

RAS 4570

**Official Transcript of Proceedings**  
**NUCLEAR REGULATORY COMMISSION**

Title: Private Fuel Storage, LLC

Docket Number: 72-22-ISFSI; ASLBP No. 97-732-02-ISFSI

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UNITED STATES OF AMERICA  
 NUCLEAR REGULATORY COMMISSION

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

U. S. Nuclear Regulatory Commission  
 Utah State Capitol  
 Salt Lake City, Utah 84114

On April 26, 2002 the above-entitled matter came on for hearing, pursuant to notice, before:

MICHAEL C. FARRAR, CHAIRMAN  
 Administrative Judge  
 Atomic Safety & Licensing Board Panel

DR. JERRY R. KLINE  
 Administrative Judge  
 Atomic Safety & Licensing Board Panel

DR. PETER S. LAM  
 Administrative Judge  
 Atomic Safety & Licensing Board Panel

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## I N D E X

## E X A M I N A T I O N

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## E X H I B I T S

No.	MRKD/ADMTD
State's Exhibits 159-167 were admitted (Previously marked)	/5356
Staff's Exhibit F: Map of State of Utah	5402/5402

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1 April 26, 2002

9:00 a.m.

2

3

## P R O C E E D I N G S

4

5

JUDGE FARRAR: Good morning everyone.

6

We're here to resume the hearing on the State's

7

hydrology contention. It's a few minutes after

8

9:00 and the parties were conferring on some

9

matters, but we're now ready to start. Dr. Liang,

10

Mr. Lewis, you're still under oath.

11

MS. MARCO: Before we start, Staff wants

12

to raise a small housekeeping issue. Yesterday I

13

don't believe that the Board or the parties were

14

informed that we do have a witness unavailability

15

matter that if the proceeding extends beyond 2:00

16

p.m. on Saturday, our witness would be unavailable.

17

But having discussed this informally with counsel

18

for PFS and counsel for the State, that does not

19

appear to be an issue at this time.

20

JUDGE FARRAR: You think we will finish?

21

MS. MARCO: I don't know what's in the

22

cross-examination, but I understand that it would

23

finish by then.

24

JUDGE FARRAR: If we're not finished,

25

would the parties want to take that witness out of

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1 order?

2 JUDGE MARCO: That would have been my  
3 suggestion. I did suggest to have the PFS  
4 witnesses go after and put Mr. Kettle up now, but  
5 I've been told that they would prefer to stay in  
6 order and they think it can be done.

7 MR. NELSON: And if we need to do it by  
8 telephone, we perhaps could do it by telephone, I  
9 guess.

10 JUDGE FARRAR: Let's move along smartly  
11 and maybe we won't have to deal with that problem.  
12 Ms. Marco, if we do get to the point where you're  
13 concerned about that, please bring it up at the  
14 appropriate time. We'll see where we are and the  
15 Board will make a decision on whether we'll take  
16 the witness out of order.

17 MS. MARCO: Thank you.

18 JUDGE FARRAR: Thank you. Mr. Nelson.

19 MR. NELSON: Thank you. Just as a  
20 preliminary matter, I have spoken with Mr.  
21 Silberg -- I'm sorry, Cathy, I did not have a  
22 chance to talk to you -- but by stipulation I would  
23 move the admission of the Exhibits of the State 159  
24 through 167 that we handed to the Board at the  
25 previous session.

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1 JUDGE FARRAR: What about 158?

2 MR. NELSON: Oh, excuse me, 158 through  
3 167.

4 JUDGE FARRAR: All right. You have a  
5 stipulation with Mr. Silberg on that?

6 MR. SILBERG: Yes, sir.

7 JUDGE FARRAR: Ms. Marco?

8 MS. MARCO: Your Honor, if I recall, the  
9 last order of business or the last matter before  
10 was the Staff had an objection to the Standard  
11 Review Plan which is Exhibit 158. It came up in  
12 testimony not as the introduction of the Exhibit  
13 into evidence. Our reasoning is that it deals with  
14 radiological issues because it's part of the Staff  
15 Safety Review. I believe I read into evidence what  
16 the introductory part of it talked about. So  
17 therefore, the Staff would have an objection to the  
18 inclusion of Exhibit No. 158, but not for the rest.

19 JUDGE FARRAR: Then on this matter, Mr.  
20 Nelson, the same as I recall some of your  
21 witnesses' testimony, is this being introduced just  
22 as background --

23 MR. NELSON: It is. I understand --

24 JUDGE FARRAR: -- to deal with  
25 non-radiological matters? Is there something we

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1 can draw from this for non-radiological?

2 MR. NELSON: Our position is is that I  
3 understand the legal argument that this is not  
4 applicable, I think it is a legal argument. Our  
5 position is is that it is a document that is  
6 reflective of the review the Staff does in other  
7 areas and it could be used as evidence that  
8 potentially it is for nonradiologics a good idea to  
9 do the same kinds of things.

10 JUDGE FARRAR: All right. Let's then  
11 carry the motion with the case. It will be in  
12 front of us and then this is something you can  
13 brief in your post findings and conclusions --  
14 let's see what's done with it here. You can brief  
15 it in your proposed findings and conclusions as to  
16 whether we will eventually admit it into the case.

17 MS. MARCO: Okay. So you're not  
18 admitting it now?

19 JUDGE FARRAR: Not admitting it now. We  
20 will admit Exhibits 159 to 167. The motion to  
21 admit 158 will be carried with the case and we'll  
22 decide that later on as part of the -- after  
23 hearing further legal arguments from all of you and  
24 seeing how the testimony plays out.

25 MR. NELSON: Thank you.



1 JUDGE FARRAR: I do that rather than  
2 hear any lengthy arguments now while we're trying  
3 to deal with witnesses.

4 MS. MARCO: Thank you.

5 (STATE'S EXHIBITS 159-167 WERE ADMITTED.)

6 JUDGE FARRAR: Go ahead, Mr. Nelson.

7

8 CROSS-EXAMINATION (Resumed)

9 BY MR. NELSON:

10 Q. Mr. Lewis, good morning.

11 MR. LEWIS: Good morning.

12 Q. We discussed the collection sump in the  
13 canister building. We did not discuss the  
14 operation and maintenance building. Is there a  
15 floor drain or a sump in the operation and  
16 maintenance building?

17 MR. LEWIS: No, there is not. There are  
18 no, actually, floor drains anywhere on the site.

19 Q. What are the provisions for cleaning the  
20 operation and maintenance building?

21 MR. SILBERG: Excuse me. I assume you  
22 mean clean with respect to spills?

23 Q. (By Mr. Nelson) Spills, water on the  
24 floor, how will that be handled?

25 MR. LEWIS: I'm just only estimating,

1 but I would guess that we would probably clean  
2 those up, if you had spills from water, from snow  
3 or something like that, we would probably mop those  
4 up. If you had oil spills we would have to clean  
5 those up with absorbent materials and dry wipes,  
6 dispose of them in a solid container.

7 Q. I asked Dr. Liang about -- or Mr. Lewis,  
8 I asked you about Exhibit 165 and you indicated  
9 that you had not reviewed that information. I  
10 don't believe I asked Dr. Liang about that. Dr.  
11 Liang, if you could turn to page 14 of your  
12 prefiled testimony.

13 DR. LIANG: Page 14.

14 Q. Page 14. Answer to question 33, you  
15 say, "Geotechnical tests were performed on samples  
16 obtained from the borings at the PFSF site. The  
17 tests were conducted at the S&W Geotechnical  
18 Laboratory in Boston, Massachusetts, on 20 boxed  
19 split spoon jar samples and nine undisturbed tube  
20 samples from the Skull Valley site. The testing  
21 program performed analyses to determine water  
22 content." Did you review information from the  
23 soils testing program and borings on water content?

24 DR. LIANG: I look at the data, yes.  
25 The result of the data, yes.

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1 Q. Did you look specifically at Exhibit  
2 165, that page?

3 DR. LIANG: Yes.

4 Q. Can you tell me under the column on 165,  
5 Water Content, what those numbers mean?

6 DR. LIANG: That is the percent of the  
7 water, percentage of water contained in the sample.

8 Q. Is it a percent by weight or a percent  
9 by volume?

10 DR. LIANG: I read the whole report. It  
11 didn't indicate one way or the other. So I would  
12 say no, I don't know if it is by volume or by  
13 weight.

14 Q. For these kinds of soils it's probably  
15 about the same, isn't it, percentage by weight or  
16 percentage by volume?

17 DR. LIANG: I would say so.

18 Q. If you look at the results for C-1,  
19 which is -- I believe you indicated in the prefiled  
20 testimony was close to the detention pond, it shows  
21 46.7, 38.9 and 30.3. So that is the percent water  
22 content in the sample; is that correct?

23 DR. LIANG: Yes, in three different  
24 samples.

25 Q. In your review and in arriving at your

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1 conclusions with that kind of water content, would  
2 that affect your conclusion as to whether or not  
3 water would percolate down to the groundwater?

4 DR. LIANG: I do not using the water  
5 content to evaluate the percolation.

6 Q. The water content in the soils does not  
7 affect how fast it percolates?

8 MR. SILBERG: I'm sorry, you're  
9 referring to these particular soils or soils in  
10 general?

11 MR. NELSON: Yes, these soils under C-1.

12 MR. SILBERG: Thank you.

13 DR. LIANG: In theory, the water content  
14 will affect the movement of the water. In other  
15 words, permeability.

16 Q. (By Mr. Nelson) Mr. Lewis, we discussed  
17 the frost heave and plant root system with respect  
18 to maintaining a permeability of soils. We did not  
19 discuss a term called dessication cracks. Do you  
20 know what that term means?

21 MR. LEWIS: No.

22 Q. Can I refer you to page 4-12 of the  
23 Environmental Impact Statement?

24 MR. SILBERG: Is that included within  
25 Exhibit 161?

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1 MR. NELSON: It is. It's in 161, page  
2 4-12.

3 Q. (By Mr. Nelson) Looking at the third  
4 paragraph down it says, "Natural preferential  
5 seepage pathways could include buried dessication  
6 cracks in the subsurface soils and man-made  
7 pathways would include abandoned geotechnical  
8 borings beneath the site." You do not know what  
9 dessication cracks are that are being referred to  
10 there?

11 MR. LEWIS: No, I do not know the exact  
12 nature of what a dessication crack is. I could --

13 Q. Mr. Liang, Dr. Liang --

14 MR. SILBERG: Excuse me. I think Mr.  
15 Lewis was continuing his answer.

16 MR. LEWIS: I could make some  
17 assumptions, but it may not be correct.

18 Q. (By Mr. Nelson) Dr. Liang, do you know  
19 what a dessication crack is?

20 DR. LIANG: At first I didn't know the  
21 meaning, but I discuss with my soil engineer, he  
22 gave me definition of dessication. Is when the  
23 soil is dry there's a crack in the soil layer or  
24 soil texture.

25 Q. So if you have laid down, placed some

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1 soils and those soils have some moisture in it, as  
2 those soils dry out there's cracking. Is that a  
3 dessication crack?

4 DR. LIANG: That normally would happen  
5 on the clay or more final soil particle.

6 Q. So the soils that are being proposed for  
7 the detention pond I believe are silty clay clayey  
8 silts, aren't they?

9 DR. LIANG: I would believe so, yes.

10 Q. So there is the potential for  
11 dessication cracks in those soils?

12 DR. LIANG: If very dry. If the soil,  
13 water content in that soil very dry, it could crack  
14 as so-called dessication crack.

15 Q. The .09 inches per day --.

16 JUDGE FARRAR: Mr. Nelson, is this a new  
17 subject?

18 MR. NELSON: No, it goes along with the  
19 detention pond.

20 JUDGE FARRAR: New from dessication  
21 cracks?

22 MR. NELSON: Yes.

23 JUDGE FARRAR: I hate to interrupt  
24 you --

25 MR. NELSON: That's fine.

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1 JUDGE FARRAR: -- but when Mr. Nelson  
2 asked what a dessication crack was I thought I  
3 knew. How come neither of you gentlemen know?

4 DR. LIANG: I though I know. I say  
5 after discuss with my soil engineer I do understand  
6 what the dessication term means.

7 JUDGE FARRAR: I understood it without  
8 consulting with anybody and I'm only a lawyer. Mr.  
9 Lewis?

10 MR. LEWIS: Well, as I mentioned earlier  
11 in my testimony, I'm not a soils expert. There are  
12 some points of the soil that I did not understand  
13 the -- or was not familiar with the terminology. I  
14 am aware of natural cracks that occur in the soil.

15 JUDGE FARRAR: Go ahead.

16 Q. (By Mr. Nelson) You indicate that the  
17 permeability rate in the detention pond of .09  
18 inches per day was used to do the estimates on the  
19 water in the pond. That, as I recall, is about 54  
20 times less permeable than the .2 inches per hour  
21 that was used as the general statement for soils in  
22 the area; isn't that correct, Mr. Lewis?

23 MR. LEWIS: Yes, it is.

24 Q. And how is that type of permeability  
25 going to be achieved?

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1 MR. LEWIS: The .09?

2 Q. Yes.

3 MR. LEWIS: The .09 actually comes from  
4 the soil strata that was located 5 to 10 to 15 feet  
5 below in the area of the detention basin. It would  
6 not necessarily be the same as the soils that are  
7 directly on the surface, which would -- which are  
8 more generally described as the .2 to .6  
9 permeability.

10 Q. If you put that kind of permeability  
11 soil and expose it then to frost heave, to  
12 dessication cracks, to plant root systems with the  
13 wheat grass, aren't you going to increase  
14 significantly the permeability of that layer?

15 MR. LEWIS: I had a chance to look over  
16 the soil strata diagrams that we have put in our  
17 license application and there already exist natural  
18 cracking into those layers. And the review  
19 revealed that none of those cracks which are there  
20 now, which I would presume occur through the  
21 dessication cracks and through freeze/thaw cycles  
22 and stuff, none of them extend through the clay  
23 layers that would have made up the .09  
24 permeability.

25 Q. But if you bring those soils to the

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1 surface and subject them to the three types of  
2 effects that I just described, don't you change the  
3 permeability rate in those soils?

4 MR. LEWIS: Not necessarily. Those  
5 soils right now have all three of those; they have  
6 frost, they have plants with root systems that  
7 reach down through there, and there are dry soils.  
8 So I am sure they would experience the type of  
9 cracking due to the moisture leaving them.

10 Q. So you disagree with the statement on  
11 page 4-12 in the Environmental Impact Statement  
12 that says that, "If processes such as frost heave  
13 or vegetation root cause disruption of the  
14 compacted soil layer increasing its permeability,  
15 the seepage rate through the floor and side slopes  
16 could increase"?

17 MR. LEWIS: No, I agree with this  
18 statement because what they are saying here is that  
19 if these processes can reach down and disrupt that  
20 layer it could increase the permeability. But in  
21 fact, the soil diagrams that I reviewed revealed  
22 that none of those cracks, natural cracks were  
23 extending down through the clay layer, completely  
24 through the clay layer.

25 Q. You really don't know by looking at

1 those diagrams whether there is any dessication  
2 cracks that are deep in the ground, do you?

3 MR. LEWIS: Those diagrams actually show  
4 the cracks, yes.

5 Q. But you didn't know what a dessication  
6 crack was so how could you look for one on a --

7 MR. LEWIS: Because as we looked at  
8 those I recognized those as naturally occurring  
9 cracks. I did not know the term "dessication."

10 Q. A dessication crack can be hairline, can  
11 it not?

12 MR. LEWIS: I suppose.

13 Q. Mr. Lewis, on page 30 of your prefiled  
14 testimony -- well, wait. This might be one that I  
15 thought I had caught. It's on page 29. On page 29  
16 of your prefiled testimony you say that "Most of  
17 the relatively small volume of water impacting the  
18 cask storage area during a typical rainstorm will  
19 be absorbed into the 8-inch thick compacted gravel  
20 surface."

21 Are you aware of any studies that have  
22 been done -- as the result of your work in your  
23 professional capacity, are you aware of any studies  
24 that have been done within the last 10 years  
25 concerning the impact of a gravel cover on

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1 evaporation rates?

2 MR. LEWIS: No, I am not aware of those.  
3 But we did look at this particular example and we  
4 calculated that the compacted gravel, based on the  
5 gradation that we have, could absorb up to 66  
6 percent of the rain that would be falling onto it.  
7 So that indicates it could be over half of it,  
8 depending on the number of fines that are actually  
9 at the surface of the gravel.

10 Q. Did you look at what impact having the  
11 water go into the gravel might have on a change in  
12 the evaporation rate?

13 MR. LEWIS: At those depths under the  
14 soil it would not have much of effect on the  
15 evaporation.

16 MR. SILBERG: I'm sorry, could I just  
17 have -- you were answering a question about soil  
18 and I think the question was about gravel.

