UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation)	)	ASLBP No. 97-732-02-ISFSI
	)	January 31, 2000

STATE OF UTAH'S OBJECTIONS AND RESPONSES TO APPLICANT'S FOURTH SET OF DISCOVERY REQUESTS TO INTERVENORS STATE OF UTAH AND CONFEDERATED TRIBES

The State responds to Applicant's January 14, 2000 Fourth Set of Discovery Requests, which relate to Utah Contentions E (Financial Assurance), H (Inadequate Thermal Design), L (Geotechnical), S (Decommissioning), and GG (Failure to Demonstrate Cask-Pad Stability During Seismic Event for TranStor Casks). The State and the Applicant have agreed that the party responding to Requests for Admissions and Interrogatories, during the formal discovery period, may have eight working days in which to timely file a response. In addition, counsel for the Applicant agreed that the State may file responses to the Applicant's 4th Set of Discovery at the same time as it files responses to the Applicant's 5th Set of Discovery (*i.e.* January 31, 2000).

GENERAL OBJECTIONS

These objections apply to the State of Utah's responses to all of the Applicant's Forth Set of Discovery Requests.

1. The State of Utah objects to the Applicant's instructions and definitions on

the grounds and to the extent that they request or purport to impose upon the State any obligation to respond in manner or scope beyond the requirements set forth in 10 CFR §§ 2.740, 2.741 and 2.742.

2. The State of Utah objects to Applicant's Request for Production of Documents to the extent that it requests discovery of information or documents protected under the attorney-client privilege, the attorney work-product doctrine and limitations on discovery of trial preparation materials and experts' knowledge or opinions set forth in 10 CFR § 2.740 or other protection provided by law. The State has provided PFS with a Privilege Log which identifies all documents subject to these privileges and protections and which the State reserves the right to supplement.

I. GENERAL INTERROGATORIES

General Interrogatory No. 1. State the name, business address, and job title of each person who was consulted and/or who supplied information for responding to interrogatories, requests for admissions and requests for the production of documents. Specifically note for which interrogatories, requests for admissions and requests for production each such person was consulted and/or supplied information.

If the information or opinions of anyone who was consulted in connection with your response to an interrogatory or request for admission differs from your written answer to the discovery request, please describe in detail the differing information or opinions, and indicate why such differing information or opinions are not your official position as expressed in your written answer to the request.

RESPONSE TO GENERAL INTERROGATORY NO. 1: The following persons were consulted and/or supplied information in responding to the discovery requests for Applicant's Fourth Set of Requests. Their Declarations are attached hereto as Exhibit 1.

Utah Contentions E and S
Michael F. Sheehan, Esq.
Economist and Financial Expert, Osterberg & Sheehan
33126 S.W. Callahan Road
Scappoose, Oregon 97056

Utah Contentions H
Marvin Resnikoff, Ph.D.
Senior Associate
Radioactive Waste Management Associates
526 West 26th Street, Room 517
New York, NY 10001

Utah Contentions L
M. Lee Allison, Director (limited to Interrogatory No. 2 and document requests)
Kansas Geological Survey
1930 Constant Ave.
Lawrence, Kansas 66047

Steven F. Bartlett, Ph.D. (limited to Admission Requests, Interrogatory No. 1, and the first paragraph of Interrogatory No. 2)
Research Project Manager, Research Division
Utah Department of Transportation
4501 South 2700 West
Salt Lake City, Utah 84114-8410

Utah Contention GG
Farhang Ostadan, Ph.D.
Consultant for Soil Dynamics and Soil-Structure Interaction
2 Agnes Street
Oakland, California 94618

General Discovery Requests
Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
Salt Lake City, Utah 84114-0873

In response to whether the information or opinions of anyone who was consulted

in connection with the State's response to an interrogatory or request for admission differs from the State's written answer to the discovery request, the State is unaware of any such difference among those consulted.

Supplement to General Interrogatory No. 3.

In response to General Interrogatory No. 3, Applicant's First Set of Formal Discovery Requests to the State dated April 2, 1999, the State identifies Dr. Farhang Ostadan, whom it expects to call as witness at the hearing for Utah Contentions L and GG. His area of testimony will be soils and soil structure interaction. He has reviewed the following documents: Applicant's license application to the NRC and amendments thereto; Applicant's responses to NRC Staff's requests for additional information; the Applicant's calculation packages; and calculation packages and reports relating to the TranStor casks. Included herein as Exhibit 2 is Dr. Ostadan's resume which provides answers to the questions of profession, employer, area of professional expertise, and educational and scientific experience.

II. GENERAL DOCUMENT REQUESTS

General Request No. 1. All documents in your possession, custody or control identified, referred to, relied on, or used in any way in (a) responding to the interrogatories and requests for admissions set forth in Applicant's First Set of Formal Discovery Requests to Intervenors State of Utah and Confederated Tribes, (b) responding to the interrogatories and requests for admissions set forth in Applicant's Second Set of Discovery Requests with Respect to Groups II and III Contentions, (c) responding to the interrogatories and requests for admissions set forth in Applicant's Third Set of Discovery Requests with Respect to Groups II and III Contentions, and (d) responding to the following interrogatories and requests for admissions in this document, or (e) responding to the any subsequent interrogatories and requests for admissions filed with

respect to the State's and/or Confederated Tribes Contentions as admitted by the Board.

RESPONSE TO GENERAL DOCUMENT REQUEST NO. 1: *See* responses to specific Document Requests below.

III. STATE RESPONSES TO DISCOVERY REQUESTS

A. CONTENTION E (FINANCIAL ASSURANCE)

Document Requests - Utah E

1. All documents discussing health and safety concerns the State asserts have been encountered by "financially strapped nuclear licensees." See State of Utah's Response to the Applicant's Motion for Partial Summary Disposition of Utah Contention E/Confederated Tribes Contention F, at 10 [hereinafter State Resp. to Utah E Mot.].

RESPONSE TO DOCUMENT REQUEST NO. 1 - UTAH E.

A. The State refers the Applicant to publicly available materials, including NRC decisions, regulations, guidance and other notifications as discussed in State's December 27, 1999 Response to Applicant's Motion for Partial Summary Disposition of Utah Contention E (hereinafter "State's Resp. Sum. Disp."), at 9-10 and the Sinclair Declaration (Exh. B). For example, *see* the following:

1. 57 Fed. Reg. 13389, Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites (1992) (listing NRC regulated sites which have "buildings, former waste disposal areas, large piles of tailings, groundwater, and soil contaminated with low levels of uranium or thorium (source material) or other radionuclides . . . present[ing] varying degrees of radiological hazard. . . [where at particular sites] the licensee or responsible party is unable or unwilling to perform cleanup." Id. at 13390);

2. 59 Fed. Reg. 36026, Final Rule, Timeliness in Decommissioning of Materials Facilities (1994);

3. Site Decommissioning Management Plan, NUREG-1444, Suppl. 1 (November 1995);

4. SECY-99-035, Status of Decommissioning Program and Site Decommissioning Management Plan Sites (February 1, 1999) (containing the most recent SDMP list the NRC's Public Document Room librarians were able to locate; listing a total of 50 sites, including 36 on the list and 24 removed as of January 1999).

5. Documents filed In re Atlas Corporation, Bankruptcy Case No. 98-23331 DEC (Dist. Colo.); *e.g.*, State of Utah's January 14, 1999 Supplement to Its Proof of Claim ($77 million to mitigate the ground and surface water contamination caused by the Atlas tailings); NRC's January 12, 1999 Proof of Claim ($44 million mitigation costs);[1]

6. Sequoyah Fuels Corporation and General Atomics (Gore, Oklahoma Site Decontamination and Decommissioning Funding), LBP -96-24, 44 NRC 249 (1996) at Dissenting Statement by Bollwerk, J (the Gore facility is listed on the SDMP in SECY-99-035).

7. Shieldalloy Metallurgical Corporation (Newfield, New Jersey), DD-97-10, 45 NRC 338 (1997) (the Newfield facility is listed on the SDMP in SECY-99-035).

8. Gulf States Utilities Co., (River Bend Station, Unit 1), LBP-95-10, 41 NRC 460 (1995).

See also, Utah Department of Environmental Quality's Atlas Corporation files, which are available for inspection and copying, upon co-ordination with counsel for the State, at the Division of Radiation Control and the Division of Water Quality.

