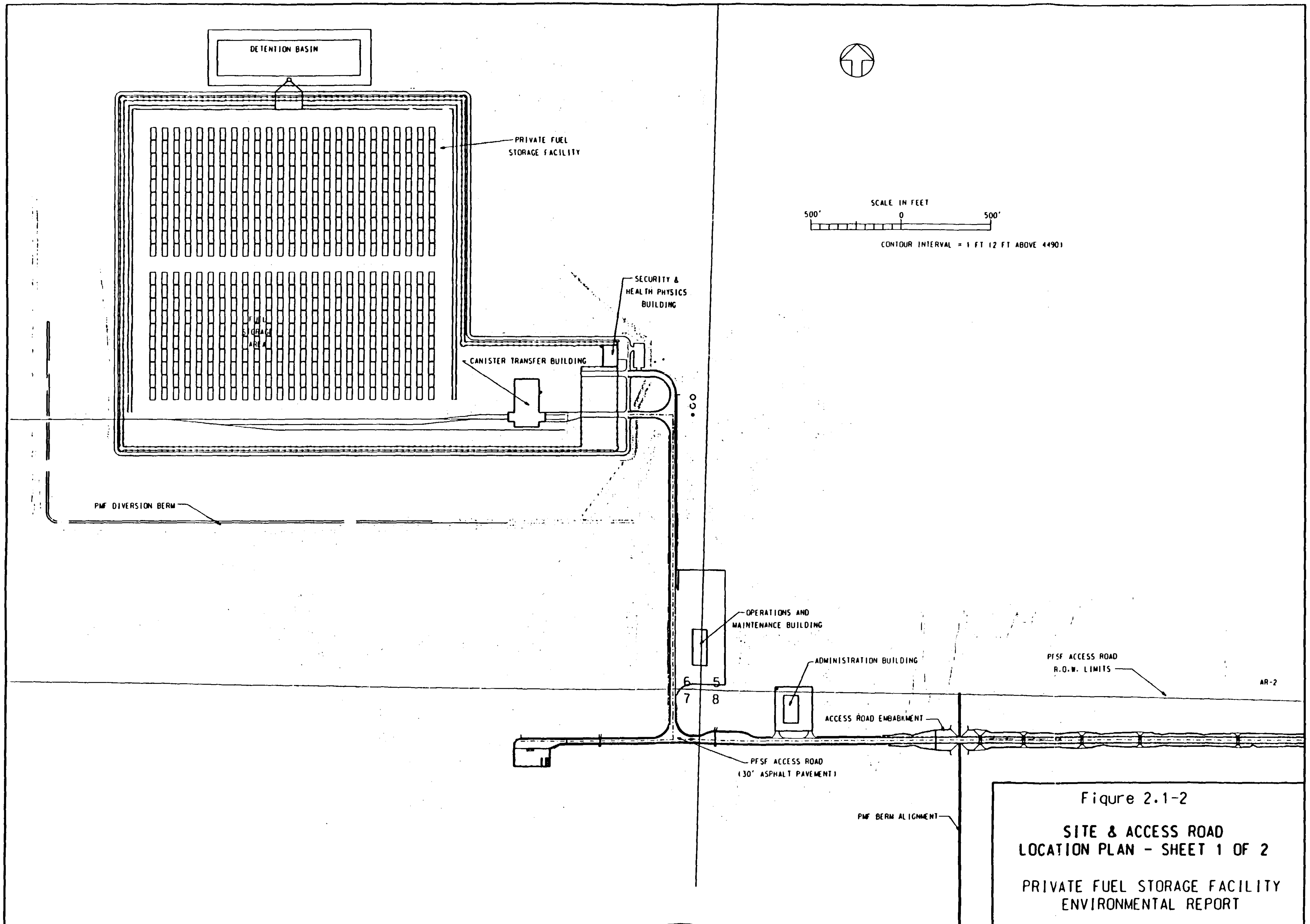

Figure 2.1-2

SITE & ACCESS ROAD
LOCATION PLAN - SHEET 1 OF 2

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT

Revision 13

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of the "Testimony of John Donnell on Contention SUWA B—Railroad Alignment Alternatives," the "Testimony of Douglas Hayes on Contention SUWA B—Railroad Alignment Alternatives," the "Testimony of Susan Davis on Contention SUWA B—Railroad Alignment Alternatives," the "Testimony of George H.C. Liang and Donald Wayne Lewis on Contention Utah O—Hydrology," Applicant's prefaces to witness testimony, Applicant's outlines of key determinations on Contentions SUWA B and Utah O, and PFS Exhibits AA through KK, were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 18th day of March, 2002.

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