19 MR. NELSON: I'm talking about the  
20 8-inch gravel layer.

21 MR. SILBERG: I just want to make sure  
22 the question and the answer match up.

23 MR. LEWIS: The compacted gravel layer,  
24 it's highly compacted and the water that would fall  
25 on that from the rain is not expected to seep very

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1 far into the gravel. It would be very shallow.  
2 Most of -- or -- yeah, most of the water would  
3 probably be absorbed into the first inch or so and  
4 then the rest would run off to the edges into the  
5 ditches and down into the detention basin.

6 Q. (By Mr. Nelson) I believe I asked this  
7 question, but I just want to make sure because I  
8 didn't have a copy of the transcript back. Are  
9 either one of you familiar with the term "field  
10 capacity"?

11 MR. SILBERG: I don't think you asked  
12 the question.

13 Q. (By Mr. Nelson) Are either one of you  
14 familiar with the term "field capacity"?

15 MR. LEWIS: I'm not.

16 Q. Dr. Liang?

17 DR. LIANG: F-I-E-L-D, field capacity?

18 Q. Field capacity.

19 DR. LIANG: I'm not familiar with that  
20 term.

21 Q. Thank you.

22 If I could refer again to page 4-12 of  
23 the Environmental Impact Statement, the last  
24 sentence on the second to the last paragraph of the  
25 page, Mr. Lewis, the sentence reads, "The water

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1 quality of runoff that would enter the detention  
2 basin is expected to be similar to that from urban  
3 or industrial facilities in the region." Do you  
4 agree with that statement?

5 MR. LEWIS: Yes, I do.

6 Q. Dr. Liang, do you agree with that  
7 statement?

8 DR. LIANG: Yes.

9 Q. Mr. Lewis, if I could refer you to  
10 Exhibit 163, that's the Uniform Plumbing Code  
11 Training Manual, and refer you to page 485, in the  
12 first column on the left, the third sentence down,  
13 the sentence reads: "The UPC does not recognize  
14 evapotranspiration in sizing a disposal field or  
15 bed because conditions are hard to control." Do  
16 you agree with that sentence?

17 MR. LEWIS: Yeah. What they're saying  
18 here is that they want to be conservative in the  
19 design so they make the assumption that you  
20 wouldn't have any evapotranspiration so that you  
21 don't undersize your facility.

22 Q. I don't believe I have asked the  
23 question of the definition of evapotranspiration.  
24 The evaporation part of that relates to what's  
25 going into the air; is that correct?

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1 MR. LEWIS: Yes.

2 Q. And the transpiration part of that, what  
3 does that mean?

4 MR. LEWIS: That means it gets absorbed  
5 into the roots of plant systems and then it  
6 eventually gets evaporated out through the root  
7 leaves -- or through the plant leaves, excuse me.

8 Q. And in the graveled area there will be  
9 no transpiration; is that correct?

10 MR. LEWIS: Of the drain field?

11 Q. Of the water. No. The gravel, the  
12 8-inch graveled area in the 99-acre pad, there will  
13 be no transpiration in that area?

14 MR. LEWIS: That's correct, there are no  
15 plants there.

16 Q. Dr. Liang, if I could refer to page 18  
17 of your prefiled testimony, answer to question 43,  
18 first sentence: "Groundwater monitoring at the  
19 PFSF site is not necessary and would not provide  
20 any indication of contamination from the PFSF in  
21 any event." And then the last sentence of that  
22 answer says, "Monitoring the groundwater,  
23 therefore, would not provide any useful  
24 information."

25 Wouldn't it be useful information to

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1 know that there was no contamination coming from  
2 the site?

3 DR. LIANG: Base on my review the  
4 Exhibit reference, I have no knowledge any  
5 indication the reference saying there's any  
6 contamination in the groundwater under the Skull --  
7 the site, the Skull Valley groundwater.

8 Q. In your opinion, it wouldn't be prudent  
9 to know that there was no contamination?

10 MR. SILBERG: Objection, calls for a  
11 business decision. This is not a -- that's a  
12 business question, not an expert witness question.

13 MR. NELSON: I'm asking him based on his  
14 technical expertise if you could get useful  
15 information by knowing there was not contamination.

16 MR. SILBERG: And I believe that the  
17 witness answered the question saying that there was  
18 no contamination, no mechanism for contamination,  
19 therefore, no reason to get additional information  
20 that showed zero.

21 JUDGE FARRAR: The objection is  
22 overruled. The witness can answer.

23 DR. LIANG: I have review all available  
24 information regarding the water quality --  
25 groundwater water quality of the Skull Valley. I

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1 have not found any indication there's any  
2 contamination or anything in that. But all general  
3 water quality of the groundwater already available  
4 to me for my purpose. So I don't think there's any  
5 useful information for that special site.

6 Q. (By Mr. Lewis) Mr. Lewis, you talked  
7 about the sheen test for the sumps and for the  
8 detention pond. Is there any sampling proposed for  
9 the septic tank contents?

10 MR. LEWIS: No, not at this time. It's  
11 not expected that there would be any contaminants  
12 in those.

13 Q. Would it be difficult to sample the  
14 septic tank?

15 MR. LEWIS: No, not necessarily.

16 Q. You could access it through the top of  
17 the tank even though it's buried in the ground?

18 MR. LEWIS: That is correct. And  
19 periodically you're required to remove the solids  
20 in the septic tank about every five to seven years.

21 Q. Mr. Lewis, do you know of any reference  
22 in the Environmental Impact Statement or the  
23 Environmental Report to the proposal to do the  
24 sheen test on the detention pond or on the sump?

25 MR. LEWIS: Right now in the

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1 Environmental Report all that is stated in there is  
2 to ensure that we do sampling tests for radioactive  
3 materials.

4 MR. NELSON: I have no other questions.

5 JUDGE FARRAR: We have some questions of  
6 the witnesses. I think I heard you say there are  
7 no floor drains whatsoever anywhere in this entire  
8 facility?

9 MR. LEWIS: Yeah, that's correct. In  
10 the -- yeah, there are no floor drains.

11 JUDGE FARRAR: So there's no way any  
12 indoor spill on the floor can get to the ground?

13 MR. LEWIS: Through the septic system,  
14 that's correct.

15 JUDGE FARRAR: There are no drains --  
16 there are no floor drains, at least there are no  
17 floor drains going anywhere, they're not going to  
18 the septic system, they're not going anywhere? Any  
19 indoor spill on the floor of that building or  
20 facility would be mopped up?

21 MR. LEWIS: That's correct, there are no  
22 floor drains in any of the facilities to the septic  
23 system or otherwise.

24 JUDGE FARRAR: The next question draws  
25 upon what you may or may not know are limited

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1 appearance statements where members of the public  
2 show up, not at the evidentiary hearing, and raise  
3 concerns about the facility. Those concerns are  
4 not evidence, but they're something that the  
5 parties can listen to and ask questions about. We  
6 have one question based on that.

7 A gentleman named Rex Allen, who is a  
8 member of the Skull Valley Band, and I believe his  
9 name is on the contract, raised a concern about  
10 environmental conditions generally on the  
11 reservation, not having to do with this facility,  
12 but expressed the concern that the Band was not  
13 doing a good job on routine environmental issues  
14 affecting the reservation and expressed a  
15 conclusion that because they couldn't handle the  
16 routine problems, they couldn't handle -- might not  
17 be building to handle the problems connected with  
18 this facility.

19 Is there anything about this facility  
20 from a hydrological standpoint that you're aware of  
21 that would require members of the Band to take any  
22 particular action to make sure there was not a  
23 problem or do you view that your system you've  
24 designed would be independent of any -- would  
25 function independently of any Band action?

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1 MR. LEWIS: The site, the facility is  
2 independent of the Band. And in addition, any  
3 actions that needed to be taken would be taken by  
4 personnel at the site rather than any of the Band  
5 members.

6 MR. SILBERG: Just a clarification.  
7 When you say independent of any Band members, that  
8 would of course exclude any Band members who were  
9 working at the site?

10 MR. LEWIS: Yes, that's correct. If  
11 they were employees it would be different.

12 (The Board conferred off the record.)

13 JUDGE FARRAR: Let me ask one final  
14 question to -- there's both a question to you  
15 gentlemen and a clarification of the Board's role  
16 in case there was any confusion the other night at  
17 the end of the 12 hours. We've always viewed our  
18 role, and it's confirmed by the Appendix to Part 2  
19 to some degree, that we're expected to use our  
20 expert knowledge and experience in evaluating and  
21 drawing conclusions from the evidence that's in the  
22 record. We take that a step further and think  
23 we're supposed to use that experience and  
24 background in asking questions of the members.

25 Back when I was on the Appeal Board I

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1 always thought that there was a concern that a  
2 licensing board member might bring his or her  
3 expertise in writing a decision. A witness would  
4 say one thing, another witness would say another  
5 thing, and the danger was the licensing board would  
6 say, Well, I know the answer. Our role up here I  
7 think is never to know the answers in advance, but  
8 to try to know the questions.

9 So when we asked the other night and I  
10 indicated I had an opinion, that was in that  
11 context that I, in my background and experience  
12 have formed some impressions, and rather than bring  
13 them to the writing of the opinion I would rather  
14 ask you, "Are those, in your estimation, valid  
15 opinions," and then we will ask all the witnesses  
16 and then we'll have a record of your testimony and  
17 not our testimony. So it was in that context that  
18 I said I had opinions. I might better have said  
19 impressions.

20 Mr. Silberg, that's no criticism of you.  
21 If you or any lawyer ever hears anything that you  
22 think involves possible prejudgment on our part, I  
23 encourage you to bring that to our attention. So  
24 against that background this is going to be a long  
25 question, a long background to the question, the

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1 question will be whether there are any steps  
2 dealing with hydrology that you think would result,  
3 could possibly result in an improved environmental  
4 situation.

5 Let me tell you why I ask that question.  
6 We denied summary -- we granted summary disposition  
7 on the radiological issues on the grounds that the  
8 Applicant had this almost fail-safe system; start  
9 clean, stay clean, had taken unusual steps to make  
10 sure that accidents didn't happen. We reached the  
11 opposite conclusion based on Mr. Ostler's Affidavit  
12 that you weren't in a similar situation with  
13 respect to nonradiological.

14 Reading Mr. Ostler's testimony you can  
15 draw from it, and I think he says as much several  
16 times, it leaves you with the impression that he  
17 thinks the company is behind the curve in terms of  
18 advanced thinking about environmental issues. In  
19 my experience, I've worked with 150 general  
20 managers of facilities within a company and found  
21 that many of them thought it was far better. Think  
22 solvents. There were solvents that were legal to  
23 use and legal to dispose of that might come back to  
24 haunt you if the rules later changed or if you're a  
25 person, your disposal agent did something wrong

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1 with them. So many people thought it was better to  
2 avoid the problem entirely.

3 That a Center for Strategic and  
4 International Studies working on the enterprise and  
5 the environment project that came in contact with  
6 the environmental directors of 10 or so of the  
7 leading companies in the country and they had that  
8 same approach; avoid problems, kind of like you're  
9 doing with the radiological issues. With that  
10 background, and given what Mr. Ostler is going to  
11 testify to, are there any measures in this not  
12 being proposed, not being undertaken that could be  
13 undertaken to avoid possible environmental  
14 contamination down the road and any charges that  
15 you're a bad neighbor?

16 MR. SILBERG: Could I just have a  
17 clarification? When you say "any measures that  
18 could be taken," are you talking about any measures  
19 or any reasonable measures? Clearly there are  
20 measures that could be taken.

21 JUDGE FARRAR: Well, before you testify,  
22 I'll answer your question. You can deal with it in  
23 terms of any measures and then you can tell me why  
24 those measures would make no sense, that they're  
25 just so farfetched that they wouldn't make sense.

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1 But--

2 MR. SILBERG: Excuse me, Mr. Chairman,  
3 just a minute.

4 (Off the record.)

5 MR. SILBERG: If the Chairman wishes to  
6 get the PFS position on those kinds of business  
7 decision questions, I would ask leave of the Board  
8 that we could put on Mr. Donnell now or later, who  
9 is the project director, who I think is in a  
10 position to give you those answers.

11 JUDGE FARRAR: The reason I was asking  
12 of these witnesses is they were the only people  
13 scheduled to be in front of us. Let's do this.  
14 Let's ask them from an environmental standpoint if  
15 there are any measures or any reasonable measures,  
16 and depending on their answer, then if Mr. Donnell  
17 would like to take the stand and explain why those  
18 are not being taken, we would be happy to hear  
19 about it.

20 MR. SILBERG: Is your question any  
21 reasonable measures or any measures?

22 JUDGE FARRAR: Let's let the witnesses  
23 answer and we will all explore that.

24 MR. SILBERG: Well, I think it's  
25 important, though. If it's any measures I think --

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1 JUDGE FARRAR: They may say there's no  
2 measures then we --

3 MR. SILBERG: Well, I can postulate that  
4 I can line the site with stainless steel and weld  
5 it. That would be a measure. It is certainly  
6 theoretically possible to do that. Is that what  
7 any sensible person suggest that? No. That's why  
8 I suggested the reasonableness aspect to your  
9 question.

10 JUDGE FARRAR: Let's say any measures  
11 that are the state-of-the-art in the corporate  
12 environmental community, recognizing that for  
13 purposes of these questions this is essentially I  
14 think you've said an industrial facility like any  
15 other industrial facility, maybe dealing with spent  
16 fuel casks and there are radiological concerns at  
17 least for hydrological reasons that have been dealt  
18 with. But any measures that are within the  
19 accepted state-of-the-art in the corporate  
20 environmental community.

21 MR. LEWIS: To the contrary, I believe  
22 that many state-of-the-art provisions have been  
23 made in and above what typically would occur on an  
24 industrial facility similar to this. The site has  
25 employed the use of double-wall tanks versus dikes



1 which are more state-of-the-art because it prevents  
2 any diesel fuel from any chance of reaching the  
3 environment. A dike doesn't.

4 JUDGE FARRAR: Now, the dikes you're  
5 talking about are when you have a single-walled  
6 above-ground tank?

7 MR. LEWIS: Right.

8 JUDGE FARRAR: And then you have this  
9 cinder block, cinder block or earthen berm?

10 MR. LEWIS: Earthen berm.

11 JUDGE FARRAR: And with the double wall  
12 ones you eliminate the dike, but your opinion is  
13 that the double-walled ones are better than the  
14 single wall and the dike?

15 MR. LEWIS: Right. Because they prevent  
16 any chance from that diesel fuel from even someone  
17 stepping in it or something like that. But a  
18 single-wall tank with a dike is clearly acceptable.  
19 So we have gone above and beyond there.

20 The absence of any floor drains in the  
21 building is typically not employed, but we have  
22 gone to that extra effort to ensure that we won't  
23 have contamination that could inadvertently reach  
24 the sewage system. We have actually employed  
25 special areas for storage of materials to ensure

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1 that that stays away from the other side of the  
2 building where there might be restroom facilities  
3 or something to that nature.

4 And even though it's an industrial  
5 facility, unlike a typical industrial facility, it  
6 is more like a nuclear facility in the fact that  
7 there are strict training and procedural  
8 requirements that help employees be aware of spills  
9 to ensure that they avoid spills. We've used  
10 absorbent mats under the filling area. That's  
11 above and beyond. The training and the procedures  
12 I don't believe would be typically used at just --  
13 at most, say, truck transfer operations in the city  
14 here of Salt Lake City. So clearly we're above and  
15 beyond what would be used in industrial facilities  
16 there. So I think there are a lot of provisions  
17 that we have made that are better.

18 JUDGE FARRAR: Dr. Liang, do you share  
19 those sentiments?

20 DR. LIANG: Yeah. In addition to that,  
21 because I have been an environmental engineer for  
22 many years and serving in that capacity in my  
23 company I have been in nuclear facility, nuclear  
24 power plant and also the environmental program and  
25 I have seen this one is no different, much

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1 different. But all the, from my perspective  
2 hydrology point of view, the most important measure  
3 like erosion and sediment control is a very  
4 important thing in this facility. We have -- that  
5 plan will be implemented.

6 Another thing is, the most important  
7 environmental pollution control is control the  
8 source. And this project is almost have very nice  
9 procedure to control that kinds of things  
10 happening. Like Dr. Lewis just mentioned, that  
11 kind of measure. I think these environmental  
12 control program, so-called, the best managing  
13 program has been very nice for this kind industry  
14 facility based on my experience on other projects.

15 JUDGE FARRAR: All right. How about the  
16 absence of any special liner in the detention pond,  
17 would that be routine? Is the situation you  
18 propose routine for stormwater detention at other  
19 industrial facilities?