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[1] Counsel for the Applicant should be aware of the Atlas bankruptcy case; *see, e.g.* December 29, 1998 Notice. . . for Allowance of Fees and Expenses for Shaw Pittman Potts & Trowbridge. . . (interim fees and expenses of $35,772), filed in the Atlas case.

B. In addition to the response in Part A, the State has the following documents relating to certain nuclear power plants, which are available for inspection and copying upon notification of counsel for the State.

1. Commonwealth Edison.
   a. Performance of Commonwealth Edison Company Plants, June 25, 1992, SECY-92-228.

   b. Commonwealth Edison Company Board of Directors Briefing dated March 14, 1996 and September 10, 1997.

   c. Assessment of Zion Nuclear Power Station, An Independent Assessment, February 18, 1997.

2. Millstone
   a. Focused Audit on the Connecticut Light and Power Company Nuclear Operations, Final Report, December 31, 1996 by RCB&A Management Consultants.

   b. Report on the Fundamental Cause Assessment Term, July 12, 1996.

3. Maine Yankee
   a. A Management Audit of Maine Yankee Atomic Power company for the Maine Public Utility Commission, August 29, 1997 prepared by Barrington-Wellesley Group, Inc.

   b. Letter from Shirley Ann Jackson, Chairman, NRC. to Charles D. Frizzel, President, Maine Yankee Atomic Power Co, dated October 7, 1996 and attached NRC independent Safety Assessment, Maine Yankee Atomic Power Station.

2. All documents concerning "corners cut" by nuclear licensees to minimize costs that have compromised safety. See State of Utah's Statement of Disputed and Relevant Material Facts (filed with State Resp. to Utah E Mot.), at ¶ 11 [hereinafter Utah St. Mat. Facts].

RESPONSE TO DOCUMENT REQUEST NO. 2 - UTAH E. *See* Response

to Document Request No. 1.

3. All documents discussing "pre-existing liabilities" the State contends PFS would have at the time construction of the PFSF would begin. See State Resp. to Utah E Mot. at 12.

RESPONSE TO DOCUMENT REQUEST NO. 3 - UTAH E. The State objects to this Request on the grounds that it requires the State to speculate what might occur at some indefinite future date. Since PFS does not know when construction may begin, it is difficult to know, list, or estimate the magnitude of, the "pre-existing liabilities" PFS may have incurred "at the time of construction." The types of liabilities incurred to date, *i.e.* prior to construction so far, include those discussed or suggested in the following documents: PFS Revenue/Expense sheets; PFS Business Plans; PFS Privilege Logs.

4. All documents discussing the "pre-construction debt" and "non-construction obligations" that could affect PFS's financial base. Utah St. Mat. Facts at ¶ 24.

RESPONSE TO DOCUMENT REQUEST NO. 4 - UTAH E. The State objects to this Request on the grounds that it requires the State to speculate what might occur at some indefinite future date. Since PFS does not know when construction may begin, it is difficult to know, list, or estimate the magnitude of, the "pre-existing liabilities" PFS may have incurred "at the time of construction." The types of liabilities incurred to date, i.e. prior to construction so far, include those discussed or suggested in the following documents: PFS Revenue/Expense sheets; PFS Business Plans; PFS Privilege Logs. Revenue/Expense sheets and PFS-Goshute Lease.

5. All documents concerning the "financial depth" that the State contends is necessary for PFS to build the PFSF and "adequately protect the public health and safety." See Utah St. Mat. Facts at ¶ 19.

RESPONSE TO DOCUMENT REQUEST NO. 5 - UTAH E. The State objects to this Request in that "financial depth" is implicit in the reasonable assurance requirement under 10 CFR § 72.22(e) and thus, PFS is requesting documents that call for a legal opinion.

6. All documents discussing how, in the State's view, the acceptance of spent fuel at the DOE repository at Yucca Mountain would impact the projected revenue of the PFSF. See Utah St. Mat. Facts at ¶ 34.

RESPONSE TO DOCUMENT REQUEST NO. 6 - UTAH E. The State has no documents that satisfy this request.

7. All documents discussing the "liabilities" the State asserts may "impair funding of construction, operation, maintenance, and decommissioning of and transportation services" provided for the PFSF. See Utah St. Mat. Facts at ¶ 58.

RESPONSE TO DOCUMENT REQUEST NO. 7 - UTAH E. *See* Response to Document Request No. 4.

8. All documents discussing the operating and maintenance and other costs of the PFSF that the State asserts will be fixed rather than variable. See Sheehan Dec. (submitted with State Resp. to Utah E Mot.) at ¶ 9.e.

RESPONSE TO DOCUMENT REQUEST NO. 8 - UTAH E. *See* Response to Document Request No. 4.

9. All documents related to the costs of constructing ISFSIs, including any and all documents relied upon to dispute the reasonableness of PFS's construction cost estimates.

RESPONSE TO DOCUMENT REQUEST NO. 9 - UTAH E. All documents

provided by PFS, including discovery responses. In addition, Trojan Decommissioning Plan; Final Environmental Impact Statement for the Point Beach Nuclear Power Plant Projects (PFS produced document, bates no.33406, et seq.), and PFS Business Plans.

10. All documents related to the costs of operating and maintaining ISFSIs, including any and all documents relied upon to dispute the reasonableness of PFS's operation and maintenance cost estimates.

RESPONSE TO DOCUMENT REQUEST NO. 10 - UTAH E. *See* Response to Document Request No. 9.

11. All documents comprising or relating to any evaluation performed by the State or its experts of the costs of constructing an ISFSI.

RESPONSE TO DOCUMENT REQUEST NO. 11 - UTAH E. *See* Response to Document Request No. 9.

12. All documents comprising or relating to any evaluation performed by the State, or its experts, of the costs of operating and maintaining an ISFSI.

RESPONSE TO DOCUMENT REQUEST NO. 12 - UTAH E. *See* Response to Document Request No. 9.

13. All documents comprising or relating to any evaluations or analysis by the State or its experts of the adequacy of the financial qualifications of PFS to construct and operate the PFSF.

RESPONSE TO DOCUMENT REQUEST NO. 13 - UTAH E. The State objects to this request as overbroad and burdensome. The entire Contention E is about the adequacy of PFS's financial qualifications. Notwithstanding this objection, the State refers PFS to all documents produced to date for Contention E.

B. CONTENTION H (INADEQUATE THERMAL DESIGN)

1. Requests for Admission – Utah H

1. Do you admit that there would be no net transfer of radiant heat between two vertically arrayed casks, at the same temperature, in the vicinity of each other?

RESPONSE TO ADMISSION REQUEST NO. 1 - UTAH H. Admit.

2. Do you admit that any one cask would have no net gain of radiant heat from others in an array with a large number of casks, all at the same temperature?

RESPONSE TO ADMISSION REQUEST NO. 2 - UTAH H. Admit. However, it is important to note that one cask would have no net loss of radiant heat either, and that this question specifically refers to radiant heat gains.

3. Do you admit that if two casks are arrayed in close vicinity of each other, where one cask is hotter than the other, the hot cask would not receive net radiant heat from the cold cask?

RESPONSE TO ADMISSION REQUEST NO. 3 - UTAH H. Admit.

4. Do you admit that if two casks are arrayed in close vicinity of each other, where one cask is hotter than the other, the hot cask would tend to cool down due to radiation heat transfer?

RESPONSE TO ADMISSION REQUEST NO. 4 - UTAH H. Denied.

5. Do you admit that it is not necessary to specify or know the temperature of a perfectly reflecting boundary to correctly formulate a radiation heat transfer simulation?

RESPONSE TO ADMISSION REQUEST NO. 5 - UTAH H. Denied, on the grounds that " to correctly formulate a radiation heat transfer simulation" implies that the PFS FLUENT model is a correct radiation heat transfer simulation.

6. Do you admit that a perfect reflector does not return radiant energy as a function of its temperature?

RESPONSE TO ADMISSION REQUEST NO. 6 - UTAH H. Admit.

7. Do you admit that the exit temperature of air in a ventilated cask containing a canister loaded with typical spent nuclear fuel would not stay the same as the temperature of air entering the overpack?

RESPONSE TO ADMISSION REQUEST NO. 7 - UTAH H. Admit.

8. Do you admit that heating of the upflowing air through its contact with the inside surface of the overpack helps increase the rate of ventilation in a ventilated overpack such as HI-STORM 100?

RESPONSE TO ADMISSION REQUEST NO. 8 - UTAH H. Admit.

9. Do you admit that the heat input to a cask from other casks in a typically loaded array of HI-STORM casks, at the PFSF design basis heat load, would be less than the heat input from PFSF design basis insolation?

RESPONSE TO ADMISSION REQUEST NO. 9 - UTAH H. The State lacks sufficient information to either admit or deny this request. The State has not yet performed a run of a thermo-hydraulic modeling program, which would be necessary in order to answer this request.

10. Do you admit that the peak temperatures of a HI-STORM 100 cask would be decreased if the spacing between the casks is decreased?

RESPONSE TO ADMISSION REQUEST NO. 10 - UTAH H. Denied.

11. Do you admit that the State claims that it is necessary to specify or know the temperature of a perfectly reflecting boundary in order to correctly formulate a radiation heat transfer simulation?

RESPONSE TO ADMISSION REQUEST NO. 11 - UTAH H. Denied.

12. Do you admit that the HI-STORM storage cask has been analyzed for a continuous ambient temperature of 125°F?

RESPONSE TO ADMISSION REQUEST NO. 12 - UTAH H. Denied, on the

grounds that "ambient temperature" has not been defined.

13. Do you admit that the TranStor storage cask has been analyzed for a continuous ambient temperature of 125°F?

RESPONSE TO ADMISSION REQUEST NO. 13- UTAH H. Denied, on the grounds that "ambient temperature" has not been defined.

14. Do you admit that Holtec International has committed to adhere to the provisions of ACI-349 for concrete used in the HI-STORM cask?

RESPONSE TO ADMISSION REQUEST NO. 14 - UTAH H. Admit.

15. Do you admit that the temperature limit of 350°F for "cask surface temperature," as stated in Table 1 of Attachment 1 to Holtec International's December 13, 1999 submittal to the NRC Staff entitled "PFS EHT Thermal Modeling Features Sensitivity Study," is a valid and correct temperature limit for the HI-STORM cask?

RESPONSE TO ADMISSION REQUEST NO. 15 - UTAH H. Admit, provided that the sensitivity study adheres to ACI-349 with respect to the concrete aggregate mix and procedures for pouring concrete.

16. Do you admit that the temperature limit of 775°F for "canister shell temperature," as stated in Table 1 of Attachment 1 to Holtec International's December 13, 1999 submittal to the NRC Staff entitled "PFS EHT Thermal Modeling Features Sensitivity Study," is a valid and correct temperature limit for the HI-STORM cask?

RESPONSE TO ADMISSION REQUEST NO. 16 - UTAH H. The State lacks sufficient information to either admit or deny this request. The State's expert, RWMA, received a copy of Holtec's December 13, 1999, submittal only recently, and has not yet had an opportunity to evaluate it fully.

17. Do you admit that the temperature limit of 1058°F for "peak cladding temperature," as stated in Table 1 of Attachment 1 to Holtec International's December 13, 1999 submittal to the NRC Staff entitled "PFS EHT Thermal Modeling Features

Sensitivity Study," is a valid and correct temperature limit for the HI-STORM cask?

RESPONSE TO ADMISSION REQUEST NO. 17 - UTAH H. *See* Response to Admission Request No. 16 above.

18. Do you admit that the FLUENT software package is a valid and correct code for performing thermal analyses for spent fuel dry storage casks?

RESPONSE TO ADMISSION REQUEST NO. 18 - UTAH H. The State lacks sufficient information to either admit or deny this request, because the FLUENT software package code cannot be validated without access to the code itself. The State does not have access to the FLUENT code. Moreover, to the State's knowledge, the NRC Staff has not independently verified the correctness, accuracy or validity of the FLUENT code.

19. Do you admit that the thermal analyses performed by Holtec International using the FLUENT code for the HI-STORM storage cask at the PFSF site, wholly apart from the State's position on the validity of the input assumptions, are correct, accurate, and valid?

RESPONSE TO ADMISSION REQUEST NO. 19 - UTAH H. The State objects to this request on grounds of lack of clarity. The State is unable to ascertain from this question what PFS considers to constitute a part of the FLUENT code, and what PFS considers to constitute "input assumptions." Without waiving this objection, the State responds that it lacks sufficient information to either admit or deny this request, because the FLUENT software package code cannot be validated without access to the code itself. The State does not have access to the FLUENT code. Moreover, to the State's knowledge, the NRC Staff has not independently verified the correctness, accuracy or validity of the FLUENT code.

20. Do you admit that the generic thermal analyses performed by Holtec International using the FLUENT code for the HI-STORM storage cask in the HI-STORM Topical Safety Analysis Report, wholly apart from the State's position on the validity of the input assumptions, are correct, accurate, and valid?

RESPONSE TO ADMISSION REQUEST NO. 20 - UTAH H. *See* Response to Request for Admission No. 19 above.

21. Do you admit that, other than the errors alleged in Interrogatories No. 1 below, the State alleges no errors in PFS' thermal analysis of the HI-STORM storage cask at the PFSF site?

RESPONSE TO ADMISSION REQUEST NO. 21 - UTAH H. Admit.

22. Do you admit that the State has no ambient temperature data for Skull Valley that contradicts the temperature estimates for the PFSF site given in the PFSF Safety Analysis Report?

RESPONSE TO ADMISSION REQUEST NO. 22 - UTAH H. The State objects to this Request on the ground that the term "ambient temperature" is not defined. Without waiving this objection, the State responds that it does not have temperature data for Skull Valley, other than data that has already been provided by PFS.

23. Do you admit that the State has no ambient temperature data for PFSF site that contradicts the temperature estimates for the PFSF site given in the PFSF Safety Analysis Report?

RESPONSE TO ADMISSION REQUEST NO. 23 - UTAH H. The State objects to this Request on the ground that the term "ambient temperature" is not defined. Without waiving this objection, the State responds that it does not have temperature data for the PFS facility site, other than data that has already been provided by PFS.

24. Do you admit that the EHT model for the Holtec thermal analysis of the HI-STORM cask at the PFSF site models all of the air in the system, from the ISFSI pad

surface to the top of the storage cask?

RESPONSE TO ADMISSION REQUEST NO. 24 - UTAH H. Denied.

25. Do you admit that the FLUENT code is a commercially-available software package?

RESPONSE TO ADMISSION REQUEST NO. 25 - UTAH H. Denied, on the grounds that the price ($26,000 for a one-year license) makes the package effectively unavailable (to both the State and NRC).

26. Do you admit that the hypothetical reflecting boundary used in the EHT model thermal analysis performed by Holtec International for PFS models an infinite array of identical dry storage casks?

RESPONSE TO ADMISSION REQUEST NO. 26 - UTAH H. Denied.

27. Do you admit that the ambient temperature data provided by PFS in the PFSF SAR accurately bounds the actual temperatures at the Skull Valley site where the PFSF is to be located?

RESPONSE TO ADMISSION REQUEST NO. 27 - UTAH H. Denied.

28. Do you admit that the ambient temperature data collected by PFS over a two-year period from its meteorological station in Skull Valley, and produced to the State, accurately reflects the actual temperatures at the Skull Valley site where the PFSF is to be located?

RESPONSE TO ADMISSION REQUEST NO. 28 - UTAH H. Denied.

29. Do you admit that air is effectively transparent to thermal radiation?

RESPONSE TO ADMISSION REQUEST NO. 29 - UTAH H. The State objects to this Request on the ground that the question is vague and does not define the term "effectively transparent."

30. Do you admit that radiation heat transfer from the HI-STORM cask to air

is negligible?

RESPONSE TO ADMISSION REQUEST NO. 30 - UTAH H. The State objects to this Request on the ground that the term "negligible" is not defined. Without waiving its objection, the State responds that radiation heat transfer from the HI-STORM cask will slightly increase air temperature.

31. Do you admit that the EHT model thermal analysis performed by Holtec International for PFS correctly models the geometry of a HI-STORM dry storage cask?

RESPONSE TO ADMISSION REQUEST NO. 31 - UTAH H. Denied.

32. Do you admit that the EHT model thermal analysis performed by Holtec International for PFS correctly models the heat transfer properties of the materials in a HI-STORM dry storage cask?

RESPONSE TO ADMISSION REQUEST NO. 32 - UTAH H. Denied.

33. Do you admit that maximum difference between the air temperature at five feet above a heated ISFSI concrete pad and the general ambient air temperature would be, at most 1 °F to 2°F?

RESPONSE TO ADMISSION REQUEST NO. 33 - UTAH H. Denied, on the grounds that temperature measurements will vary depending on proximity to the heated casks.