20 DR. LIANG: Base on the soil condition  
21 we understand, I think the detention pond with our  
22 lining is very adequate to my point of view.

23 JUDGE FARRAR: How does it compare with  
24 other similar facilities, are they --

25 DR. LIANG: Similar --

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1 JUDGE FARRAR: Are they lining their  
2 detention ponds?

3 DR. LIANG: I don't believe unless you  
4 have a hazard waste site.

5 JUDGE FARRAR: Mr. Lewis?

6 MR. LEWIS: Yeah, I would agree with  
7 that. And in addition, because of the soils that  
8 happen to be where our detention basin is going to  
9 be at, it almost has a natural clay liner which is  
10 not required, nor typically used in a similar type  
11 of site.

12 JUDGE FARRAR: You'll remember, or maybe  
13 you won't remember the other night I asked you to  
14 assume that someone would flush something down the  
15 toilet. And I think Mr. Ostler's Affidavit  
16 suggested accidents happen, and we know that  
17 employees, no matter how well you train them, for  
18 whatever reason, they're anxious to get home, they  
19 forgot your training, they're under financial  
20 pressures not to spend too much money and somebody  
21 flushes something down.

22 Can you refresh me on your answer to  
23 that, how you deal with that or whether in the  
24 context of what we're asking about this morning,  
25 are there any other measures you could take to

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1 prevent that situation?

2 MR. LEWIS: Well, first let me answer  
3 something you had in your question or -- yes, in  
4 your question in regards to financial influences.  
5 Typically on nuclear sites which are regulated by  
6 the NRC financial matters are not to be considered.  
7 And from my experience working on nuclear plants  
8 are a rarity ever considered. Typically  
9 regulations are the governing factor.

10 In regards to -- it is possible that  
11 someone could inadvertently do that, you know,  
12 someone could intentionally do that and it is hard  
13 to prevent that other than to -- in training to  
14 ensure then, as most nuclear facilities do, that if  
15 you intentionally do something like that it will  
16 cost you your job. But we have designed  
17 provisions. The areas that we work on are on the  
18 opposite side of the building as the restroom  
19 facilities. Storage areas are right next to where  
20 they would be working.

21 You mentioned I think the other night  
22 the use of solvents. Typically solvents, from my  
23 experience, I worked for my father for several  
24 years in a service type -- where we did mechanic  
25 work and then when I was in college I worked at a

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1 auto mechanic facility. Parts, engine solvents are  
2 always contained in a barrel that has an integral  
3 sink attachment and has a recirculation system such  
4 that you never have to worry about pulling it out  
5 of storage or taking it over and dumping the stuff  
6 out. It's just self-contained and when it gets  
7 dirty enough then you call the company and have  
8 them come out and bring out a new one.

9 JUDGE FARRAR: Some of those companies  
10 have developed, let me use the word less harsh for  
11 lack of a better word, less hazardous solvents than  
12 used to be in common usage?

13 MR. LEWIS: That is correct. They might  
14 be more biodegradable and they are also less  
15 harmful to the personnel that are using them.

16 JUDGE FARRAR: Has your plan gone so far  
17 as to prescribe what solvents will be employed or  
18 are we way ahead of ourselves at this point?

19 MR. LEWIS: Yeah, not at this time. But  
20 you can see these type of solvent containers in any  
21 service station around town. And so I can't  
22 imagine that we wouldn't do what is -- we can do  
23 something similar to that. It would be to our  
24 advantage to use that.

25 JUDGE FARRAR: Dr. Liang, anything to

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1 add on?

2 DR. LIANG: No, I am not.

3 JUDGE FARRAR: Mr. Nelson, if you want  
4 to, you're free to follow-up on any of these  
5 questions and answers.

6 JUDGE LAM: Before you do, Mr. Nelson,  
7 let me ask the witnesses a couple of questions.  
8 Good morning, Dr. Liang, good morning, Mr. Lewis.

9 DR. LIANG: Good morning.

10 JUDGE LAM: When I read your prefiled  
11 testimony I came across with two slightly different  
12 perceptions. On the one hand, both of you testify  
13 in your answer to question 78 and 80 that there are  
14 no opportunity and no impact on groundwater.  
15 Specifically the last sentence in answer 78, both  
16 of you stated, in part, "Also am sure there is no  
17 opportunity for any inevitable contamination to  
18 spread to groundwater."

19 And similarly in the last sentence in  
20 your answer 80, the last sentence, "There will be  
21 no impact on either surface or groundwater from the  
22 sanitary waste system." Now, that's one perception  
23 I have.

24 When I read your conclusion, I refer you  
25 to page 36, answer 83, I see you are saying, "The

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1 facility will have no significant impact on the  
2 groundwater." Now, there is a difference in my  
3 mind as to absolutely no way, relative to well,  
4 there may be some, but it would be trivial. Which  
5 position are you taking in this proceeding,  
6 gentlemen?

7 MR. LEWIS: Based on my studies of this  
8 particular facility, I'm inclined to say that there  
9 would be no impact to the groundwater. Precisely  
10 because the groundwater is at such a depth that  
11 even if there were minute amounts of contamination  
12 that were emptied into, for example, the detention  
13 pond, they would quickly and easily be filtered out  
14 by the ground. In particular, petrochemicals such  
15 as diesel fuel, tend not to soak very far into the  
16 ground and they tend to vaporize very quickly, and  
17 what is left, the residue tends to get stuck to the  
18 upper surfaces of the ground. Any heavy chemicals  
19 tend to, what we call adsorb into particularly clay  
20 soils. So I cannot imagine how any of that would  
21 trickle through 125 feet or 120 feet of ground  
22 clear down to the groundwater.

23 DR. LIANG: My point of view of this  
24 somehow a little bit, say, in one area we say most  
25 impact. The other reason, we are having some

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1 routine operation construction there will no  
2 impact. However, in dealing with certainly  
3 accidentally, we may have some insignificant impact  
4 on that area. That's what I going to make the  
5 clarification here because routinely we have those  
6 so-called control episodes, a best managing  
7 practice, but sometimes accident may happen, but we  
8 have some measure to control that that kind of big  
9 accident happen, if happen, it may have some  
10 insignificant impact on that environment.

11 JUDGE LAM: Okay, thank you.

12 JUDGE KLINE: Just one question  
13 concerning your view that there's no groundwater  
14 recharge from the surface in the Skull Valley. I  
15 would like you to, when you consider that answer, I  
16 would like you to consider it in the light of  
17 distinguishing between natural groundwater recharge  
18 from natural precipitation and the kind of  
19 groundwater recharge we would likely -- not  
20 groundwater recharge, the saturated flow conditions  
21 that we would likely get from a more or less  
22 continuous input of water from the sanitary drain  
23 field four feet or so below the surface.

24 Now, I understand your view that natural  
25 rainfall does not reach the groundwater because of

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1 the evapotranspiration. But with the subsurface  
2 injection of water, and I understand the water  
3 might partition and some of it move up and some of  
4 it move down, but isn't there more or less a  
5 continuous saturated flow downward from that  
6 subsurface injection, even understanding that there  
7 is some evaporation and evapotranspiration?

8 MR. LEWIS: You actually get downward  
9 flow out of the drain field kind of in a cone  
10 direction, but because you have very low permeable  
11 clays there, the moisture is going to tend to  
12 travel horizontal outward from the drain field.

13 Now, in regards to our questioning the  
14 other night, I had a chance to take a look at that.  
15 And based on the amount of evaporation, you know,  
16 you would have water that's going into the ground,  
17 and I know it sounds like other a year you're going  
18 to have a huge amount of quantity. But I decided  
19 to figure out what's the balance between all the  
20 moisture going into the ground versus what gets  
21 evaporated, and it turns out that it only takes a  
22 quarter of an acre to evaporate all that moisture  
23 out if you consider the evaporation rates on an  
24 annual basis. That's not very much, about 104 feet  
25 square. So even though it sounds like over the

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1 course of a year you're dumping a lot of water in  
2 there, you're actually evaporating out a lot of  
3 water as well.

4 JUDGE KLINE: Okay. You had an Exhibit  
5 showing, and I've forgotten -- oh, yeah, Exhibit  
6 165, showing a number of borings with a natural  
7 water content and the water fairly deep in the soil  
8 column. Have you got any idea how that water got  
9 there? That is, these columns are 10 or 11 or so  
10 feet deep. Why is the moisture -- why is the  
11 subsurface at 10 feet moist?

12 MR. LEWIS: All I can give you --

13 JUDGE LAM: More than moist.

14 JUDGE KLINE: More than moist. It's  
15 substantial water, yes.

16 MR. LEWIS: I would have to confer with  
17 our soil experts on it, but my presumption is that  
18 all this moisture would be due to rainwater. These  
19 moisture contents may not necessarily be that high  
20 for soil that we have to talk to a soil expert on.

21 JUDGE KLINE: Since you've said it, I'll  
22 admit it's my understanding too, that it's probably  
23 rainwater, ancient rainwater, perhaps, but it does  
24 indicate that there's some kind of hydrological  
25 connection between the surface and the subsurface.

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1 If evapotranspiration really took care of all the  
2 water then the whole column would be dry the whole  
3 way down, wouldn't it?

4 MR. LEWIS: Well, yeah. But keep in  
5 mind that rain adds moisture to the ground, and the  
6 ground, when you have fine granular and  
7 particularly clay and silty soils, it tends to hold  
8 that soil in suspension which you would discover  
9 whenever you took a sample. That moisture gets  
10 evaporated out. But in the meantime it does rain  
11 again, doesn't it? And so there's more moisture  
12 added and that moisture will eventually get  
13 evaporated out.

14 JUDGE KLINE: All right. So this is  
15 just sort of a steady state position?

16 MR. LEWIS: Right. It's not as if the  
17 soil all of a sudden becomes absolutely zero  
18 moisture.

19 JUDGE KLINE: Okay. Thank you.

20 JUDGE FARRAR: Mr. Nelson, if you want  
21 to follow-up on any of the Board's questions,  
22 you're welcome to.

23 Q. (By Mr. Nelson) Just a couple of  
24 follow-up questions. You were asked by Judge  
25 Farrar concerning lining in the detention pond.

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1       Isn't it true that the determination of the types  
2       of permeability and liners for detention ponds is  
3       based on the kind of facility that you have and the  
4       potential for what the runoff would be?

5               MR. LEWIS: That's correct.

6               Q.       And you, both you and Mr. Liang, I  
7       believe, indicated in previous testimony that you  
8       have, neither one of you, been involved in  
9       designing and building a detention pond.

10              MR. LEWIS: I am not the one that  
11       particularly does the detailed design of the  
12       detention pond. However, that does not mean that I  
13       have not had input to the design of the detention  
14       pond. I am the one who performed the calculations  
15       to see how long the water would stand in the  
16       detention pond.

17              Q.       No, I'm sorry. You haven't -- your  
18       previous experience has not been in designing  
19       detention ponds; is that correct? You haven't done  
20       work on detention ponds or stormwater ponds?

21              MR. LEWIS: We have civil engineers that  
22       work in our group that have designed several  
23       detention ponds, but I have not.

24              Q.       Dr. Liang, did I understand your  
25       testimony correctly that that's not your area of

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1 expertise?

2 DR. LIANG: Yes. But again, like Mr.  
3 Lewis saying, in our company we have expertise  
4 engineer in that area. And when under certain  
5 engineer leadership, like Mr. Lewis saying, that if  
6 something come up with that we will review it and  
7 technical adequacy and so on. But within our  
8 company we have a team of expertise which  
9 specialize in the detention pond, in civil engineer  
10 group and so on. And then when a engineer assigned  
11 this project he will review that before they, you  
12 know, submit to the design, so on.

13 Q. You indicated the absence of floor  
14 drains. Isn't it true that in a normal operation  
15 and maintenance facility there is a floor drain  
16 that drains to a specific container. You then are  
17 collecting the waste and can manage the waste  
18 better than if you didn't have a floor drain?

19 MR. LEWIS: If you had operations where  
20 you were draining oil on a continuous daily basis,  
21 such as a oil change facility, that might be the  
22 case. But we will not be doing that. Any oil  
23 leaks would be minimal leaks that could occur  
24 underneath the vehicle and would be much easier to  
25 clean those up with dry rags than it would be to

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1 have to chase it down through a sump system.

2 Q. Doesn't it increase the likelihood of  
3 inappropriate material being disposed of if you  
4 don't have a specific receptacle to contain that?

5 MR. LEWIS: Again, it all depends on the  
6 quantities of the material that you're handling.  
7 If you were handling hundreds of gallons per week  
8 that might be the case. But if you have an oil  
9 spill, even if you spilled the entire contents out  
10 of an engine, four quarts, four to five quarts or a  
11 gallon's worth, that would be much easier to handle  
12 with just some dry rags.

13 Q. You've indicated that when water goes  
14 down it travels horizontally and vertically in the  
15 same soil. If you have water in the same soil, the  
16 same permeability on both sides, doesn't gravity  
17 cause that water, it's the extra factor to cause  
18 that water to go down as opposed to go to the side?

19 MR. LEWIS: Actually, in fine grain  
20 soils the capillary action is likely to draw it  
21 more in either direction, either downward or  
22 horizontally, than necessarily gravity. Gravity  
23 does have an effect and everything in terms of  
24 where that water is going is related to forces on  
25 it.

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1 Q. Going down you have not only capillary  
2 action going down but you have gravity going down,  
3 whereas, going up all you have is capillary action?

4 MR. LEWIS: Well, you might have a  
5 little bit of what I would call wicking action that  
6 occurring in any direction around the soil and you  
7 have some that is gravity and you have wicking  
8 action to the surface. But you also have  
9 evaporation because when you get evaporation of the  
10 surface of the ground, what happens is it creates  
11 basically a low pressure area across the top of the  
12 soil, a suction, if you will. And I had a chance  
13 to look over some of my textbook material and that  
14 suction can actually occur downwards towards 25  
15 feet under the ground. And it can become a major  
16 force that draws the water to the surface of the  
17 ground.

18 Q. So based on that we shouldn't have a  
19 problem with any septic drain field in the State of  
20 Utah with water going down?

21 MR. LEWIS: I would suspect that a lot  
22 of the moisture from septic systems in the State of  
23 Utah probably does rise to the surface. But again,  
24 it depends on where the groundwater is in  
25 relationship to the bottom of the septic system.

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1 If you've got groundwater that's three feet away,  
2 there is a very good likelihood that some of that  
3 water will make it to the groundwater.

4 MR. NELSON: That's all I have.

5 JUDGE FARRAR: Mr. Silberg, any  
6 redirect?

7 MR. SILBERG: Yes. We have a  
8 considerable amount of redirect. What I would like  
9 to propose, however, because of the conflict, the  
10 Staff witness conflicts, we would be willing to  
11 postpone that and put the Staff witnesses on to  
12 make sure they can get in and out.

13 MS. MARCO: Staff would be very  
14 appreciative of that.

15 JUDGE FARRAR: Mr. Nelson, recognizing  
16 that we're not a jury and can kind of sort things  
17 out ourselves, we would expect -- now if this is a  
18 problem for you, let us know -- but we would expect  
19 to extend the same courtesy to any of the parties  
20 if they had a problem.

21 MR. NELSON: That means we would go  
22 ahead with Mr. Ketelle?

23 MS. MARCO: We'll go ahead with Mr.  
24 Ketelle at this time, yes.

25 MR. NELSON: That would be fine.

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1 JUDGE FARRAR: All right. Then we will  
2 -- and Mr. Nelson, we appreciate that. And again,  
3 if you or any of your colleagues have a similar  
4 situation, let us know. Then we'll excuse these  
5 witnesses temporarily. You'll have another chance  
6 to sit there. Let's get the witness sworn in.  
7 Let's get you sworn in and then we'll take a break.

8 MS. MARCO: All right. Let me -- in the  
9 meantime I'll pass these out.

10 JUDGE FARRAR: Sir, would you stand and  
11 raise your right hand.

12

13

RICHARD H. KETELLE,

14

15

called as a witness, by and on behalf of the  
Staff, being first duly sworn by Judge Farrar, was  
examined and testified as follows:

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JUDGE FARRAR: Thank you. Ms. Marco has  
been handing out the testimony and some Staff  
exhibits. Let's get those marked. Ms. Marco, tell  
us what to do and then we'll take a break.

22

23

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(A break was taken.)