34. Do you admit that maximum difference between the air temperature at fifteen feet above a heated ISFSI concrete pad and the general ambient air temperature would be negligible?

RESPONSE TO ADMISSION REQUEST NO. 34 - UTAH H. Denied, on the grounds that temperature measurements will vary depending on proximity to the heated casks.

35. Do you admit that the State has not performed any independent analyses to verify or evaluate the results of the Holtec EHT model thermal analyses of the HI-STORM cask for the PFSF site?

RESPONSE TO ADMISSION REQUEST NO. 35 - UTAH H. Denied.

36. Do you admit that the Holtec sensitivity studies performed for PFS and submitted to the NRC on December 13, 1999 show an increase in HI-STORM cask surface temperature due to radiation heat transfer from adjacent casks?

RESPONSE TO ADMISSION REQUEST NO. 36 - UTAH H. The State lacks sufficient information to either admit or deny this request, because it has not yet had sufficient time to review Holtec's December 13, 1999, submittal.

37. Do you admit that the Holtec sensitivity studies performed for PFS and submitted to the NRC on December 13, 1999 show an increase in inlet duct air temperature due to heat transfer to the air from the ISFSI concrete pad and cask?

RESPONSE TO ADMISSION REQUEST NO. 37 - UTAH H. See Response to Request No. 36, above.

38. Do you admit that the effective area of the concrete pad used in the EHT model thermal analysis envelopes the actual concrete pad area for dry storage in the PFSF storage cask array?

RESPONSE TO ADMISSION REQUEST NO. 38 - UTAH H. Denied, on the grounds that the EHT model only considers one cask.

39. Do you admit that the conceptual heat transfer model used in the FLUENT code is valid and correct?

RESPONSE TO ADMISSION REQUEST NO. 39 - UTAH H. The State objects to this Request on the ground that it is unclear which "model" is referred to (the EHT model or the set of equations used in the FLUENT code). Without waiving this

objection, the State responds that it is impossible to fully evaluate the validity and correctness of the conceptual heat transfer model used in the FLUENT code without access to the code itself, and therefore the State is unable to admit or deny this Request.

40. Do you admit that the design temperature limits for the HI-STORM 100 casks are a generic cask issue addressed in the HI-STORM 100 general rulemaking proceeding?

RESPONSE TO ADMISSION REQUEST NO. 40 - UTAH H. Denied, on the ground that if PFS proposes to use the HI-STORM 100 casks in the specific location of the PFS facility in Skull Valley, the design temperature limits for the cask must take into account local conditions.

41. Do you admit that the design temperature limits for the TranStor casks are a generic cask issue addressed in the TranStor general rulemaking proceeding?

RESPONSE TO ADMISSION REQUEST NO. 41 - UTAH H. *See* Response to Request No. 40, above.

42. Do you admit that the only issue in Basis 7 of contention Utah H is whether or not the temperatures of a HI-STORM cask at the PFSF site are enveloped by the design temperature limits for the HI-STORM 100 cask?

RESPONSE TO ADMISSION REQUEST NO. 42 - UTAH H. *See* Response to Request No. 40, above.

43. Do you admit that the only issue in Basis 6 of contention Utah H is whether or not the temperatures of a TranStor cask at the PFSF site are enveloped by the design temperature limits for the TranStor cask?

RESPONSE TO ADMISSION REQUEST NO. 43 - UTAH H. *See* Response to Request No. 40, above.

44. Do you admit that the heat generated by the storage casks themselves can be accounted for by thermal analysis of an infinite array of storage casks that include mechanisms of heat transfer?

RESPONSE TO ADMISSION REQUEST NO. 44 - UTAH H. Denied.

45. Do you admit that the increase in the HI-STORM 100 inlet duct air temperature will result in an increase in the outlet duct air temperature?

RESPONSE TO ADMISSION REQUEST NO. 45 - UTAH H. Admit.

2. Interrogatories – Utah H

1. Identify and explain in detail any and all errors, and the bases therefor, that the State alleges to be in the EHT model thermal analysis of the HI-STORM storage cask at the PFSF site performed by Holtec International for PFS, including the December 13, 1999 sensitivity studies.

RESPONSE TO INTERROGATORY NO. 1 - UTAH H. The EHT model, a perfectly reflecting insulated cylinder around a storage cask, does not correctly model adjacent heated casks on a concrete pad, and likely underestimates the temperatures of the cask outer surface, concrete outer surface and canister outer surface and likely overestimates the air velocity through the HI-STORM ducts. Air is primarily heated by conduction at a heated surface, such as at cask walls and the pad. Adjacent casks heat the incoming downward air column between casks on all cask surfaces and at the pad and by all outgoing vents. In contrast, the EHT model heats the outer downward air on one side, and with one outgoing vent. This is a major error. Also in error are the choice of radius and the modeling of the duct within the cask.

The following is a more detailed explanation of the errors in the EHT model thermal analysis of the HI-STORM 100 storage casks. Please note that this should not be

considered a final list. As the State and its experts continue to investigate the EHT model and prepare a report for the hearing, other errors and factors that must be taken into account may arise. In addition, the State has not yet had sufficient time to fully evaluate the sensitivity studies submitted by Holtec on December 13, 1999, and therefore we cannot comment upon them at this time.

a. By using a hypothetical reflecting boundary, Holtec does not correctly model the physical situation of the PFS facility. The EHT model uses a reflecting boundary spaced 1.52 meters (4.87 ft) away from the cask outer surface, and determines from this that "thermal radiation incident on a HI-STORM module from its neighboring overpacks is included in the [EHT] model." Holtec also claims that since the inside of the hypothetical cylinder is insulated, "this assumption simulates an infinite array of casks each emitting design basis decay heat." This is incorrect. The model does not show the effects of air between the casks being heated on each side of the passage between two casks for example. The hypothetical reflecting boundary is not modeled as a heat source, whereas the casks surrounding a central cask in the PFS scenario all are heat sources. This affects both the amount of radiative heat a centralized cask can be expected to lose to cooler "sinks" and the air profile of both the chimney vent inside the cask and the air available for ventilation.

b. The EHT model does not account for the non-symmetric nature of heat inputs to a storage cask. The FLUENT model is two-dimensional, using the assumption that the problem is axisymmetric to consider the 2-D "slice" representative of the rest of

the cask conditions. However, in the PFS case, the geometry of the site is not axisymmetric. Some casks will be separated by as little as 4 feet, something not accounted for in the EHT model. This will have a significant effect on the results.

c. Insolation is modeled as a volumetric heat source over a finite volume of the ISFSI pad, whereas a more accurate and conservative model would consider it a surface heat flux over the area of the ISFSI pad outside the cask footprint.

d. Insolation is modeled as a volumetric heat source over a finite volume of the cask lid, whereas a more accurate and conservative model would consider it a surface heat flux.

e. Insolation is modeled as a volumetric heat source over a finite volume of the cask surface, whereas a more accurate and conservative model would consider it a surface heat flux.

f. The EHT model does not consider the temperature very near the ground to be impacted by the Heat Island effect. In the EHT model, the 3 K temperature difference in air temperature above the heated pad is not indicative of the hottest air temperatures as they sweep very near the surface, where the air temperature will be much closer to the surface temperature.

g. The EHT model (run M68PFS2 and run M68EH) depicts the top inch of the ISFSI pad as cooler than the inch below it. This is unrealistic. If insolation were modeled as a surface heat flux rather than a volumetric heat source, this would not happen.

2. Identify in detail any and all temperature limits that the State alleges that would be violated, and the bases therefor, by storing PFSF design basis fuel in the HI-STORM storage cask at the PFSF site.

RESPONSE TO INTERROGATORY NO. 2 - UTAH H. The State has not completed its evaluation of the Holtec thermal analysis or the December 13, 1999, submittal, and therefore is unable to respond to this question. The State will update its response when it obtains the necessary information.

3. Identify and explain in detail what the State alleges should be used, and the bases therefor, as the ambient temperature of the PFSF site in performing thermal analyses of dry storage casks at the PFSF site.