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## DIRECT EXAMINATION

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BY MS. MARCO:

Q. Will you please state your name for the record.

A. Richard Ketelle.

Q. And I have placed a document in front of you. Do you recognize it?

A. Yes, I do.

Q. Will you please identify it.

A. This is my Staff testimony on the Contention Utah O on hydrology.

Q. And attached to that document is there listed a statement of your professional qualifications?

A. Yes, there is.

Q. And is that your statement of professional qualifications?

A. Yes, it is.

Q. Do you have any changes, additions or corrections to make to either of those two documents?

A. I have some changes to make to my prefiled testimony. I will go through them now. On page 7 of this prefiled testimony on the first full paragraph, first line, we wish to insert the

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1 word "clearly" after only. "PFS has indicated that  
2 the only clearly identified hazardous materials."

3 MR. NELSON: Excuse me. Could you state  
4 that one more time for me?

5 THE WITNESS: On page 7, the first full  
6 paragraph, the first sentence, "PFS has indicated  
7 that the only clearly identified hazardous  
8 materials that will be used."

9 JUDGE FARRAR: Now, that's already  
10 indicated on the copies?

11 MS. MARCO: Yes. All of the changes  
12 that Mr. Ketelle is addressing at this time have  
13 been indicated in the document I have just  
14 distributed to the parties.

15 MR. KETELLE: On page 8 of the last  
16 sentence in the first full paragraph currently  
17 reads: "Further, as described above, PFS will  
18 implement a BMP plan." We wish to replace BMP plan  
19 with "operating procedures."

20 On page 11, answer number 15, there's a  
21 typographical error. The word to by is run  
22 together. We wish to correct that.

23 Q. (By Ms. Marco) Did you have any further  
24 corrections?

25 A. Yes. There was one other clarification

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1 or change we need to make in the prefiled  
2 testimony. It's on page 14, answer A21. Down  
3 toward the upper third of that paragraph, where the  
4 seepage velocity is entered as 3 feet per day, that  
5 should be 3 millimeters per day. This also is a  
6 correction that applies to the seepage velocity  
7 rate as printed in Chapter 3 of the FEIS.

8 MR. NELSON: Excuse me. Was that 3  
9 millimeters or 3 meters?

10 MR. KETELLE: 3 millimeters per day.

11 Q. (By Ms. Marco) And with these changes,  
12 does this represent your prefiled testimony?

13 A. Yes, it does.

14 Q. And is it true and accurate to the best  
15 of your knowledge and information?

16 A. Yes, it is.

17 MS. MARCO: And with these changes I  
18 would ask that the prefiled testimony of Richard  
19 Ketelle be entered into the record bound as if  
20 read.

21 JUDGE FARRAR: Any objection?

22 MR. SILBERG: No, sir.

23 MR. NELSON: No objection.

24 JUDGE FARRAR: Then it will be bound in  
25 as if read.

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(Prefiled testimony of Richard H. Ketelle  
follows:)

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-ISFSI  
 )  
(Independent Spent )  
Fuel Storage Installation) )

NRC STAFF TESTIMONY OF RICHARD H. KETELLE  
CONCERNING CONTENTION UTAH O (HYDROLOGY)

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Richard H. Ketelle. I am employed as a subsurface contamination specialist, with the Bechtel Jacobs Company, LLC in Oak Ridge, Tennessee. I am providing this testimony under a technical assistance contract between the staff of the Nuclear Regulatory Commission ("NRC Staff" or "Staff") and Oak Ridge National Laboratory ("ORNL"). A statement of my professional qualifications is attached hereto.

Q2. Please summarize your education and experience related to subsurface hydrology.

A2. I hold Bachelor of Science and Master of Science degrees in Geology from the University of Tennessee in Knoxville. I have worked in the field of subsurface hydrology since 1979 and have wide-ranging experience in site assessment and groundwater contamination investigations. In 1993 and 1994, I served as the Technical Lead for groundwater activities for ORNL's Environmental Restoration Program. I performed hydrogeologic analyses for several remedial action projects at ORNL, which culminated in construction of groundwater collection and treatment facilities. I worked with advanced groundwater models for use in risk assessment analyses for site remediation at ORNL. In 1995 and 1996, I served as the Groundwater Coordinator for the ORNL site. From 1996 to 2000, I provided oversight of groundwater monitoring.

activities for ORNL. I also served as the technical lead for the Remedial Investigation Report preparation for the Melton Valley Watershed in Tennessee and assisted in the preparation of the Melton Valley Proposed Plan and Record of Decision.

Q3. Please describe your current responsibilities.

A3. I am currently responsible for the Water Quality Program at the ORNL site, including planning and overseeing surface water and groundwater monitoring for the Environmental Monitoring Program at ORNL. I provide technical support to remediation projects and procurement teams for the ORNL site. In addition, I provide technical assistance to ORNL's Research Reactors Division on the release of tritium, cobalt, and europium-contaminated process wastewater to groundwater at ORNL's High Flux Isotope Reactor site.

Q4. Please explain what your duties have been in connection with the NRC Staff's review of the application filed by Private Fuel Storage, L.L.C. ("PFS" or "Applicant") for a license to construct and operate an Independent Spent Fuel Storage Installation ("ISFSI") on the Reservation of the Skull Valley Band of Goshute Indians, geographically located within Skull Valley, Utah (the "proposed PFS Facility").

A4. As part of my official responsibilities, I assisted the NRC Staff in its evaluation of the potential environmental impacts related to the Applicant's construction and operation of the proposed PFS Facility. My specific role was to conduct an evaluation of potential impacts to water resources due to construction and operation of that facility. Further, I assisted in preparation of the Staff's "Draft Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Facility on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah," NUREG-1714, issued in June 2000 ("DEIS"). I also assisted in preparation of the Staff's "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 in Tooele County, Utah," NUREG-1714, issued in December 2001 ("FEIS"). In addition, I assisted the NRC Staff in preparing the "NRC Staff's Response to Applicant's Motion for Summary Disposition of Utah Contention O -- Hydrology," dated July 19, 2001.

Q5. What is the purpose of this testimony?

A5. The purpose of this testimony is to provide the NRC Staff's views concerning Contention Utah O, specifically regarding: (1) non-radiological contaminant pathways from the Applicant's sewer/wastewater system, routine facility operations, and construction activities; (2) non-radiological contaminant pathways from the Applicant's retention pond; (3) the potential for non-radiological groundwater and surface water contamination; and (4) the potential for groundwater contamination to impact downgradient water users.

Q6. Are you familiar with Contention Utah O?

A6. Yes. I understand that Contention Utah O, as admitted by the Licensing Board in LBP-98-7 and modified in LBP-99-6 and LBP-99-39, states as follows:

The Applicant has failed to adequately assess the health, safety, and environmental effects from the construction, operation and decommissioning of the ISFSI as required by 10 C.F.R. §§ 72.24(d), 72.100(b), and 72.108, with respect to the following contaminant sources, pathways, and impacts:

1. Contaminant pathways from the Applicant's sewer/wastewater system; routine facility operations; and construction activities.
2. Contaminant pathways from the Applicant's retention pond in that:
  - a. The ER fails to discuss potential for overflow and therefore fails to comply with 10 C.F.R. Part 51.
  - b. ER is deficient because it contains no information concerning effluent characteristics and environmental impacts associated with seepage from the pond in

violation of 10 C.F.R. § 51.45(b) and § 72.126(c) & (d).

3. Potential for groundwater and surface water contamination.
4. The effects of Applicant's water usage on other well users and on the aquifer.
5. Impact of potential groundwater contamination on downgradient hydrological resources.

In addition, I understand that certain portions of these issues (*i.e.*, water usage impacts and radiological contamination) have been resolved by the Licensing Board's decision in LBP-01-40.

Q7. Has the Staff conducted an evaluation of the potential impacts to hydrologic resources (*i.e.*, groundwater and surface water) resulting from the construction and operation of the proposed PFS Facility?

A7. Yes. The Staff's evaluation of these matters is set forth in various sections of the FEIS issued in December 2001. In particular, the impacts of the proposed PFS Facility on hydrological resources in and around the proposed Skull Valley site are discussed in FEIS §§ 3.2.2, 4.2.1, 4.2.2, 6.1.2, and 9.4.2.

Q8. Has the Staff reached a conclusion as to the potential impacts that may result from construction and operation of the PFS Facility on hydrologic resources?

A8. Yes. As set forth in sections 3.2, 4.2, 6.1.2, and 9.4.2 of the FEIS, the Staff has evaluated the potential impacts due to construction, operation and decommissioning of the PFSF on hydrological resources in Skull Valley, and has determined that any such impacts will be small.

Q9. What information did the Staff consider in conducting this evaluation?

A9. The Staff considered the information contained in the Applicant's Environmental Report ("ER"), which addressed the environmental impacts of the proposed PFS Facility, as well as the Applicant's responses to Staff requests for additional information, and the Applicant's Safety Analysis Report ("SAR").

I. **Basis 1: Contaminant Pathways: Sewer/Wastewater System, Operations, and Construction Activities.**

Q10. Do you agree with the State of Utah's assertion in Basis 1 of Contention Utah O, that inadequate consideration has been given to the health, safety, and environmental effects with respect to contaminant pathways from the Applicant's sewer/wastewater system, routine facility operations, and construction activities?

A10. No.

Q11. Please explain the basis for your conclusion in this regard.

A11. This conclusion is supported by the following considerations, with respect to the Applicant's septic systems, operations, and construction activities.

**Septic Systems.**

With respect to the Applicant's septic systems, section 4.2.2.4 (at page 4-12 to 4-13) of the FEIS addresses the potential impacts to groundwater resources from the Applicant's two proposed septic systems. One of the proposed septic systems would serve the Administration and Operation and Maintenance Buildings and the other would serve the Canister Transfer Building and Health Physics Building. Both systems are designed to use 130m<sup>2</sup> leach fields.

The FEIS includes an assessment of the ability of the site soils to accept the septic system effluent volume. Based on soil characteristics information available in the Applicant's site characterization data, the near-surface soils will prevent rapid percolation of effluent to the groundwater. The fine-grained soils are expected to allow slow seepage of effluent during which many of the constituents will adhere to soil particles because of chemical interactions between the effluent and soil. Annual rainfall at the site is less than 12 inches and annual potential evapotranspiration in the Skull Valley area is 27 – 30 inches (Utah Water Atlas) (<http://www.engineering.usu.edu/uwrl/atlas/ch3/index.html>). See Utah Water Atlas for potential evapotranspiration in Skull Valley (Staff Exhibit F). Because evapotranspiration exceeds site

rainfall, it is likely that much of the water in the effluent will be transpired to the atmosphere by plant growth. Therefore, on an annual average basis the amount of water from the leach fields that will reach the groundwater table is small.

The estimated rate of application of water to the leach fields would be much lower than the estimated soil percolation rate. Therefore, as stated in FEIS Section 4.2.2.4, the leach fields are likely to be able to accept the anticipated water volumes while preventing direct discharge into the groundwater. The FEIS recognizes (Section 4.2.2.4) that improper functioning of a septic system could occur if natural or man-made preferential seepage pathways exist within the seepage field area. In such a case, there could be rapid percolation of incompletely treated septic water downward toward to the groundwater table. However, no such pathways have been identified to date. Further, PFS has committed to register the septic fields with the Environmental Protection Agency, as stated in § 4.2.2.4 of the FEIS. Thus, seepage of incompletely treated septic water into the groundwater does not appear to warrant concern.

#### Operations.

With respect to the facility's routine operations, which include operation of the septic systems, the only liquid effluents that would be generated at the facility are stormwater runoff that would be directed to the detention basin and the natural drainage system, and domestic wastes that would be fed into the facility's septic system.

PFS has provided certain design features that serve to reduce the potential for contamination of surface and ground water by hazardous materials. For example, sections 2.1.3 (page 2-28) and 4.2.2.4 (pages 4-13 to 4-14) of the FEIS describe the drain sumps proposed for use in the Canister Transfer Building. As stated therein, the drain sumps would not be connected with the on-site septic systems, thus eliminating these areas as potential sources of contamination. Similarly, hazardous materials will be stored in a manner that reduces the potential for

contamination. Further, PFS has committed to prepare and implement a Best Management Practices ("BMP") Plan as described in FEIS Section 9.4.2 ("Mitigation Measures"). The BMP Plan would address spills or accidental releases during facility construction and operation.

PFS has indicated that the only <sup>clearly</sup> identified hazardous materials that will be used or stored on site during facility operation are lubricating oils and diesel fuel. Diesel fuel will be stored in aboveground tanks and enclosed in secondary tanks to limit the potential for leakage. PFS has committed to placing absorbent materials under nozzles during refueling to minimize accidental spilling of diesel fuel and to ensure rapid and effective remediation of the affected environment in the event of a diesel fuel spill. Lubricating oils will be stored in sealed metal drums in designated operating and maintenance buildings. There will only be limited quantities of cleaning solvents, painting products, pesticides and herbicides on site during facility operation.

A contaminant released into the shallow soils must pass through approximately 20 feet of fine-grained soil near the surface, and then percolate through approximately 100 feet of fine sand to reach the groundwater. Stormwater runoff from the facility may infiltrate in shallow soils or flow into the detention basin. In the event that runoff from cask storage pads and onsite transportation areas or vehicle parking areas carries small amounts of oil or grease, such constituents are expected to adhere to soil particles and biodegrade. In the event soluble metals are present, it is expected that chemical adsorption to the soil particle surfaces will significantly retard their movement in the soil. It is very likely that water in the shallow soils, including that which infiltrates in drainage courses, will be returned to the atmosphere through evapotranspiration before reaching the groundwater table.

On the basis that (a) the soils appear to have the capability of receiving the effluent volume, (b) the soils are of a texture that will attenuate many dissolved constituents, and (c) the depth to

groundwater is more than 100 feet, the Staff concludes that the potential for adverse groundwater impacts is small.

With respect to potential contamination of the sanitary waste system, facility design elements and procedures will be used to prevent spills of oil, antifreeze, or other chemicals from entering the sanitary waste leach field system. While it is possible for small quantities of non-hazardous chemicals to be introduced into the wastewater treatment, as discussed in FEIS section 4.2.2.4, the Applicant has not identified any unique substances of a hazardous or regulated nature that would be introduced into the septic system that would not be expected in a sanitary wastewater stream. In addition, certain of the chemicals that might be introduced into the septic system would be subject to biological decomposition, which would minimize the potential for adverse impacts to groundwater via the wastewater treatment systems. Further, as described above, PFS will implement a <sup>operating procedures</sup> BMP plan which will provide further assurance that hazardous material is not introduced in the septic system.

The Applicant has identified the hazardous and non-hazardous chemicals and materials that would be located onsite during facility operations. During facility operations, PFS has committed to place hazardous materials in sealed and properly labeled containers stored in designated areas, thereby limiting the potential introduction of such materials into the sanitary waste system. PFS has further committed to develop and implement procedures to ensure that personnel comply with and properly implement all applicable rules and regulations governing the use, storage and handling of hazardous materials. Further, during facility operation, PFS has committed to policies and procedures ensuring that all rules and regulations governing the use and storage of hazardous substances are properly implemented.

In sum, the potential for non-radiological contamination is very low due to (a) the lack of significant sources of contamination on site, (b) the Applicant's commitment to implement and

follow procedures to prevent or minimize contamination and ensure compliance with applicable rules and regulations, and (c) the presence of design features that will help control and minimize any potential contamination. The combination of facility design considerations and the implementation of procedures limiting the potential for introduction of hazardous materials into the sewer/wastewater system or the contamination of surface and ground water makes the likelihood of contamination very low.

#### Construction Activities

With respect to the Applicant's construction activities, the FEIS discusses the potential impacts of construction activities on surface water quality and groundwater quality. Section 4.2.1.1 of the FEIS addresses the specific impacts to surface water quality from spills of such chemicals as petroleum hydrocarbon fuels. Section 4.2.1.3 of the FEIS presents a similar discussion on the potential for spills to impact groundwater quality. As stated in the FEIS, the Staff has concluded that impacts to either the surface water flow system or to the groundwater quality in Skull Valley would be small as a result of construction of the facility.

As discussed above and in FEIS Section 9.4.2 ("Mitigation Measures"), PFS has committed to prepare and implement a Best Management Practices ("BMP") Plan during construction and operation of the facility. The BMP Plan would address spills or accidental releases during facility construction and operation and to maintain unobstructed flow through culverts to minimize upstream ponding where PFS access corridors cross ephemeral drainage channels. These measures are designed to prevent unacceptable environmental consequences during facility construction. Given the low annual precipitation at the site (estimated to be less than 12 inches per year), the absence of nearby downgradient surface water bodies, the weak connection between the land surface and the local groundwater system because of the low permeability of the site soils,

and the high evapotranspiration at the site, the Staff has concluded there is a very low likelihood that PFS site construction activities will lead to contamination of surface or groundwater.

Q12. The State asserts that an analysis must be conducted to determine whether a connection exists between the surface and an underlying aquifer. Do you believe this presents a valid concern?