RESPONSE TO INTERROGATORY NO. 3 - UTAH H. The "ambient" temperature reported by PFS will not be the temperature experienced by the HI-STORM casks. PFS should have placed temperature sensors at the heights of the incoming and outgoing vents of the HI-STORM cask and at mid-range, all above an extended concrete pad 3' thick and near heat sources simulating full storage casks. Instead, PFS has placed temperature sensors 2 m (~6.4 ft) above a small pad. The temperature at the height of the incoming vent of the HI-STORM cask above a concrete pad will be far higher than 80 °F due to the heat island effect. Further, the temperatures between two casks will be impacted by heat input, raising the "local ambient temperature" that should be used in the PFS calculations.

4. Explain, including providing all bases, the State's assertion that the hypothetical reflecting boundary used in the EHT model thermal analysis performed by Holtec for PFS does not envelope the radiation heat transfer from adjacent casks in the PFSF storage cask array.

RESPONSE TO INTERROGATORY NO. 4 - UTAH H. *See* Response to Interrogatory No. 1 above.

3. Document Requests – Utah H

1. Provide all documents the State has on ambient temperature data for Skull Valley that contradicts the temperature estimates for the PFSF site given in the PFSF Safety Analysis Report.

RESPONSE TO DOCUMENT REQUEST NO. 1 - UTAH H. The State objects to this request on the ground that it fails to define the term "ambient" does not have any documents on ambient temperature data for Skull Valley. Our temperature estimates rely on the fact that temperatures will be warmer near the surface of the ISFSI pad then they will be further up.

2. Provide all documents the State has on ambient temperature data for PFSF site that contradicts the temperature estimates for the PFSF site given in the PFSF Safety Analysis Report.

RESPONSE TO DOCUMENT REQUEST NO. 2 - UTAH H. *See* Response to Document Request No. 1.

3. Provide all documents relating to thermal analyses performed by the State or its contractors to verify or evaluate the Holtec thermal analysis of the HI-STORM cask for the PFSF site. This request includes, but is not limited to, both hand calculations and computer calculations.

RESPONSE TO DOCUMENT REQUEST NO. 3 - UTAH H. The State is producing a copy of Radioactive Waste Management Inc.'s ("RWMA") Microsoft Excel spreadsheet calculations estimating the temperature difference between the inlet and outlet sections of the HI-STORM 100 spent fuel storage cask. In addition, the State is

producing a printout of the equation used to estimate pressure head loss due to the neutron shields, using the porous media values used in the EHT model. RWMA has not yet run software that models thermal-hydraulic properties such as the FLUENT code. These documents are available for inspection and copying; please contact Connie Nakahara to make arrangements.

4. Provide all documents relating to the potential increase in air temperature above a heated surface. This request includes, but is not limited to, all documents authored by Dr. Hashem Akbari of the Lawrence Berkeley National Laboratory.

RESPONSE TO DOCUMENT REQUEST NO. 4 - UTAH H. The State is producing the following documents which are available for inspection and copying; please contact Connie Nakahara to make arrangements.:

a. Akbari, Levinson, and Berdahl, "ASTM Standards for Measuring Solar Reflectance and Infrared Emittance of Construction Materials and Comparing their Steady-State Surface Temperatures." LBL report No. LBL-38676 (1996).

b. An excerpt from Chapter 3 of Oke, T.R., *Boundary Layer Climates*. London: Methhuen & Co LTD (1978).

c. Chapters 1-3 and Appendix F of Levinson, R., "Near-ground cooling efficacies of trees and high-albedo surfaces," Lawrence Berkeley National Laboratory Report LBL-38678 (1997). (Note that this document is available in its entirety online from the DOE Information Bridge.)

5. Provide all documents relating to any correspondence between the State or its contractors and Dr. Hashem Akbari. This request includes, but is not limited to, the correspondence referenced in the "State of Utah's Comments on NRC's Proposed Approval of the Holtec Hi-Storm 100 Cask System," submitted by letter dated December 6, 1999 from C. Nakahara (State of Utah) to E. Julian (NRC).

RESPONSE TO DOCUMENT REQUEST NO. 5 - UTAH H. The State has already provided PFS with a copy of notes from this communication. No other related

documents exist.

6. Provide all documents relating to any evaluation performed by the State or its contractors of the PFS thermal analysis of dry storage casks at the PFSF site.

RESPONSE TO DOCUMENT REQUEST NO. 6 - UTAH H. *See* Response to Request No. 3.

7. Provide all documents relating to temperature limits applicable to concrete used for dry spent fuel storage casks.

RESPONSE TO DOCUMENT REQUEST NO. 7 - UTAH H. We will employ applicable NRC regulatory guidance and documents from the American Concrete Institute, such as ACI-349, all of which the Applicant possesses.

8. Provide all documents relating to the buoyancy of air in convective heat transfer for dry spent fuel storage casks.

RESPONSE TO DOCUMENT REQUEST NO. 8 - UTAH H. *See* Response to Request No. 3.

9. Provide all documents relating to thermal analysis of dry spent fuel storage cask temperatures performed by the State or its contractors, or anyone else.

RESPONSE TO DOCUMENT REQUEST NO. 9 - UTAH H. *See* Response to Request No. 3.

C. CONTENTION UTAH L (GEOTECHNICAL)

1. Requests for Admission – Utah L

1. Do you admit that the PFS's investigation of soil conditions at the PFS site, as described in the SAR, as amended through Amendment No. 8, are adequate to determine the suitability of the proposed site of the PFSF?

RESPONSE TO ADMISSION REQUEST NO. 1 - UTAH L. The State objects to this Request as overbroadbroad. Notwithstanding this objection, the request is denied.

2. Do you admit that PFS has conducted additional geotechnical borings across the site?

RESPONSE TO ADMISSION REQUEST NO. 2 - UTAH L. The State objects to the form of the question, which requires a comparison but does not disclose what the "additional geotechnical borings" are to be compared to. The State also objects to the term "across the site" as vague. Notwithstanding these objections, the State admits that PFS has conducted some additional borings at the ISFSI site since it submitted its original application to the NRC.

3. Do you admit that PFS has conducted additional borings below depths of 100 ft., as shown in Figs. 2.6-21 and 2.6-22 of the SAR?

RESPONSE TO ADMISSION REQUEST NO. 3 - UTAH L. Admit.

4. Do you admit that the spacing and coverage of the geotechnical borings are adequate to discover significant horizontal variation?

RESPONSE TO ADMISSION REQUEST NO. 4 - UTAH L. Denied. PFS has not performed any geostatistical analysis to show the extent of lateral variation or lack thereof.

5. Do you admit that PFS has established the depth and nature of bedrock at the site?

RESPONSE TO ADMISSION REQUEST NO. 5 - UTAH L. Denied. *See* State of Utah's Objections and Response to Applicant's Second Set of Discovery Requests with Respect to Groups II and III Contentions, June 28, 1999 (hereinafter "State's

Response 2nd Set"), Response to Interrogatory 5.F at 43.

6. Do you admit that the depth to groundwater and the hydraulic gradient, including seasonal variations, have been defined for the PFSF site?

RESPONSE TO ADMISSION REQUEST NO. 6 - UTAH L. Denied. *See* State's Response 2nd Set, Response to Interrogatory 5 at 43-44. Moreover, not enough time has elapsed since PFS may have commenced collecting groundwater data to gather sufficient data on seasonal variations at the site.

7. Do you admit that PFS has adequately addressed the potential for collapsible soils at the PFSF site?

RESPONSE TO ADMISSION REQUEST NO. 7 - UTAH L. Denied. PFS has conducted no exploration for collapsible soils to show the extent of lateral variation or lack thereof. *See* State's Response 2nd Set, Response to Interrogatory 7 at 49-51.

8. Do you admit that PFS has properly determined the soil's undrained shear strength?

RESPONSE TO ADMISSION REQUEST NO. 8 - UTAH L. Denied. *See* State's Response 2nd Set, Response to Interrogatory 8 at 51-52.

2. Interrogatories – Utah L

1. If Request for Admission No. 1 is denied, identify and fully explain in each and every respect all alleged deficiencies in PFS's investigation of soils conditions, as set forth in the latest version of the SAR and materials referenced therein, as well as any additional investigations that the State claims should be performed to adequately investigate soil conditions at the PFSF site, including the scientific and technical bases therefor.

RESPONSE TO INTERROGATORY NO. 1 - UTAH L.

Strain Rate of Soil: Any design value of strength gain, due to strain rate effects,

should be confirmed by testing of PFS soils, and not obtained from geotechnical literature. However, PFS relies on geotechnical literature. The SAR states that "[t]ests performed on Cambridge Clay (Cambridge, MA), showed that, tested at a rapid rate of loading (0.02 sec), the strength of the clay was approximately 1.9 times greater than measured at a slow rate of loading (465 sec)." SAR, Rev. 8, at 2.6-40.

The rapid loading (0.02 sec), stated in the SAR corresponds to a frequency of 50 hertz. If the effect of strain rate on the peak undrained shear strength is to be used in the design, it is more appropriate to use a laboratory strain rate that more closely matches the expected predominate frequency of vibration of the PFS soil column. The soils have a predominate frequency of vibration of about 1 hertz (*i.e.*, duration of cyclic loading of about 1 second). Thus, the expected rate of seismic loading at the PFS site is about two orders of magnitude slower than the rate of loading used in the Cambridge Tests, and about three orders of magnitude slower than the loading rate used in the Schimming et al Tests (1966), which achieved peaking loading in 0.001 to 0.005 seconds.

"Geotechnical Earthquake Engineering" Table 6-7, states that: "strain rate has no effect on non-plastic soils; and increases with strain rate for plastic soils." Kramer, S. L., *Geotechnical Earthquake Engineering*, Prentice Hall, 1996. This reference lists an "up to ~ 10% increase per log cycle increase in strain rate," for plastic soils. *Id.* Typical monotonic shear strength testing of cohesive soils usually has a duration of a few hundred seconds. Thus, this rate of loading is approximately 2.5 to 3 log cycles longer than the rate of earthquake loading. Hence, without site-specific testing, it appears more

appropriate to consider a possible 25 to 30 percent increase in peak shear strength, not the 50 percent increase recommended in the SAR at 2.6-40a.

Undrained Shear Strength: The Applicant in the section entitled "Dynamic Strength of Soils," did not consider a potential reduction in peak undrained shear strength due to earthquake cycling. SAR at 2.6-39. Based on experimental data, Makdisi and Seed report that the cyclic strength of a clayey material would appear to be 80 percent or more of the static undrained strength. Makdisi, F.I, and Seed, H.B. , *A Simplified Procedure for Estimating Earthquake-Induced Deformations in Dams and Embankments*, Report No. UCB/EERC-77/19, Earthquake Engineering Research Center, University of California at Berkeley, 1977. Makdisi and Seed recommend this value (i.e., 80 percent of the peak undrained strength) be used in sliding-block type deformation analyses. The Applicant has not considered a potential 20 percent reduction in peak shear strength, due to earthquake cycling.

Factor of Safety Against Sliding: The Applicant states

> In accordance with the requirements of NUREG-75/087, Section 3.8.5, "Foundation," Section II.5, "Structural Acceptance Criteria," the recommended minimum factor of safety against overturning or sliding failure from static loads (dead load plus maximum live loads) is 1.5 and due to static loads plus loads from extreme environmental conditions, such as the design basis ground motion, is 1.1.

SAR at 2.6-41.

Thus, based on NRC guidance, the minimum acceptable factor of safety against sliding during a seismic event is 1.1. However, the next paragraph of the SAR indicates

that "[i]f the factor of safety against sliding is less than 1 due to the design basis ground motion, additional analyses of the displacements the structure may experience are calculated using the method proposed by Newmark . . ." At 2.6-41.

The Applicant fails to comply with the NRC guidance minimum seismic sliding factor of safety of 1.1. Moreover, the Applicant has not justified use of very simplified deformation analyses (i.e., Newmark analysis) to estimate "acceptable" deformation. Nor has the Applicant defined "acceptable" deformation.

The Applicant also states:

> Analyses were performed to address the possibility that sliding may occur along a deep slip plane at the clayey soil / sandy soil interface as a result of the earthquake forces. To simplify the analysis, it was assumed that cohesionless soils extend above the 10 ft depth and, thus, the pads are founded directly on cohesionless materials. Conservatively assuming that $\phi = 30^{\circ}$, which is more than reasonable for nonplastic silts and silty sands than the values of 35 to 40° measured in the CPTs, the resistance to sliding is calculated as N tan 30° or 0.58 N, where N is the normal force. Because of the magnitude of the peak ground accelerations (0.53g) due to the design basis ground motion at this site, the frictional resistance available when N is reduced due to the uplift from the inertial forces applicable for the vertical component of the design basis ground motion is not sufficient to resist sliding.

SAR at 2.6-52.

Again the Applicant has not justified using a sliding factor of safety contrary to NRC Guidance of less than 1 and using the results of simplified deformation analysis to determine "acceptable" performance. Moreover, if soil-structure interaction and uplift forces could potentially lead to a destablizing case (i.e., factor of safety against sliding that is less than 1), then these effects should be considered by the analytical approach.

The simplified sliding block model proposed by Newmark does not account for either of these effects. Hence, the Applicant has not justified its use of the Newmark model to estimate potential displacement, if the model is known to be grossly simplify the actual situation.

The Applicant should validate through analyses its conclusion that "[i]t is likely, that should slippage occur within the soils underlying the pads, if they were cohesionless, it would minimize the level of the accelerations that would be transmitted through the soil and into the structure." *See* SAR at 2.6-56.

Factor of Safety Against Bearing Capacity: The Applicant indicates that the "factor of safety against a bearing capacity failure increases to greater than 13 when a drained strength of $\phi = 30$ degrees is used." SAR at 2.6-43. However, this reported factor of safety is misleading and potentially incorrect. There is no basis for using a $\phi =$ 30 degrees in the bearing capacity calculation for the soils in the upper 30 feet of the profile because Figure 2.6-5 of the SAR shows these soils as predominately, silt, silty clay and clayey silt.

Factor of Safety Against Sliding of the Pads: The Applicant indicates that the "factor of safety against sliding of the pads supported directly on the in situ clayey soil is ~ 1.2, which provides an adequate margin against sliding." SAR at 2.6-51. However, this claimed factor of safety against sliding is potentially incorrect because: (1) no soil-structure interaction was considered in determining the foundation loadings for the sliding analysis, (2) PFS calculations for seismic sliding used peak undrained shear

strength, C_u, and not the soil's adhesion, C_a, as recommended by a number of authorities[2], (3) no account was taken in the calculation for reduction of shear strength due to cycling as discussed above in the section on undrained shear strength.

Settlement: SAR, Rev. 8 states "[i]n order to accommodate the total estimated settlement, the storage pads will be constructed 3.5 inches above adjacent finished grade. Exposed edges of the pads will be chamfered and the compacted aggregate surface material will be feathered to meet the edges of the raised pads for transporter access, as shown in Figure 4.2-7." At 2.6-45. There is likely some uncertainty in the Applicant's settlement estimates because it is not uncommon to have actual settlements vary by a factor of ± 2 from the estimated settlement. The Applicant has not identified any provisions in the event the storage pads do not settle, or settle more, than the anticipated 3.5 inches.

Soil Cement: The Applicant plans to stabilize all of the eolian silts near the surface within the pad emplacement areas with soil-cement. There is not sufficient information to assess the merit of this soil treatment method, nor provide a comprehensive technical review. Subsequent calculations and evaluations will be required to determine foundation loadings and finish the design of the pads.

2. Identify and fully explain any alleged deficiencies in the geotechnical

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[2]Bowles, J. E., *Foundation Analysis and Design*, Fourth Edition, McGraw-Hill Book Company, 1988; NAVFAC, *Foundations and Earth Structures*, Design Manual 7.2, Department of the Navy, Naval Facilities Engineering Command, 1982; Pile Buck, *Earth Support Systems & Retaining Structures*, Copywright 1992, Pile Buck Inc., 1992.

investigations performed by PFS, as well as any additional geotechnical investigations that the State claims should be performed to adequately characterize the PFSF site, including the scientific and technical bases therefor

RESPONSE TO INTERROGATORY NO. 2 - UTAH L.

The State objects on the grounds that the term "geotechnical" is overbroadbroad and has not been defined. Moreover, the State does not have access to the site to conduct site-specific analyses of the panapoly of investigations that may need to be performed. Notwithstanding these objections and to the extent that the term geotechnical encompasses geologic conditions, potential seismicity, ground motion, soil stability and foundation loading, and further to the extent of information and data available to the State, the State responds as follows: in the State's Response 2nd Set (at 20-40, 43, 49-53) the State described deficiencies with Geomatrix conclusions in identifying faults, ground motions, ground displacements, the probabilistic seismic hazard analysis, the seismic analysis, the depth and nature of bedrock not defined, analyses of collapsible soils, overestimation of undrained shear strength. In addition, *see* response to Interrogatory No. 1 above.