A12. No. The Applicant characterized the material properties of the soil profile and determined the hydraulic conductivity of the aquifer (saturated zone) beneath the site through performance of a pump test, as discussed in section 3.2.2 (page 3-13) of the FEIS. This provides an acceptable basis for determining the potential for any contamination from the facility to affect the aquifer.

The Applicant performed soil tests of a geotechnical nature, which confirmed the presence of an approximately 20-foot layer of fine-grained soils (silty clays and clayey silts) located within the top 25-30 feet below surface, overlying fine sand that contains the ground water table, which is located at a depth of approximately 125 feet beneath the site. The natural moisture content of soils in this layer of fine-grained soils was low relative to saturated moisture contents. As stated in section 4.5.6 of the Applicant's ER and in section 3.2.2. of the FEIS, the result of the pump test indicated the aquifer beneath the site has a hydraulic conductivity of approximately  $5 \times 10^{-5}$  cm/sec.

The presence of fine-grained soils in this approximately 20-foot layer protects the underlying groundwater from rapid infiltration of water or other spills at the land surface. The presence of these fine-grained soils, combined with low annual rainfall (less than 12 inches) and an excess of potential evapotranspiration (27-30 inches), creates a setting in which movement of moisture from the surface soils to the groundwater, shown to lie 125 feet below ground surface, is slow.

Q13. Does the Applicant's analysis provide an adequate basis to determine the potential for the aquifer to be contaminated by construction and operation of the proposed PFS Facility?



A13. Yes. The site soil and groundwater characteristics data provided by the Applicant show that there is a substantial buffer between the facilities that would be constructed and operated at the land surface and the groundwater beneath the site. The Applicant's analysis of the site confirmed that groundwater beneath the proposed site has a low vulnerability for being contaminated. Factors that minimize the potential for contamination of the groundwater include the types of soils that exist within about 25-30 feet of the surface, the depth to groundwater beneath the site, low annual rainfall, and the high potential evapotranspiration of the area. Further, the Applicant tested the aquifer permeability at the site, which was found to be moderately low, meaning that groundwater seepage velocities beneath the site are low.

II. Basis 2: Contaminant Pathways - Retention Pond

Q14. Do you agree with the State of Utah's assertion in Basis 2(a) of the contention, that the Applicant's ER or the Staff's FEIS fail to adequately consider the health, safety, and environmental effects of the proposed PFS Facility, with respect to contaminant pathways from the Applicant's retention pond, in that the ER or FEIS fails to discuss potential overflow?

A14. No.

Q15. Please explain the basis for your conclusion in this regard.

A15. The potential for contamination from the retention pond (also referred to <sup>to by</sup> by PFS as the "detention pond") has been considered in both the ER and the FEIS. As stated in section 4.2.4 of the Applicant's ER, in the unlikely event that overflow of the retention pond is imminent, temporary pumps would be used to drain the basin. Such action would prevent erosion of the embankments to prevent uncontrolled release. The Staff has concluded that the potential for contamination from retention pond effluent is low. The detention pond is designed as a seepage basin capable of containing all site runoff from a storm up to a 100-year precipitation event. Theoretically, overflow could occur as a result of a storm greater than the 100-year event or if

multiple, less severe storms occur in rapid succession. However, as described above, facility design and operating procedures will make release of contamination into the detention pond unlikely. Further, PFS has committed to sample the water in the detention pond after significant storm events and prior to release of water from the detention pond. If contamination is detected, the pond water will be removed for offsite treatment and/or disposal, thus limiting the possibility of release of contaminated water via surface flow. Therefore, runoff from the retention pond is very unlikely to result in contamination of surface or groundwater.

Q16. Do you agree with the State of Utah's assertion in Basis 2(b) of the contention, that the Applicant's ER or the Staff's FEIS failed to adequately assess the health, safety, and environmental effects of the proposed PFS Facility, with respect to contaminant pathways from the Applicant's retention pond, in that the ER or FEIS contains no information concerning effluent characteristics and environmental impacts associated with seepage from the pond?

A16. No.

Q17. Please explain the basis for your conclusion in this regard.

A17. Although the Applicant did not provide a wastewater profile for the pad area or other paved surface runoff, it is assumed that this water would be similar to parking lot runoff from an concrete parking lot that receives light traffic. During the storage pad loading phase approximately 150 (100 - 200) fuel storage casks per year will be moved from the Cask Loading Facility to positions on the storage pads (FEIS page 2-19) . This rate of pad loading indicates less than one trip per day for pad loading. Ancillary operational activities on the site, such as storage area inspections and site maintenance, would also contribute to the presence of people and vehicles. Based on the expected low use levels there would be little if any dissolved material of concern. In addition, contaminant attenuation processes in the near-surface soils, such as adsorption of dissolved metals and retention of petroleum hydrocarbons accompanied by degradation by soil

microbes, are expected to prevent impacts to groundwater from small amounts of oil, grease, or dissolved metals, should they be present.

**III. Basis 3: Potential for Groundwater and Surface Water Contamination.**

Q18. Do you agree with the State of Utah's assertion in Basis 3 of this contention, that the FEIS failed to adequately assess the health, safety, and environmental effects with respect to the potential for groundwater and surface water contamination?

A18. No.

Q19. Please explain the basis for your conclusion in this regard.

A19. The potential for contamination of surface water or groundwater is discussed in the FEIS, in sections 3.2, 4.2, 6.1.2, and 9.4.2. As set forth therein, the Staff has concluded that the potential for groundwater and surface water contamination from the proposed PFS Facility is very low. This conclusion is based upon the following considerations. First, there are no perennial surface water sources within five miles downgradient of the PFSF site. The proposed PFS site is not in close proximity to any other channel, in that the nearest intermittent stream is located approximately 1,500 feet northeast of the site. Second, the wastewater treatment system and the detention pond are the two site components with any significant potential to release contaminants into the surface water or groundwater at the site of the proposed PFS Facility. Facility design features and operating procedures limit the potential release of contaminants into the wastewater treatment system or the detention pond, thus significantly reducing the potential for those areas to contaminate the groundwater or surface water. Third, the low annual precipitation and weak hydrologic link between land surface and water table, limit the ability of the wastewater treatment system and/or retention pond to contaminate the groundwater or surface water. Thus, the lack of significant contaminant sources, coupled with the absence of nearby surface water features, low

annual precipitation, and the weak hydrologic linkage between the land surface and the groundwater table, makes the likelihood of surface water or groundwater contamination very low.

**IV. Basis 5: Impact of Potential Groundwater Contamination on Downgradient Hydrological Resources.**

Q20. Do you agree with the State of Utah's assertion in Basis 5 of this contention that the Applicant's ER or the Staff's FEIS failed to adequately assess the health, safety, and environmental effects of the proposed PFS Facility with respect to the impact of potential groundwater contamination on downgradient hydrological resources?

A20. No.

Q21. Please explain the basis for your conclusion in this regard.

A21. As stated in the discussion above and in sections 3.2, 4.2, 6.1.2, and 9.4.2 of the FEIS, no significant contamination of groundwater or surface water resources as a result of the construction and operation of the proposed PFS Facility. Further, as discussed above and in section 4.2 of the FEIS, contaminants are unlikely to travel through the soil column from the land surface to the groundwater zone. In this regard, section 3.2.2 of the FEIS (page 3-13) includes an estimate of groundwater seepage velocity of approximately <sup>3 mm</sup> 3 feet per day based on available data. The nearest downgradient springs shown on the map are approximately 11 miles north of the proposed site. In the unlikely event that contamination from the proposed PFS Facility were to reach the groundwater table, the travel time for seepage to the closest spring would be decades for any contaminant that is not subject to attenuation in the soil. Further, other factors, such as the contaminant attenuation process in soil, mineral materials in the groundwater zone, dilution, and dispersion processes in the groundwater flow system, would reduce concentrations along the flow path by orders of magnitude. As a result of these considerations, any potential groundwater contamination resulting from the construction and operation of the proposed PFS Facility is unlikely to have impact on downgradient hydrological resources.

Similarly, the closest downgradient, off-reservation well to the PFSF site is estimated to be approximately 9,500 feet away. Construction and operation of the PFSF is unlikely to have a significant adverse impact on water quality in offsite wells because groundwater beneath or near the facility is not expected to be significantly impacted.

**CONCLUSION**

Q22. What is your overall conclusion with respect to the health, safety and environmental effects regarding the contaminant sources, pathways and impacts described in Contention Utah O?

A22. For the reasons discussed above and in the FEIS, there is a very low likelihood that activities associated with construction and operation of the proposed PFS Facility (including operation of the facility sewer/wastewater system) will result in any significant contamination or groundwater or surface water, or will have any significant hydrologic impact. As stated in sections 4.2 and 6.1.2 of the FEIS, the impacts of the facility on surface water quality and groundwater quality are expected to be small. Accordingly, it is my conclusion that the concerns raised in Contention Utah O have been addressed satisfactorily.

Q23. Does this conclude your testimony?

A23. Yes.

1 Q. (By Ms. Marco) Attached to your  
2 prefiled testimony and statement of professional  
3 qualifications, is there a Staff Exhibit?

4 A. Yes, there is. It's Staff Exhibit F.

5 Q. Will you please describe what Staff  
6 Exhibit F is?

7 A. Staff Exhibit F is a map of the State of  
8 Utah showing the potential evapotranspiration  
9 indexes throughout the state. This Exhibit was  
10 modified from the original prefiled information by  
11 improving the resolution of colors on the figure  
12 and adding a location symbol for the PFS site.

13 MS. MARCO: And with this I would like  
14 to have staff Exhibit F entered into the record at  
15 this time.

16 JUDGE FARRAR: We'll have to have the  
17 court reporter mark it for identification first.  
18 Then after that's done would there be any objection  
19 to it being admitted?

20 MR. SILBERG: We have no objection.

21 MR. NELSON: No objection.

22 JUDGE FARRAR: Then the document will be  
23 marked by the reporter and admitted.

24 (STAFF EXHIBIT-F MARKED AND ADMITTED.)

25 JUDGE FARRAR: Mr. Ketelle, before we

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1 take our break, where on page 313 of the FEIS  
2 should we make that same change?

3 THE WITNESS: Sorry, I don't have a copy  
4 in front of me.

5 JUDGE FARRAR: Then why don't we do that  
6 during the break, I'll ask you that, and then we'll  
7 start right up with your cross-examination on  
8 return. It's 10:25. Is ten minutes enough or do  
9 people want 15?

10 MS. MARCO: That's fine.

11 JUDGE FARRAR: Ten minutes, we'll be  
12 back at 25 of.

13 (Recess taken.)

14 JUDGE FARRAR: Mr. Ketelle, you've been  
15 sworn and you were going to tell us on page 313.

16 THE WITNESS: That is correct. In the  
17 third paragraph about halfway down where you see  
18  $1.2 \times 10^{-6}$  centimeters per second?

19 JUDGE FARRAR: Right.

20 THE WITNESS: Inside parentheses should  
21 be 1.04 millimeters per day. MM instead of one M.  
22 In the next line in parentheses it should be 3.5 MM  
23 per day.

24 JUDGE FARRAR: All right. Thank you.  
25 With that, Mr. Silberg, you would do your cross.

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1 MR. SILBERG: Yes. Mr. Rosinski will  
2 be doing our cross-examination of this witness as  
3 soon as he catches his breath.

4 JUDGE FARRAR: All right.

5

6 CROSS EXAMINATION

7 BY MR. ROSINSKI:

8 Q. Good morning, Doctor. How are you?

9 A. Good morning.

10 Q. I just have a few questions for you. Do  
11 you agree that the -- that adequate information is  
12 available to characterize the PFS site for  
13 potential environmental protection purposes?

14 A. I believe that the information that PFS  
15 provided in the ER and the SAR and in response to  
16 additional information requests has been adequate  
17 to fairly evaluate the potential environmental  
18 impacts at the site.

19 Q. In your opinion, were the PFS analyses  
20 appropriate for design purposes?

21 A. My role in the project really has not  
22 been design of the facility and I'm not a facility  
23 designer, per se. So I'm not sure that my answer  
24 to that would be of much value to you.

25 Q. As far as or to the extent of your role

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1 as an environmental expert related to hydrology, do  
2 you have an opinion as it relates to that position  
3 of whether the design information that you're aware  
4 of is adequate?

5 A. Yes. I believe in general it is.

6 Q. Regarding the correction of the 3 feet  
7 to 3 millimeter groundwater flow value, could you  
8 tell us who brought that to your attention?

9 A. That was brought to my attention this  
10 morning by one of your staff.

11 Q. Thank you. Does this correction change  
12 your conclusions in your prefiled testimony at  
13 answer 21 which states that "Any potential  
14 groundwater contamination resulting from  
15 construction operation of the proposed PFS facility  
16 is unlikely to have impact on downgradient  
17 hydrological resources"?

18 A. No, that would not change that  
19 conclusion at all.

20 Q. Would this correction in any way change  
21 your conclusion in answer 22 of your prefiled  
22 testimony that there is a very low likelihood that  
23 activities associated with the construction and  
24 operation of the proposed PFS facility, including  
25 operation of the facility sewer wastewater system

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1 will result in any significant contamination or  
2 groundwater or surface water or will have any  
3 significant hydrologic impact?

4 A. No, it would not change that conclusion.

5 Q. Do you know of any reason why the PFS  
6 site should be required to implement  
7 nonradiological contamination control requirements  
8 beyond those typically required of facilities with  
9 similar types and quantities of potentially  
10 nonradiological contaminants?

11 A. No.

12 Q. Do you agree that PFS plans, procedures  
13 and designs, as far as you are aware of, are  
14 appropriate for the potential environmental hazard  
15 posed by the PFS facility?

16 A. I believe that the utilization of plans  
17 and procedures as the first line of control of  
18 hazardous materials is the appropriate way to  
19 manage those materials. I have not seen any  
20 specific plans or procedures for review, so I can't  
21 comment further.

22 MR. ROSINSKI: Thank you. I have  
23 nothing further.

24 JUDGE FARRAR: Mr. Nelson, you may begin  
25 your cross.

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## CROSS-EXAMINATION

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BY MR. NELSON:

Q. Mr. Ketelle, your background is a geologist; is that correct?

A. That's correct.

Q. Are you familiar with the specific rules and requirements dealing with septic tank drain fields?

A. I reviewed the Utah website concerning septic tank rules. However, I don't consider myself to be an expert in septic tank rules.

Q. You don't have engineering training or installation training for those kinds of facilities?

A. No, I do not have specific septic tank installation training or experience.

Q. Is that also true with the detention ponds and lagoons and those kinds of engineered facilities?

A. I do not know the design requirements for detention ponds.

Q. Have you had experience in -- you don't have any engineering experience with detention ponds or stormwater ponds?

A. No. I have hydrogeologic experience

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1 with them.

2 Q. You indicated in your resume that you  
3 have been involved with an ORNL project?

4 A. Right.

5 Q. And that has involved groundwater  
6 monitoring?

7 A. That's correct.

8 Q. Did that involve groundwater monitoring  
9 for nonradiologics?

10 A. Yes, it does.

11 Q. Both radiologics and nonradiologics?

12 A. That's correct.

13 Q. You were here, I'm hoping, for the  
14 testimony of Dr. Liang and Mr. Lewis?

15 A. I was here.

16 Q. So you were available to see the  
17 description of the facilities and the chart that we  
18 put up, and it's your understanding that that was a  
19 general accurate description of the facility?

20 A. Yes.

21 Q. You're familiar with where the  
22 wastewater detention pond was or the stormwater  
23 detention pond?

24 A. Yes, I am.

25 Q. And you're familiar with the locations

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1 of the septic tank drain fields?

2 A. As proposed at the present time.

3 Q. You were also present in the description  
4 of the types of potential contaminants that are on  
5 site, a description of the cement batch plant, the  
6 laboratory waste chemicals that are common to this  
7 kind of a facility; paint, wastes, those kinds of  
8 materials, you heard about those?

9 A. Yes, I did.

10 Q. Do you agree that because of the nature  
11 of this facility that there is a potential  
12 cumulative effect of small releases and that  
13 potential effect has the possibility of  
14 contaminating groundwater?

15 A. I believe that there is a possibility of  
16 an accumulation of small releases from the facility  
17 to the soil column. I do not necessarily agree  
18 about the significance of impact to groundwater  
19 from that because I believe that the site soil  
20 column has a good attenuation capacity for most of  
21 the contaminants that I'm aware would be on the  
22 site.

23 Q. Have you done any calculation on  
24 quantities or soil attenuation abilities over a  
25 40-year period for this kind of accumulation?

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1 A. Not for this project.

2 Q. Mr. Ketelle, you've been involved with  
3 other groundwater clean-ups?

4 A. Yes, I have.

5 Q. It's difficult to clean up groundwater,  
6 isn't it?

7 A. In most cases it is.

8 Q. Why is that the case?

9 A. Well, in many situations the nature of  
10 groundwater contaminant is that you have adsorption  
11 of some of the contaminants into the soil or the  
12 formation materials of the aquifer, and it's a long  
13 pumping process to remove the contaminants from the  
14 adsorbed aquifer materials.

15 Q. Because as you pump some of the adsorbed  
16 materials continue to release into the water?

17 A. That's correct.

18 Q. Isn't it true that the sooner you become  
19 aware of possible contamination the better off you  
20 are in groundwater clean-ups?

21 A. Yes. Obviously, early warning is the  
22 best defense against spread of contamination. And  
23 with respect to this project, I believe that the  
24 early warning that would be provided by the  
25 Applicant's spill response plan or procedures would

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1 be the first line of preventing contamination of  
2 the soil column.

3 Q. With respect to amounts of contaminant  
4 in the water, isn't it true that parts per million  
5 and parts per billion are the kinds of measurements  
6 that are used to define contamination in the  
7 groundwater?

8 A. That's correct.

9 Q. So sometimes if you have even very  
10 small, small amounts, parts per billion, it can  
11 present an issue where you may need to do some  
12 clean-ups?

13 A. That's true.

14 Q. When you design facilities, you take  
15 every measure you can to prevent groundwater  
16 contamination because of the difficulty of  
17 clean-up; isn't that true?

18 A. That's correct.

19 Q. And notwithstanding those efforts, in  
20 your experience generally, notwithstanding those  
21 efforts, sometimes it just doesn't work and you get  
22 contamination?

23 A. There can be circumstances that allow  
24 contamination to occur despite the best plans.

25 Q. Would you agree that the wastewater

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1 treatment system and detention pond at the PFS  
2 facility are the two site components with a  
3 significant potential to release contaminants into  
4 the groundwater?

5 A. I would agree that of the facilities  
6 that are proposed on the site, those are the two  
7 that pose a potential to provide recharge to  
8 groundwater.

9 Q. If I could refer you to page 5 of your  
10 prefiled testimony, you indicate there that at the  
11 bottom of the page, "The fine-grained soils are  
12 expected to allow slow seepage of effluent during  
13 which many of the constituents will adhere to soil  
14 particles because of the chemical interactions  
15 between the effluent and the soil."

16 Isn't it true that you would need to do  
17 some soil testing to find out exactly how that  
18 process would happen, depending on the types of  
19 soils and the types of chemicals that you had that  
20 were involved?

21 A. To quantify the magnitude of that effect  
22 you would have to do site specific testing.

23 Q. On page 6 of your prefiled testimony, in  
24 the first full paragraph you are discussing the  
25 leach fields and indicate that, starting down in

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1 the middle of the paragraph there it says, "In such  
2 a case, there could be rapid percolation of  
3 incompletely treated septic water downward toward  
4 to the groundwater table. However, no such  
5 pathways have been identified to date. Further,  
6 PFS has committed to register the septic tanks with  
7 the EPA" --

8 MR. SILBERG: You mean septic fields?

9 Q. (By Mr. Nelson) Excuse me, "septic  
10 fields with the Environmental Protection Agency, as  
11 stated in Section 4.2.2.4 of the FEIS. Thus,  
12 seepage of incompletely treated septic water into  
13 the groundwater does not appear to warrant  
14 concern."

15 How does registering the septic tank  
16 fields affect whether or not that kind of  
17 circumstance exists?

18 MS. MARCO: Objection. I believe that  
19 the entire paragraph has to be taken into context  
20 to make that -- to pose that question regarding the  
21 conclusion with respect to it.

22 Q. (By Mr. Nelson) Would you look at the  
23 entire paragraph, then, and explain to me what  
24 relationship the registering has to your  
25 conclusion.

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1           A.       The registration does not have any  
2 direct tie to the conclusion of the paragraph.

3           Q.       Let's see. Do we have a set of the  
4 Exhibits that the State -- a separate set? Did I  
5 give one to you, Cathy, that you could --

6           MS. MARCO: I have one, but I don't  
7 believe the witness has one. Maybe PFS has one  
8 extra, Mr. Nelson.

9           MR. NELSON: Yes. Could we borrow those  
10 for a minute? Thank you.

11          JUDGE FARRAR: Mr. Nelson, these are the  
12 same ones you cross-examined the other witnesses  
13 on?

14          MR. NELSON: Yes. The same one you  
15 admitted except for that one.

16          Q.       (By Mr. Nelson) If I could refer you to  
17 Exhibit 165, based on your experience as a  
18 geologist --

19          MS. MARCO: Just a minute. Do you have  
20 it?

21          MR. KETELLE: Yes.

22          Q.       (By Mr. Nelson) Based on your  
23 experience as a geologist you have seen core  
24 samplings and tables such as this before?

25          A.       Yes, I have.

1 Q. And you see the water content table that  
2 is listed there?

3 A. I do.

4 Q. Do you know if that would be percent by  
5 weight or percent by volume?

6 A. My assumption would it would be percent  
7 by weight because that's a standard medical  
8 moisture content test result units for soil  
9 analyses.

10 Q. And there is a conversion factor to  
11 percent by volume. Would you guess that in this  
12 particular case it might be about the same?

13 A. Well, I would guess that it may be  
14 close. I would also guess that with the plastic --  
15 plasticity index of these soils there's a fair clay  
16 content.

17 Q. Does moisture affect the capillary  
18 potential?

19 A. Yes, it does.

20 Q. Isn't it true that if you have a very  
21 dry circumstance that the capillary action would go  
22 up?

23 A. That's true.

24 Q. If you would have a percentage moisture  
25 content for a clay, silty clay soil, if you had 30

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1 percent, that would significantly affect the  
2 capillary action, wouldn't it, going up?

3 A. That's one arbitrary moisture content  
4 picked out of a potential range so I don't know  
5 that 30 percent would mean much for a particular  
6 soil or not. It depends on the possible range of  
7 moisture content for that soil.

8 Q. Isn't it true that as the percentage of  
9 moisture goes up, the capillary action decreases  
10 exponentially?

11 A. It decreases according to a curve that's  
12 specific to each soil type and it does usually  
13 appear to be exponential.

14 Q. Do you know what the term "field  
15 capacity" means?

16 A. Yes, I do.

17 Q. Would you explain that, please.

18 A. Field capacity is the amount of water  
19 that would be left in a soil sample after it was  
20 allowed to gravity drain. It would be the residual  
21 water content.

22 MS. MARCO: I'm sorry, after it was  
23 allowed to what?

24 MR. KETELLE: To drain, gravity drain,  
25 it would be a residual water content of the soil.

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1 Q. (By Mr. Nelson) If you have soils that  
2 are sandy, sand.

3 A. Correct.

4 Q. The field capacity of that sand is  
5 usually in the range of less than 5 percent, isn't  
6 it?

7 A. I'm not really up to speed on the field  
8 capacity of sands, but I would accept that as a  
9 likely number.

10 Q. As you increase in -- or excuse me. As  
11 a soil of clay or silty clay, would it be  
12 reasonable to assume that a silty clay would have a  
13 field capacity of up to 30 to 35 percent?

14 A. It would be higher than that of the  
15 sand. I don't know if 30 to 35 percent would be a  
16 realistic number or not. But it would be higher  
17 than the sand.

18 Q. In any event, if you have sand, the  
19 field capacity is a certain amount. What happens  
20 to the water once that field capacity is satisfied?

21 A. Excess water drains by gravity.

22 Q. And that's not anywhere close to a  
23 saturation point, is it?

24 A. It would probably not be.

25 Q. If I could refer you to page 7 of your

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1 prefilled testimony, the second full paragraph which  
2 begins, "A contaminate released." Do you see where  
3 I'm starting there?

4 A. I see it.

5 Q. "A contaminate released into the shallow  
6 soils must pass through approximately 20 feet of  
7 fine-grained soil near the surface, and then  
8 percolate through approximately 100 feet of fine  
9 sand to reach the groundwater." Based on your  
10 review of the soils information for the site, there  
11 is some variation in that levels, isn't there?

12 A. Yes, there is.

13 Q. And in a couple of the borings that we  
14 saw that we referred to yesterday, I believe it was  
15 boring AR-1 and AR-2, the sands, there was some  
16 sand that was as close as 5 feet?

17 A. There was sand within a shallow depth to  
18 the surface, but the complete review of that log  
19 shows that there was also clay below that sand.

20 Q. So it varies depending on the site?

21 A. Yes, it does.

22 Q. So when you say 20 feet of fine-grained  
23 soil and then 100 feet of sand, each borehole is  
24 probably a little different, but you're drawing a  
25 generalization?

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1           A.       Right.  But the overall stratification  
2 of soil materials for the site in general as it was  
3 portrayed in the SAR shows a layer of fine-grained  
4 sediments that extend 25 to 35 feet below the  
5 ground surface, and below that essentially all of  
6 the material to the water table was fine sand.

7           Q.       Do you think there's a hydrologic  
8 connection to the groundwater at the site?

9           A.       Yes, I believe that it is possible for  
10 saturated flow to occur from the ground surface to  
11 the water table at the site.

12                   THE REPORTER:  I'm sorry, I didn't hear  
13 that.

14                   MR. KETELLE:  I said, yes, it is  
15 possible for saturated flow to occur from the  
16 ground surface to the water table.

17           Q.       (By Mr. Nelson)  If I could refer you to  
18 page 11 of your prefiled testimony, in answer to  
19 question 15 we're discussing here the detention  
20 pond, retention pond, and you indicate that it's  
21 your understanding that temporary pumps will be  
22 used to drain the basin "in the unlikely event that  
23 overflow of the retention pond is imminent."  Is  
24 that your understanding of the facts?

25           A.       That's my understanding of the

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1 applicant's plans.

2 Q. On page 12 you indicate that, "Further,  
3 PFS has committed to sample the water in the  
4 detention pond after significant storm events and  
5 prior to release of the water from the detention  
6 pond. If contamination is detected, the pond water  
7 will be removed for off-site treatment and/or  
8 disposal, thus limiting the possibility of release  
9 of contaminated water via surface flow." They are  
10 not sampling for nonradiologics, are they?

11 A. PFS indicated in testimony that they  
12 plan only to observe whether there is a petroleum  
13 sheen on the surface of the water. However, in  
14 sworn declaration of June 28th, 2001 they committed  
15 to sample and analyze for hazardous and  
16 radiological constituents.

17 Q. In the detention pond?

18 A. Yes.

19 Q. What constituents did they agree to  
20 sample for?

21 A. No specific list was identified. They  
22 stated that they would sample and analyze for  
23 hazardous and radiological constituents.

24 Q. You were here when you heard the  
25 testimony of Mr. Lewis that he indicated he was

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1 only going to use a sheen test and he indicated  
2 there was no other kind of sampling for  
3 constituents?

4 A. I heard that.

5 Q. Is there anywhere in the EIS or the  
6 Environmental Report where PFS commits to sampling  
7 nonradiologics in that pond?

8 A. The commitment did not get placed into  
9 the EIS and it has not been put into the ER.

10 Q. And the commitment, you don't know what  
11 they have committed to sample to?

12 A. Well, at this point I'm a bit confused.

13 Q. Well, you just indicated that they have  
14 committed to do sampling of nonradiologic hazardous  
15 materials?

16 A. That's correct.

17 Q. Which materials, what types of  
18 materials?

19 A. No specific materials have been  
20 identified.

21 Q. So your testimony here on page 12 is  
22 based on the fact that they have committed to do  
23 sampling of nonradiologics, but you don't know  
24 which ones they're going to sample for?

25 A. That is correct.

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1 Q. If I could refer you to your prefiled  
2 testimony on page -- again on page 12, the answer  
3 to A17, you say, "Although the Applicant did not  
4 provide a wastewater profile for the pad area or  
5 other paved surface runoff, it is assumed that this  
6 water would be similar to parking lot runoff from  
7 an concrete parking lot that receives light  
8 traffic?

9 What kinds of contaminants are in a  
10 parking lot runoff from concrete -- or excuse me, a  
11 concrete parking lot that receives light traffic?

12 A. I would expect small amounts of oil and  
13 grease that would be dripped from vehicles during  
14 operation on site. There could be residual  
15 antifreeze that comes out of a radiator that gets  
16 hot and overflows a little bit. There could be  
17 metal contamination that would be derived from  
18 parts of vehicles that washes off of in rain or is  
19 abraded off.

20 Q. Are you familiar with the operation of a  
21 cement plant?

22 A. I have not spent any time working in a  
23 cement plant, but I have been around cement yards a  
24 bit.

25 Q. What kinds of materials does a cement

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1 plant deal with, to your knowledge, that could be a  
2 contaminant?

3 A. There's a lot of Portland Cement that's  
4 used on site generally and water and gravel.

5 Q. Lime?

6 A. Lime.

7 Q. If I understand your testimony, you  
8 disagree with the conclusions of Mr. Lewis and Dr.  
9 Liang that there is no connection to groundwater.  
10 Your testimony is that it's just a slow --

11 A. That's correct.

12 Q. -- slow connection?

13 A. My understanding of the site behavior is  
14 that the shallow soil materials that we spoke of  
15 previously that are fine-grained in character  
16 provide something of a buffer against direct  
17 percolation, rapid percolation of precipitation or  
18 waters and materials at the surface directly to the  
19 groundwater system. But I think that through many  
20 of those processes and at times of saturation of  
21 the soil there probably is direct percolation of  
22 water.

23 Q. If I could ask you to turn now to page 5  
24 of your prefiled testimony, and this also is in  
25 conjunction with the Staff Exhibit F, the map of --

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1 evapotranspiration map, and ask you some questions  
2 concerning that.

3 JUDGE FARRAR: Mr. Nelson, can you hold  
4 on a second? Since we only have the room until one  
5 o'clock, let's let the court reporters switch, if  
6 this was a new subject.

7 MR. NELSON: It is a new subject.

8 JUDGE FARRAR: Let's switch now. Nobody  
9 leave the room.

10 (A break was taken.)

11 JUDGE FARRAR: Mr. Nelson, we have made  
12 the switch, if you will continue.

13 MR. NELSON: Thank you. Mr. Ketelle, on  
14 the bottom of Page 5 there's a reference to Staff  
15 Exhibit F, evapotranspiration map. And then the  
16 sentence following that says, "Because evapo-  
17 transpiration exceeds site rainfall, it is likely  
18 that much of the water in the effluent will be  
19 transpired to the atmosphere by plant growth." Are  
20 you talking about the effluence from the septic  
21 systems?

22 A. Yes. This is the section of testimony  
23 about septic systems.

24 Q. You heard the testimony of Mr. Lewis  
25 that the drain lines will be four and a half feet

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1 in the ground and there will be a twelve-inch  
2 filter material below that. So you have water that  
3 is five feet in the ground.

4 A. That's correct.

5 Q. Knowing that, does that change your  
6 conclusion that most or much of the water will be  
7 transpired into the atmosphere by plant growth?

8 A. Knowing that that's the depth that the  
9 percolation layer will be built at for the leach  
10 fields, I believe that increases the likelihood of  
11 more percolation into the soil than having  
12 shallower cover. However, I don't know what the  
13 rooting depth of plants at the site is. But I  
14 would expect, given a semi-arid setting, that the  
15 rooting depth of plants out there would be tens of  
16 feet. And that would provide opportunities for  
17 plant growth to transpire water from beneath five  
18 and a half foot, five foot depth.

19 Q. Do you know what the rooting depth of  
20 wheat grass is?

21 A. No, I don't. But I suspect natural  
22 vegetation that is adjacent to the area where the  
23 drain fields will be installed would still be  
24 active and will be intercepting percolating water.

25 Q. What percentage would you put on the

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1 amount of water that would be drawn up from a five  
2 foot depth to be transpired at that point? Is that  
3 a correct way of saying it?

4 A. That would be a correct way of saying  
5 it. I don't have a good estimate of that.

6 Q. Would it be 80 percent that would be  
7 transpired that way?

8 MS. MARCO: Objection. He said he  
9 didn't have an estimate of that.

10 Q. Do you have a range of estimate?

11 A. No, I don't.

12 Q. If you are putting 640 gallons a day  
13 through a drain field, and that 640 gallons would  
14 be dependent upon the plants that were within the  
15 surface area, so you have a surface area of 1400  
16 feet squared, I believe is the number that was  
17 used --

18 MS. MARCO: Objection. I don't believe  
19 he said it would be dependent on the surface area.

20 A. I believe that plants adjacent to the  
21 drain fields may have roots that extend below the  
22 areas where the leach fields are constructed, and  
23 could also have access to water that's percolating.  
24 I also think that water that's percolating from the  
25 leach fields will tend to move laterally away from

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1 the 1400 square foot area because if there are  
2 layered deposits beneath the site there will be a  
3 complex drainage pattern that I would expect to  
4 develop under this with perching on some of the  
5 clay layers and perhaps vadose processes going on  
6 in areas between the clay layers. I expect the  
7 performance of the leach fields to be something  
8 much more dynamic than we have been portraying it  
9 in hearings thus far.