The following discusses additional deficiencies in evaluating the structural geology and tectonics: the four shear wave seismic reflection lines (PFSC-98 A-D) acquired in 1998 in Skull Valley, Utah are dominated by noise rather than signal. The stacked data do not accurately represent the subsurface. The data set is sufficiently contaminated by source noise that no meaningful interpretation is possible. As a result the lines are not useful in determining the structural geology and earthquake faulting

hazards at the site. The Bay Geophysical and Geomatrix interpretations of the data are not founded on good quality reflections interpreted on a majority of the shotgathers and are likely incorrect.

The data acquisition was not optimum for this near-surface setting. Data processing emphasized correlation of coherent noise that contaminated or overwhelmed real reflections. Many acquisition and processing parameters were not documented or reported. Sufficient processing history was not available to the State to allow the Bay Geophysical's results to be replicated.

State consultants reprocessed some of the data which confirmed that reflectors from the 'Qp' horizon and shallower are direct wave refraction and ground roll noise and are not real. Reflections are sufficiently inconsistent from shot to shot and the overall data quality varies so dramatically that stacked signals are of poor quality and no reliable interpretation of faulting, folding, or other geological characteristics can occur.

Data Acquisition: Geomatrix argued that shear wave seismic reflection data be gathered because it would provide higher resolution results. However, other characteristics of shear wave data in the Skull Valley environment seriously degrade the data quality.

The State's consultants detected large variability in data character between consecutive shot points characteristic of variable surface (soil, vegetation, hydrologic and geologic) conditions. This type of environment amplifies variability in data acquisition. Variable data character is not unusual for shear wave data in any environment. Coupling

of the geophones with the ground is suspected to be poor as evidenced by trace-to-trace changes in wavelet properties. In general it is more difficult to get a good shear coupling between the seismic source (vibrator) than with a compression wave survey. Bay Geophysical simply pushed the geophones into the loose grassy soil. The geophones should have been placed at least 6 - 8 inches beneath the surface to make contact with more competent layers for better signal response.

The poor signal response (low signal to noise ratio) contributed to the variation in adjacent seismic traces. This affects the CDP (common depth point) stacking which is the process in which adjacent traces from different shots are summed. There are some real shear wave reflections in the data but in some areas nothing but noise is evident even with significant processing.

Bay Geophysical's field notes indicate a constant problem keeping the "mini-vib" seismic source operating at peak performance.[3] Shot points were vertically stacked in the field. There are no records of the results of each individual sweep (raw recorded data or sweep itself). Therefore, it cannot be determined or evaluated what kind of signals went into the ground, the variability within each shot point gather, or the quality.

In addition, the State did not have access to vibrator performance data. Thus, the base plate and vibrator response and performance are unknown. Additionally, the State did not have access to accelerometer data for the base plate or mass.

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[3]To the extent they exist, the State does not have access to the vibrator files. Without vibrator files there is no way to tell with certainty what the vibrator was doing.

The "pilot" trace (trace #1) is not identified as a ground force or a synthetic. It cannot be determined if the data shows a weighted and summed vibrator response or some kind of "ideal," independent of actual motions. These factors resulted in summing different wave forms from side by side shots and degraded data quality.

There was a serious failure to document quality control measures related to the vibrator. Documenting quality control measures is standard in the seismic reflection industry, such as those practiced by the petroleum industry, the largest users of these kind of data.

Data Processing: Subject to the disadvantage of reviewing no detailed processing history, it appears that no first arrival (or "top) mute was used that would take out the ground roll. Reference in the processing flow to "mute" is vague and is not related to top mute based on the stacked section. The upper 100 milliseconds (ms) of data, and especially the upper 50 ms, are contaminated by widespread first arrivals, ground roll, and refractions. These three affects are inherently flat on a stacked section and were misidentified by Bay Geophysical interpreters as reflections instead of source-generated noise.

PFS did not produce any detailed velocity data, only extremely general ranges of velocities. It is not clear whether the velocities indicated are interval or stacking velocities. Without knowledge of which velocity is used, the interpretations of depth and displacement could be in error by orders of magnitude in the shallow section.

The SAR reported shear wave velocity as 515 feet per second in the upper 30 –40

feet. SAR, Rev. 5, at 2.6-33. However, Bay Geophysical used 1000 feet per second for a datum velocity correction for the upper 3- 50 feet. Thus, the Bay Geophysical report and the SAR disagree on the shear wave velocity of the site. Moreover, in reprocessing the reflection data, State consultants identified a NMO velocity of about 750 feet per second in the near surface (upper 40 feet), increasing to about 1000 feet per second at a time depth of 150 ms.

Additionally, Bay Geophysical used a datum elevation correction of 4500 feet for Line A. The actual elevation over the area is about 4460 feet. Bay Geophysical should compensate for the elevation changes in the 40 feet of overburden by using the shear wave velocity of 500 - 750 feet per second. However, analysis of the data suggests Bay Geophysical used a velocity of 1000 feet per second. This implies that stacking velocities used by Bay could be 30 – 50% greater than actual (realistic) values. However, the State cannot determine what information was used to stack data. If the wrong stacking velocity is used, then the waveforms will destructively interfere resulting in smearing of the data, unrealistic results, or coherent noise. By possibly using the wrong stacking velocity, Bay Geophysical missed stacking the geologic signals, resulting in a seismic line dominated and contaminated by stacked noise.

No information was available on the detailed processing flow (i.e., specific parameters or values defined for each process listed), velocity profiles, and vibrator parameters to analyze their data. Nonetheless, these lines can be reprocessed with the data received by the State. Absent detailed processing data, Bay Geophysical's data

processing cannot be duplicated or replicated. Subsequently, Bay Geophysical's processed data cannot be corrected nor can the State understand the processing flow or resulting stacked sections. The quality of their data is unverifiable and therefore is invalid.

Interpretation of Seismic Reflection Lines: The Bay Geophysical seismic lines are dominated by noise and cannot be reasonably interpreted. State consultants reprocessed some of the seismic reflection data using standard basic procedures, without sophisticated coherency steps, in order to not introduce spurious events. However, the State could not replicate Bay Geophysical's results.

The velocity structure varies 15 – 20% across the seismic lines. This is a prominent variation that could mask relief on subsurface layers of up to 60 feet. Moreover, time sections are meaningless without laterally variable input velocities. Bay Geophysical's use of the time section only to infer geologic interfaces and structures is not valid and could hide potentially large vertical offsets on faults.

State consultants found there are no reflections above about 80 ms (about 25 feet) on Line A that could be interpreted with confidence on shot gathers. In a few places valid reflectors as shallow as 30 feet in depth were identified. Most of the shallow section displays stacked ground roll in the upper 100 ms and not real data.

Given the shortcomings in the acquisition, documentation, and quality control, the State's consultants could not offer an interpretation of the seismic lines with any assurance. The reprocessed data allow the possible presence of numerous faults with

vertical offsets of many 10s of milliseconds (or possibly 100s of ms) extended to the shallowest recorded levels.

Due to the poor quality of the existing data, new seismic reflection lines need to be acquired over the site and surrounding areas that provide adequate and sufficiently high quality data to allow for a reasonable interpretation of fault character and locations. There should be at least one cross line, connecting the other lines, to allow for direct correlation of reflectors among all the lines.

The lines should be spaced close enough to allow correlation of faults from one line to another. A 3-D survey would also fulfill this criterion. Far field lines should be acquired to ascertain the maximum length of faults in order to estimate the magnitude of earthquakes that could be generated along the faults.

New lines should be processed in both time and depth sections, using velocities that accurately characterize the variable nature of the location. Velocity profiles should be run in boreholes drilled to the depth of investigation along the seismic lines so that measured velocities can be compared to the velocities used in the seismic processing.

Quality assurance standards equivalent to those typically used for petroleum industry seismic reflection data need to be maintained in order to replicate the results.

3. Document Requests – Utah L

1. All documents related to the State's review and analysis, including that of its experts, of the seismic, geotechnical and other information and data related to Utah L provided by PFS to the NRC.

RESPONSE TO DOCUMENT REQUEST NO. 1 - UTAH L.

The State objects to this request to the extent that it calls for production of privileged information. Notwithstanding this objection, documents will be available for review at the Office of the Utah Attorney General.

2. All documents comprising or relating to any evaluation performed by the State, or its experts, in its evaluation of the sufficiency and correctness of the information and data provided by PFS to the NRC.

RESPONSE TO DOCUMENT REQUEST NO. 2 - UTAH L.

The State objects to this request to the extent that it calls for production of privileged information; that this request is either duplicative of Document Request No. 1 or not relevant to Contention L; and that the request is overbroad because PFS does not specify what information and data PFS has provided to the NRC. Notwithstanding these objections, documents comprising or relating to evaluations performed by the State, or its experts, in its evaluation of the sufficiency and correctness of the seismic or geotechnical information and data provided by PFS to the NRC will be available for review at the Utah Office of the Attorney General.

3. All seismic, geotechnical, and other information and data related to Utah L reviewed and relied upon by the State (and its experts) in its evaluation of the sufficiency and correctness of the information and data provided by PFS to the NRC.

RESPONSE TO DOCUMENT REQUEST NO. 3 - UTAH L.

The State objects to this request to the extent that it calls for production of privileged information. Notwithstanding this objection, documents will be available for review at the Office of the Utah Attorney General.

4. All documents, data or other information describing, reviewing, analyzing,

evaluating or otherwise relating to the reviews of seismic data performed by Barry Solomon and/or Lee Allison in the last five years.

RESPONSE TO DOCUMENT REQUEST NO. 4 - UTAH L.

The State objects to this request to the extent that it calls for production of. privileged information. Notwithstanding this objection, documents will be available for review at the Office of the Attorney General.

D. CONTENTION UTAH S (DECOMMISSIONING)

1. Document Requests – Utah S

1. All documents related to the costs of decommissioning ISFSIs, including any and all documents relied upon to dispute the reasonableness of PFS's decommissioning cost estimates.

RESPONSE TO DOCUMENT REQUEST NO. 1 - UTAH S. All documents provided by PFS, including discovery responses. In addition, Trojan Decommissioning Plan; Final Environmental Impact Statement for the Point Beach Nuclear Power Plant Projects (PFS produced document, bates no.33406, et seq.), and PFS Business Plans.

2. All documents comprising or relating to any evaluation performed by the State, or its experts, of the costs of decommissioning the PFSF.

RESPONSE TO DOCUMENT REQUEST NO. 2 - UTAH S. The State has no documents that satisfy this request.

3. All documents comprising or relating to any evaluations or analysis by the State or its experts of the adequacy of the financial assurance provided by PFS for the decommissioning of the PFSF.

RESPONSE TO DOCUMENT REQUEST NO. 3 - UTAH S. The State has

no documents that satisfy this request.

E. CONTENTION UTAH GG (FAILURE TO DEMONSTRATE CASK-PAD STABILITY)

1. Request for Admissions – Utah GG

1. Do you admit that a value of 0.2 conservatively bounds the lower limit of the coefficient of friction between steel and concrete?

RESPONSE TO ADMISSION REQUEST NO. 1 - UTAH GG. Request for Admission No. 1 is denied. A uniform coefficient of friction of 0.20 does not represent the actual flexible behavior of the foundation pad under static and dynamic loading. Thus, a value of 0.2 does not conservatively bound the lower limit of the coefficient of friction between steel and concrete.

2. Do you admit that a value of 0.8 conservatively bounds the upper limit of the coefficient of friction between steel and concrete?

RESPONSE TO ADMISSION REQUEST NO. 2 - UTAH GG. Request for Admission No. 2 is denied. The Applicant has not addressed the cold bonding condition that may develop between the cask and the foundation pad. In addition, use of a uniform coefficient of 0.80 does not consider the flexible behavior of the pad and the change of frictional forces due to the pad's local displacement. Thus, a value of 0.8 does not conservatively bound the upper limit of the coefficient of friction between steel and concrete.

2. Interrogatories – Utah GG

1. Identify and fully explain the upper and lower limits of the coefficient of

friction between steel and concrete, and the scientific and technical bases therefor?

RESPONSE TO INTERROGATORY NO. 1 - UTAH GG. Under cold bonding a complete bond develops between the cask and the pad. This bond may or may not break during seismic loading depending on the contact stresses. The breakage of the bond, if it occurs, will be non-uniform at the contact points. Moreover, the simplified analysis used by the Applicant to model the interaction of the pad and the cask does not consider the real behavior of the interaction forces on a flexible pad. The coefficient of friction chosen by the Applicant to represent the interaction between the cask and the pad should represent the real behavior of the pad. Under the flexible behavior of the pad, the coefficient of friction varies over the surface of the pad. Therefore, the actual interaction between the pad and the cask cannot simply be bound by the application of two uniform values of coefficients of friction.

2. Identify and fully explain any events that would occur during a seismic event that would change the material properties of either the TranStor storage cask or the concrete pad that would affect the coefficient of friction and the scientific and technical bases therefor.

RESPONSE TO INTERROGATORY NO. 2 - UTAH GG. The material properties of the two media (cask and the pad) are not expected to change during the seismic event. However, because the pad is flexible, the contact condition between the pad and the cask are expected to change during static and seismic loading. The assumption that frictional forces are independent of foundation pad behavior as was assumed by the Applicant does not represent the real condition of the interaction forces.

3. Identify and fully explain the range of values for the coefficient of friction that would be expected to occur between steel and concrete and the scientific and technical bases therefor.

RESPONSE TO INTERROGATORY NO. 3 - UTAH GG. *See* response to Interrogatory No. 1. In addition, an applicable range of coefficients of friction within the modeling technique adopted by the Applicant should be developed from a detailed and a through analysis of the foundation pad behavior and the interaction forces between the cask and the pad under both static and dynamic loading. The contact points between the cask and a rigid pad will cause the coefficient of friction to vary across the contact points. The cold bonding condition and the variation of the coefficient of friction need to be properly represented.

4. Identify and explain in detail any and all errors, and the consequences thereof and the bases therefor, that the State alleges to be in the "TranStor Dynamic Response to 2000 year Return Seismic Event," HI-992295 (Exhibit 2 to PFS's Motion for Summary Disposition of Utah GG) related to the use of the coefficient of friction in that analysis, including the shift from the static case to the kinetic case.

RESPONSE TO INTERROGATORY NO. 4 - UTAH GG. The foundation pad acts as a flexible member under both static and seismic loading. Thus, the interaction forces between the cask and the pad are a function of the pad's local behavior. The Applicant incorrectly assumes a rigid pad behavior and thus, applies uniform coefficients of friction. A rigid pad does not represent the real behavior of the pad. The application of uniform coefficients of friction at 0.2 and 0.8 do not bound the coefficient of friction because the coefficient of friction varies across the surface of the pad.

Moreover, the Applicant has not considered the condition of the cold bonding that

may develop between the cask and the pad. The cold bonding may break in a non-uniform pattern depending upon the seismic load at the cask and pad contact points in terms of shear and overturning moment. Thus, effects of cold bonding are not bound by the 0.8 coefficient of friction.

3. Document Requests – Utah GG

1. All documents, data or other information describing, reviewing, analyzing, evaluating or otherwise relating to the proper coefficient of friction between the TranStor storage cask and the concrete pad.

RESPONSE TO DOCUMENT REQUEST NO. 1 - UTAH GG. The State objects to this request to the extent that it calls for production of privileged information. Notwithstanding this objection, documents will be available for review at the Office of the Attorney General. In addition, the following publications relate to the State's evaluation of the proper coefficient of friction between the TranStor storage cask and the concrete pad:

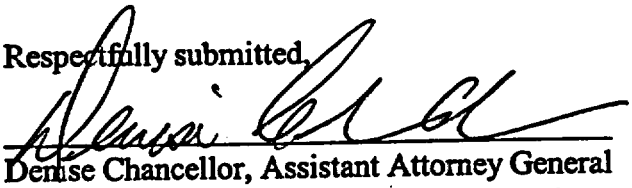
1. Bowels, Joseph E., *Foundation Analysis and Design*, Fourth edition, McGraw Hill Company, 1988.

2. Iguchi and Luco, *Dynamic response of Flexible Rectangular Foundations on an Elastic Halfspace*, Journal of Earthquake Engineering and Structural dynamics, 1981, Vol. 9.

The above described publications are readily available to the Applicant and will not be produced by the State.

DATED this 31st day of January, 2000.

Respectfully submitted,



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CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S OBJECTIONS AND RESPONSES TO APPLICANT'S FOURTH SET OF DISCOVERY REQUESTS TO INTERVENORS STATE OF UTAH AND CONFEDERATED TRIBES was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 31st day of January, 2000:

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