10 Q. In fact, if you had a sandy area, you  
11 may have water going just straight down at that  
12 point and not being affected by any kind of  
13 transpiration or evaporation?

14 A. That could occur.

15 Q. The evapotranspiration map that you used  
16 is based on a surface rate, is it not?

17 A. Yes.

18 Q. It doesn't presume that the water begins  
19 five feet into the ground?

20 A. No.

21 Q. It presumes that water is falling on the  
22 ground.

23 A. That's my understanding.

24 Q. And that rate would be significantly  
25 different in the winter when plants are dead and

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1 evaporation is less than it would be in the summer?

2 A. It would be lower in the winter season  
3 than it is in the growing season.

4 Q. So water that is put into the drain  
5 lines in December -- well, let's use January.  
6 January, when plants are not growing, when plants  
7 are dead - "dead" isn't maybe the correct word -  
8 but when plants are not growing, and when there's  
9 less evaporation, there would be more of a tendency  
10 during those time periods for the drain field to be  
11 having the water percolating down through the  
12 soils.

13 A. That's correct.

14 Q. So just because you have an application  
15 rate that may be less than the amounts shown on the  
16 table doesn't necessarily, on any particular day,  
17 determine where the water is going to go?

18 A. No. That's an over-simplification of  
19 the mathematics. It would go on through a whole  
20 annual cycle of evapotranspiration and recharge.

21 MR. SILBERG: Just for clarification,  
22 when you said "the table", what table was being  
23 referred to?

24 MR. NELSON: Did I say "the table"?

25 MR. SILBERG: I believe so.

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1 JUDGE FARRAR: Let's hear the question  
2 again.

3 (The record was read back as follows:  
4 "So just because you have an application rate that  
5 may be less than the amounts shown on the table  
6 doesn't necessarily, on any particular day  
7 determine, where the water is going to go.")

8 MR. NELSON: I was referring to Exhibit  
9 F, the map. Excuse me.

10 MR. SILBERG: Thank you.

11 Q. (By Mr. Nelson) If we can turn to Page  
12 14 of your prefiled testimony, beginning on the  
13 answer to Question 21. Part way down through the  
14 paragraph you state there that, "The nearest  
15 downgradient springs shown on the map are  
16 approximately 11 miles north of the proposed site.  
17 In the unlikely event that contamination from the  
18 proposed PFS facility were to reach the groundwater  
19 table, the travel time for seepage to the closest  
20 spring would be decades for any contaminant that is  
21 not subject to attenuation in the soil." When you  
22 look at the design of a facility and evaluate the  
23 potential for groundwater contamination, you look  
24 at the water directly under the site, don't you?  
25 You don't just design it to keep it from getting 11

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1 miles away.

2 A. That's right.

3 MS. MARCO: Objection. Objection. This  
4 issue is -- he is speaking about Basis 5 which is  
5 in the State's contention which speaks to the  
6 impact of potential groundwater contamination on  
7 downgradient hydrological resources. And this  
8 is -- his statement in the testimony is perfectly  
9 fair and it addresses that.

10 MR. NELSON: I didn't say it wasn't  
11 fair. I'm just asking him a question about the  
12 testimony.

13 MS. MARCO: You were asking him whether  
14 it is appropriate, in looking at the impacts to the  
15 facility, to consider that travel. And that is not  
16 -- the purpose of bringing that up in testimony was  
17 to address your specific point in the basis of that  
18 contention.

19 JUDGE FARRAR: We will overrule the  
20 objection. This is cross-examination and it seems  
21 legitimate.

22 MR. NELSON: Maybe I better try with the  
23 question again.

24 JUDGE FARRAR: Let's read it back.

25 (The record was read as follows:

1 "If we can turn to Page 14 of your prefiled  
2 testimony, beginning on the answer to Question 21.  
3 Part way down through the paragraph you state there  
4 that, 'The nearest downgradient springs shown on  
5 the map are approximately 11 miles north of the  
6 proposed site. In the unlikely event that  
7 contamination from the proposed PFS facility were  
8 to reach the groundwater table, the travel time for  
9 seepage to the closest spring would be decades for  
10 any contaminant that is not subject to attenuation  
11 in the soil.' when you look at the design of a  
12 facility and evaluate the potential for groundwater  
13 contamination, you look at the water directly under  
14 the site, don't you? You don't just design it to  
15 keep it from getting 11 miles away.")

16 A. That's correct.

17 Q. Isn't it true that if you do have  
18 polluted groundwater, it can cause problems for  
19 decades into the future?

20 A. That's correct, depending on, as we  
21 discussed earlier, the interaction between  
22 dissolved contaminants and the aquifer matrix  
23 material, attenuation processes as that water  
24 migrates. There are attenuation processes for some  
25 contaminants that can occur in situ and reduce the

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1 amount of contamination within a contaminant plume  
2 area without intervention by man.

3 Q. This gets back to the question I  
4 originally asked you, doesn't it, about the  
5 difficulty in cleaning up groundwater?

6 A. Yes. It relates back to that question.

7 Q. If I could refer you to your prefiled  
8 testimony on Page 10. In the answer to Question 12  
9 you refer to a pump test. If I can read the  
10 sentence, it says, "The Applicant characterized the  
11 material properties of the soil profile and  
12 determined the hydraulic conductivity of the  
13 aquifer (saturated zone) beneath the site through  
14 performance of a pump test, as discussed in Section  
15 3.2.2 (Page 3-13) of the FEIS. This provides an  
16 acceptable basis for determining the potential for  
17 any contamination from the facility to affect the  
18 aquifer." That really wasn't a pump test, was it?  
19 It was a slug test.

20 A. It was a pump-in test as described by  
21 the Applicant where a constant rate of injection  
22 was held on the well for a period of time to  
23 determine the permeability.

24 Q. A pump test, I guess if you -- a pump  
25 test usually involves pumping water out of the

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1 aquifer, doesn't it?

2 A. Not always. You can pump water out or  
3 pump water in.

4 Q. So you called it a pump --

5 A. A pump-in.

6 Q. A pump-in test?

7 A. Instead of a pump-out test.

8 Q. So this was a pump-in test?

9 A. Correct.

10 Q. How does a pump-in test provide a basis  
11 for determining potential for contamination from a  
12 facility?

13 A. The pump-in test provides the basis for  
14 understanding the approximate rate of groundwater  
15 seepage in the saturated zone. Other  
16 characterization tests that the Applicant performed  
17 in terms of soil characterization describe other  
18 properties of the overlying materials that are  
19 relevant to understanding the connection between  
20 the land surface and the saturated zone.

21 Q. For this pump-in test, it determined the  
22 hydraulic conductivity at the 125-foot level, did  
23 it not?

24 A. That's correct.

25 Q. It did not determine the permeability of

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1 the soils above that?

2 A. That is correct.

3 Q. Mr. Ketelle, if I could ask you to refer  
4 to what's been marked as the State's Exhibit 158.  
5 Is this a document -- are you familiar with the  
6 document the Standard Review Plan for Spent Fuel  
7 Dry Storage Facilities NUREG 1567?

8 MS. MARCO: Objection. I am objecting  
9 to the use of this document in questioning because  
10 this document pertains to the Staff's Safety  
11 Evaluation Report, not the Staff's Environmental  
12 Impact Statement. This document pertains to how  
13 you address radiological contamination.

14 MR. NELSON: I believe I'm entitled to  
15 ask him if he has seen the document and knows about  
16 it.

17 MS. MARCO: The document, as I described  
18 last night, already addresses that it has no  
19 bearing on this. And therefore he should not be  
20 questioned on any aspect of this document.

21 MR. NELSON: Counsel has made  
22 representations to that effect. But all I am  
23 asking him is if the document, if he has seen the  
24 document and if he has reviewed it. That's the  
25 only question I have asked.

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1 MS. MARCO: If the document is  
2 irrelevant, it's irrelevant for all purposes and he  
3 shouldn't be questioned on it.

4 MR. NELSON: I believe the document  
5 is --

6 JUDGE FARRAR: We don't know yet that  
7 it's irrelevant, given our prior ruling about  
8 needing legal arguments on this. We understand the  
9 basis of your objection. It is preserved. But for  
10 now the objection to the question is the overruled.

11 Go ahead and answer.

12 A. I have not seen this document prior to  
13 these proceedings.

14 Q. (By Mr. Nelson) That solves that.

15 You have been involved, in your work, in  
16 monitoring of groundwater?

17 A. Yes, I have been.

18 Q. And how do you make a determination that  
19 a groundwater has been contaminated, generally?  
20 How do you make that determination?

21 A. By sampling and submitting it to a  
22 laboratory for analysis for certain contaminant  
23 parameters.

24 Q. And you usually have to have a  
25 comparison, don't you, between an upgradient and a

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1 downgradient comparison with the quality of the  
2 groundwater?

3 A. It depends on the site. If you are at a  
4 site where you have no plausible upgradient sources  
5 of contaminants, the detection of a listed  
6 contaminant would logically tie back to the site of  
7 interest.

8 Q. You could just assume at that point that  
9 it came from the site?

10 A. Correct.

11 Q. If you have a large -- based on your  
12 experience, if you have four buildings, a lab,  
13 heavy equipment hauling large quantities of nuclear  
14 waste, rail equipment, locomotives, drain fields,  
15 detention basins, don't you think it would be  
16 prudent to monitor groundwater?

17 MS. MARCO: I object to the  
18 characterization of large quantity radiological  
19 waste in that question. It is not part of this  
20 proceeding.

21 JUDGE FARRAR: Read the question back,  
22 please.

23 (The record was read as follows:

24 "If you have a large -- based on your  
25 experience, if you have four buildings, a lab,

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1 heavy equipment hauling large quantities of nuclear  
2 waste, rail equipment, locomotives, drain fields,  
3 detention basins, don't you think it would be  
4 prudent to monitor groundwater.")

5 JUDGE FARRAR: The objection is  
6 overruled.

7 A. I think the groundwater monitoring needs  
8 to be closely tied to specific sources of  
9 contamination that have a very good reason to be  
10 putting in wells and monitoring for them. And  
11 locomotives I don't see as sources that warrant  
12 groundwater monitoring. Buildings with essentially  
13 no connection to the outside environment, to me  
14 provide fairly good containment areas for materials  
15 that might be introduced into the environment, and  
16 I don't think in and of themselves warrant  
17 groundwater monitoring, especially when combined  
18 with procedures that control the use of materials  
19 that would be environmental contaminants and  
20 commitments to the proper disposal of those  
21 hazardous materials.

22 Q. You don't believe that the cumulative  
23 effect of all of those kinds of activities would  
24 warrant some kind of checking to make sure, in  
25 fact, that your management programs are working?

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1           A.       I reiterate that I think there needs to  
2 be a very good reason to impose ground water  
3 monitoring on a source-specific basis.

4           Q.       Is that because of expense?

5           A.       In part.

6           Q.       Do you have a feel for how costly  
7 groundwater monitoring would be to put in one well?

8           A.       Yes, I have a fairly good handle on cost  
9 of installing wells and doing groundwater monitor.

10          Q.       What would be the cost of a groundwater  
11 monitor well?

12          A.       It would be on the order of \$10,000,  
13 \$20,000 probably to install a proper high quality  
14 groundwater monitoring well. And annual monitoring  
15 costs would be several thousand dollars per year  
16 per well.

17          Q.       Have you ever been asked by NRC staff to  
18 evaluate the need for groundwater monitoring at  
19 this site?

20          A.       We considered the need for groundwater  
21 monitoring at this site in preparation of the FEIS.  
22 And we determined in the review of groundwater  
23 monitoring there that we don't see a clear driver  
24 for groundwater monitoring as a license condition  
25 at this facility.

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1 Q. Didn't you testify that cost was not an  
2 issue in licensing of --

3 A. I didn't testify anything about cost  
4 related.

5 Q. Excuse me. Maybe that was another --

6 A. It was another witness.

7 Q. Did you agree with that in your analysis  
8 that you do, that cost should not be an issue with  
9 respect to these kinds of facilities?

10 A. I think it's -- I think we are talking  
11 about a slightly different question when it comes  
12 to facilities that have potential identified for  
13 release of nuclear material on site. I think the  
14 compliance with the environmental rules and  
15 regulations stand on their own to impose  
16 groundwater monitoring for specific processes or  
17 specific facilities.

18 Q. Would you agree that there's probably  
19 basically two ways that contaminants could be  
20 released from this site; either through the air or  
21 through the groundwater?

22 A. I think that's probably right.

23 Q. I have no other questions.

24 JUDGE FARRAR: Let me ask one quick  
25 question. No. To be honest, one quick series of

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1 questions. How much of your work is done for or  
2 with the NRC staff?

3 THE WITNESS: I do about ten percent of  
4 my work with the NRC and the remainder is with DOE.

5 JUDGE FARRAR: Are you familiar enough  
6 with the Staff processes to answer this question:  
7 You indicated earlier there was some confusion in  
8 your mind about the Applicant's representations  
9 about what it would do to sample the water in the  
10 detention pond. Is that correct?

11 THE WITNESS: Right. I have heard  
12 different things from the Applicant concerning  
13 sampling analysis of detention pond water.

14 JUDGE FARRAR: Are you familiar with the  
15 Staff processes to know how that would be  
16 resolved --

17 THE WITNESS: No, I'm not.

18 JUDGE FARRAR: So you don't know how  
19 that representation that you referred to in some  
20 declaration a year ago, how that would get  
21 transferred into an enforceable technical  
22 specification.

23 THE WITNESS: No, I'm not.

24 MR. KLINE: You used the term "vadose  
25 processes". Could you give us a definition?

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1 THE WITNESS: Vadose zone is a zone  
2 above the water table where soils are partially  
3 saturated. The moisture content in the soil is not  
4 up to the full saturation level. It's the zone  
5 typified by capillary action, negative pore  
6 pressures in fine-grained soils that can hold that  
7 moisture in pendular suspension.

8 MR. KLINE: Define that.

9 THE WITNESS: It's the zone where the  
10 moisture deficit in soil actually will cause soil  
11 to take up the moisture through capillary action  
12 and hold it against downward seepage based on the  
13 pore pressure and the permeabilities of the soil.

14 MR. KLINE: So that water, that zone,  
15 the soil or the moisture is essentially not moving.  
16 Is that correct?

17 THE WITNESS: Under a normal  
18 circumstance, if you are not pouring water into the  
19 top of the vadose system, very little water is  
20 moving through it. It is basically in an  
21 equilibrium. If you pour water into the top, it  
22 reduces those negative pore pressures because you  
23 have added moisture to satisfy the demand of the  
24 soil and a little bit of the moisture can move  
25 down. And if you've got evaporation coming back

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1 off the surface, then the pore pressure goes back  
2 down. When you have plants involved, you have --  
3 the vegetation has an extractive capability to pull  
4 additional water out far below what the field  
5 capacity of the soils would be, because the plants  
6 are transpiring water into the air; thereby the  
7 more available water out of the siltier soils is  
8 more subject to being transpired. It is harder to  
9 pull the moisture out of the clay because the pore  
10 pressure relationships for clay soils drive a much  
11 lower vacuum potential.

12 MR. KLINE: Okay. We are still  
13 struggling with the idea of how we get water  
14 injected at four and a half feet, how we get it  
15 back to the surface. And I understand your view on  
16 plants. Are there physical processes as well, for  
17 example, capillarity, that would tend to move water  
18 towards the surface?

19 THE WITNESS: Well, capillarity from the  
20 sides of the seepage trench or the leach field  
21 could tend to pull moisture out and up some  
22 distance.

23 MR. KLINE: That's what I'm asking.

24 THE WITNESS: It depends on how much the  
25 water pools in the base of that gravel-filled

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1 trench. If it never gets up on the side walls,  
2 then you are not going to get that much capillarity  
3 pulling it up. It will go out into a bulb,  
4 basically, from the base of that percolation  
5 trench.

6 MR. KLINE: I'm trying to visualize when  
7 the water is first injected from the distribution  
8 pipes, is it fair to say, then, that it sort of  
9 partitions some of it moving sideways and some of  
10 it moving downward and some of it moving upward?

11 THE WITNESS: Correct. But gravity is  
12 the dominant source over --

13 JUDGE KLINE: Okay. So initially we are  
14 going to suspect a predominantly downward movement.

15 THE WITNESS: If you start with a soil  
16 that is low in its moisture characteristic  
17 initially, the first water you put in there is  
18 going to begin to just spread rather evenly away  
19 from the floor of your seepage basin. And that's  
20 being pulled out by the negative pore pressure of  
21 the fine-grained soil. As you satisfy that low  
22 pore pressure in the immediate vicinity of the  
23 percolation trench, then you can get saturation.  
24 And if the rate that the soil is pulling moisture  
25 away exceeds the rate that you are feeding water

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1 into the trench, then you will never obtain  
2 saturated flow. You will be feeding the vadose  
3 need, and that will dissipate out into the soil  
4 mass.

5 MR. KLINE: So it is just dissipating  
6 into the soil volume, then.

7 THE WITNESS: Right.

8 MR. KLINE: Okay.

9 THE WITNESS: And if you apply water at  
10 a rate greater than what the vadose demand is, then  
11 you will saturate the soil and get saturated  
12 percolation flow. And for the PFSF site, we've got  
13 a layering of materials in this upper 25 feet that  
14 says we have a potential for a fairly complicated  
15 moisture absorption system.

16 MR. KLINE: That's what I'm trying to  
17 untangle, if we can. Is it fair to say, then, that  
18 to the extent you get saturation below the  
19 distribution pipes, that the saturated zone might  
20 be in a sense perched on clay layers or something  
21 like that?

22 THE WITNESS: Yes. That would be very  
23 possible. You could perch on a layer and it could  
24 seep along the top of the layer to a point where it  
25 can get through, and then it could go through

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1 vadose flow again from there.

2 MR. KLINE: Okay. So what seems  
3 counter-intuitive at first is that when one repeats  
4 the process, that is, repeated injections day in  
5 and day out for twenty years, that cumulatively we  
6 wouldn't start pushing water down towards the  
7 saturated zone of the water table? Is it your  
8 belief that the vadose zone has sufficient  
9 absorptive capacity, when coupled with the  
10 evaporative capacity, that it just prevents that  
11 connection?

12 THE WITNESS: I don't think it will  
13 prevent that.

14 JUDGE KLINE: Okay.

15 THE WITNESS: The ER for this project  
16 indicates soils characterized at about 70 percent  
17 of saturation on average. So you've got about 30  
18 percent of your porosity available for the vadose  
19 process to occur. And that's an average number  
20 that was summarized in the ER.

21 MR. KLINE: Right. Okay. Thank you.

22 JUDGE LAM: Mr. Kettle, if I refer you  
23 to the State Exhibit No. 163, Page 480, the fourth  
24 full paragraph on the left-hand side.

25 THE WITNESS: Fourth paragraph?

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1 JUDGE LAM: Right. Assuming I read it  
2 directly, this Uniform Plumbing Code Requirement  
3 Illustrated Training Manual proffered by the state  
4 of Utah tells me the separation requirement between  
5 the septic tank leach lines and the groundwater  
6 table is only five feet.

7 THE WITNESS: That's a very thin margin,  
8 isn't it?

9 JUDGE LAM: Right. Assuming I read it  
10 correctly and assuming this is, indeed, an  
11 acceptable standard, would you clarify for me the  
12 significance of all the current dispute here?

13 THE WITNESS: I don't know that I can  
14 clarify the current dispute. But what I can  
15 observe is that it appears that the site where  
16 these facilities are proposed has a grade excess of  
17 filtration capacity for the leach fields compared  
18 to this direction. We have got about 120 feet to  
19 the water table at the site below the intended  
20 installation depth of the leach fields.

21 JUDGE LAM: Well, my question, to be  
22 more blunt, is if this five feet separation is an  
23 acceptable standard, which I do not know if it is,  
24 then why do we have a dispute here?

25 THE WITNESS: I am afraid I can't answer

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1 that question.

2 JUDGE LAM: All right. I will reserve  
3 this question for the state of Utah's witness, Mr.  
4 Ostler. Thank you.

5 JUDGE FARRAR: In starting to answer  
6 Judge Lam's question, your first response was, with  
7 what I took a look of surprise, that this is a  
8 rather thin margin. Can you elaborate on that?

9 THE WITNESS: Well, the minimum  
10 installation depth per this code would be five feet  
11 above the water table. I don't think that is a  
12 large buffer zone to protect a water table from a  
13 leach field.

14 JUDGE LAM: But the code only requires  
15 that much, the way I read it.

16 THE WITNESS: By our reading of that  
17 page, that's the code requirement.

18 JUDGE LAM: Okay. Thank you.

19 MR. KLINE: I have one more. Can you  
20 give us a feel for how deep in the soil aerobic  
21 decomposition of the organic load takes place?

22 THE WITNESS: Not at this site.

23 MR. KLINE: Roughly the --

24 THE WITNESS: I wouldn't be able to  
25 offer on that. Aerobic process for decomposition,

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1 for example fuel hydrocarbons can occur at the  
2 water table. They can occur at fairly great depth  
3 with aerobic bacteria. It depends on the  
4 availability of an oxygen donor for the bacteria to  
5 use.

6 MR. KLINE: Can you comment on the  
7 overall water quality; that is, of any water that  
8 does, for whatever reason, get into the water table  
9 125 feet down? Can you comment on the significance  
10 of that vis-a-vis water quality?

11 THE WITNESS: From the leach fields I  
12 would not expect to see contaminants such as  
13 hydrocarbons and site- related materials getting  
14 there. There probably will be some nitrate that  
15 would be dissolved. Nitrate is not readily -- it  
16 doesn't absorb. It remains in solution. There  
17 could be some bacterial consumption of nitrate as  
18 it is moving down through the soil or at the water  
19 table. But I would not expect to see much getting  
20 there of a quality problem through this thickness  
21 of soil.

22 MR. KLINE: Once material does get there  
23 in whatever quantity it does, does the water table  
24 itself contribute to dilution?

25 THE WITNESS: Oh, yes. In the transport

1 process in the groundwater table, dilution and  
2 dispersion occur. But the flow between the aquifer  
3 granular material causes mixing of the water as it  
4 flows around different drains. And the  
5 dispersivity can be fairly substantial so that the  
6 farther you go, the more diluted your plume may get  
7 simply because of the mixing within the plume.

8 MR. KLINE: If I understand correctly,  
9 the nearest downstream user is 11 miles.

10 THE WITNESS: No. The nearest spring.  
11 There are well water users for irrigation two and a  
12 half miles or something away from the site. I  
13 believe that's the approximate distance.

14 MR. KLINE: Do you have an opinion as to  
15 whether anything from the site could be detected  
16 after dilution at that site say two miles away?

17 THE WITNESS: I would not expect to see  
18 anything at that site that distance away.

19 JUDGE FARRAR: In response to Judge  
20 Kline's question about aerobic activity at depth,  
21 you said you had to have an oxygen donor. As the  
22 water goes down through the soil, through whatever  
23 process, does it lose, does it tend to lose the  
24 dissolved oxygen it would have had at the surface?

25 THE WITNESS: Well, the oxygen that it

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1 would have at the surface would tend to get  
2 consumed by biological and chemical demands; you  
3 know, the chemical reactions within the waste water  
4 consume oxygen that is available, as do bacteria.

5 JUDGE FARRAR: Mr. --

6 MR. ROSINSKI: Thank you, judge.

7 JUDGE FARRAR: How much do --

8 MR. ROSINSKI: Just a couple questions.

9 MS. MARCO: I believe he already crossed  
10 our witness. Right?

11 JUDGE FARRAR: Yes.

12 MS. MARCO: We are on redirect now,  
13 right?

14 JUDGE FARRAR: I'm sorry.

15 MS. MARCO: So it's my turn.

16 JUDGE FARRAR: Right.

17 MS. MARCO: Okay. I have a number of  
18 questions.

19 JUDGE FARRAR: Just in terms of timing,  
20 I think you said the witness was available until  
21 tomorrow?

22 MS. MARCO: That's correct. I realize  
23 that it is almost noon at this point.

24 JUDGE FARRAR: But it looks like we are  
25 almost finished. Is there a benefit to -- can we

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1 finish him today? Is that of benefit to him?

2 MS. MARCO: I don't have beyond 35  
3 minutes or so of this.

4 JUDGE FARRAR: Is it of benefit to the  
5 witness to finish today rather than tomorrow?

6 MS. MARCO: Yes, it is of benefit to the  
7 witness.

8 JUDGE FARRAR: But since we took him out  
9 of order, you will arrange to get him a transcript  
10 of the rest of the proceedings in case we have to  
11 get him back by telephone at some other time?

12 MS. MARCO: Yes. Sure.

13 JUDGE FARRAR: Go ahead.

14

15 REDIRECT EXAMINATION

16 BY MS. MARCO:

17 Q. In your opinion, what type of a facility  
18 warrants groundwater monitoring? Can you give me  
19 an example of those kinds of facilities?

20 A. Facilities that would be placing  
21 hazardous waste into the ground for the purpose of  
22 storage or disposal of it would have the potential  
23 to need groundwater monitoring.

24 Q. And are these the kinds of facilities  
25 that you had experience with with ORNL?

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1 A. Yes.

2 Q. Did you consider costs at all in your  
3 evaluation?

4 A. No.

5 Q. And for this facility, you did not --  
6 did you accept this design without groundwater  
7 monitoring?

8 A. Yes.

9 Q. And what was the reason for that?

10 A. Because I think based on the processes  
11 that are going to go on at the site, and the nature  
12 of the site materials, there isn't any activity or  
13 material on site that appears to mandate needing to  
14 do groundwater monitoring. The site capability,  
15 the facility design appear to provide good  
16 protection in groundwater.

17 Q. You mentioned with respect to your  
18 experience, your hydrogeologic experience, that it  
19 does pertain to the retention pond. Can you please  
20 explain that?

21 A. Yes. I have worked with a number of --  
22 actually they aren't so-called retention ponds.  
23 They are actually wastewater ponds, in my  
24 experience in Oakridge. And I have observed  
25 shallow groundwater seepage away from those ponds

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1 in my experience.

2 Q. You said you did not have specific  
3 septic tank or system experience. But what  
4 information have you looked at or seen with respect  
5 to septic systems?

6 A. I have read textbooks on septic tank  
7 installations, leach field design. But I don't  
8 have any practical experience in the installation  
9 or construction of them.

10 Q. What types of contaminants were found in  
11 groundwater that is considered in terms of parts  
12 per billion?

13 A. Typically volatile organic solvent  
14 compounds, trichloroethene, tetrachloroethane,  
15 those types of materials would be of concern at  
16 those concentrations.

17 Q. And is this different from the types of  
18 contaminants that you expect from this facility?

19 A. I have no knowledge that those types of  
20 materials will be used on the site.

21 Q. On Page 5 of your testimony, I believe a  
22 question came up regarding fine-grained -- in the  
23 sentence is says, "The fine-grained soils are  
24 expected to allow slow seepage of effluent during  
25 which many of the constituents will adhere to soil

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1 particles because of chemical interactions between  
2 the effluent and soil." And would you need a  
3 site-specific test to make that assertion?

4 A. No. In general, clay soils, very fine  
5 grain soils, have ion exchange capacity that would  
6 allow them to attenuate charged particles in the  
7 groundwater by ion exchange and absorption. The  
8 amount of that interaction is a site-specific,  
9 soil-specific parameter. However, the general  
10 conclusion that fine-grained soils are able to  
11 attenuate materials is a well-accepted principle.

12 Q. There were some questions that came up  
13 concerning the term "field capacity" and it was  
14 described, if I recall, as the -- I'm sorry, can  
15 you repeat what that was?

16 A. Field capacity is the residual water  
17 content of the soil after it is gravity drained  
18 from saturation.

19 Q. And how does this relate to the  
20 saturation point of the soils in the site, this  
21 concept?

22 A. Whether the soils on site are at field  
23 capacity or not would require some additional  
24 testing. I don't know if that is the case. It's  
25 conceivable that soils would be at field capacity,

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1 depending on evapotranspiration stresses on the  
2 moisture content.

3 Q. And was this required in order for you  
4 to make your determination?

5 A. No.

6 Q. Do you feel that this information was  
7 something that you needed to have before you?

8 A. No.

9 Q. There was some question regarding the 30  
10 percent -- I'm sorry the moisture content for the  
11 clay and the silt soil affecting the action of the  
12 water going back up. Can you please describe how  
13 this soil property relates to the soils that were  
14 found at the site?

15 A. The -- I'm not sure I understand your  
16 question.

17 Q. Okay. I thought I heard that there was  
18 some back and forth concerning a 30-percent soil  
19 moisture content.

20 A. Well, we were discussing whether the  
21 30-percent, by weight percent, constituted a highly  
22 saturated condition for the soil. I reviewed all  
23 of the soil moisture and Atterberg Limits tests  
24 that I had available to me in the SAR and I  
25 observed that upon average the soils at the site

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1 are about the mid- range of their plastic range,  
2 which I think is probably consistent with the  
3 published 70-percent saturation value that the  
4 Applicant placed in the ER. In general, the soils  
5 there, except for a few very wet test results,  
6 indicate that there is or they are mostly below  
7 saturation.

8 Q. You say that the hydrologic connection  
9 is possible, but what's the likelihood of it?

10 A. Well, I think there's a weak connection  
11 between the ground surface and the water table at  
12 the site.

13 Q. And your basis for that conclusion?

14 A. My basis for that conclusion is the soil  
15 textures of the upper 25 to 35 feet where there are  
16 a number of clay layers, and most of the material  
17 is silty clay and clayey silt which, in my  
18 experience, has a pretty low permeability. It is  
19 not liner material, as was being discussed  
20 yesterday or the day before. But these soils have  
21 a good capability to retard downward groundwater  
22 flow. But if you, as we have discussed, are  
23 placing water into that soil column, then it's, you  
24 know, the gravity is going to be working on it and  
25 allowing it to go downward.

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1 Q. And beyond wheat grass will there be  
2 other plants around the septic system area?

3 A. I don't have any knowledge. I would  
4 assume that there would be native vegetation left  
5 in areas that weren't required to be disturbed.

6 Q. In sandy soil it was part of testimony I  
7 believe I heard that the percolation would be  
8 straight down.

9 A. Probably.

10 Q. And how does that relate to the soils on  
11 the site?

12 A. Well, most of the sand is under the 25  
13 to 35 feet of finer-grained silty clays and clayey  
14 silt sediments. I think it is reasonable to  
15 presume that once water gets to the base of these  
16 fine grain soils, then its avenue for migration is  
17 predominantly downward unless there are plant roots  
18 that get that far and can recover some of it for  
19 transpiration.

20 Q. Do the sands filter?

21 A. Yes. The sand would provide a filtering  
22 mechanism. It's a fine sand, as described in the  
23 boring logs. Rather dense. It would provide a  
24 good filtration capacity and there may be coatings  
25 on sand particles that would provide additional

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1 chemical interactions with the water. Although  
2 that's not been demonstrated one way or the other,  
3 it could be there.

4 Q. Okay. Hold on one second, please.

5 Can you explain why the excess  
6 filtration capacity is important in this instance?

7 A. Having a greater depth from the land  
8 surface or from the septic systems to the water  
9 table provides an extra margin of protection for  
10 that water table because the processes of  
11 contaminant attenuation in that soil have a large  
12 volume within which to act.

13 Q. I don't believe I have any more  
14 questions. And I was within my estimate.

15 JUDGE FARRAR: You were well within your  
16 estimate. But it's not cumulative. Can't save it  
17 for next time.

18 MS. MARCO: Darn.

19 JUDGE FARRAR: Counsel for the Applicant  
20 now would have questions?

21 MR. ROSINSKI: Thank you, Judge.

22

23

REXCROSS EXAMINATION

24 BY MR. ROSINSKI:

25 Q. Referring back to the questions from

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1 Judges Kline and Lam and the five-foot requirement  
2 in the UPC's training manual, wouldn't that  
3 indicate to you that five feet of soil is  
4 sufficient to filter out the contaminants from the  
5 septic systems?

6 A. I would presume that in engineering  
7 practice that would be the conclusion you would  
8 draw from that requirement; that five feet of  
9 appropriate soil would protect a water table from a  
10 normal sanitary type waste stream.

11 Q. And specific to Judge Kline's question,  
12 wouldn't that also indicate that the anaerobic or  
13 aerobic processes to work the biological effluent  
14 would also be expected to occur no deeper than  
15 that?

16 A. I don't -- I don't believe that  
17 conclusion necessarily follows. Aerobic  
18 decomposition process using bacteria is not related  
19 to proximity to the atmosphere, but only to a  
20 source of oxygen as a donated ion.

21 Q. I understand that. But if it does not  
22 complete or wasn't expected to complete within the  
23 five feet, then that would indicate that it was  
24 released to the groundwater. Would you expect that  
25 to be --

1           A.       I would not conclude that the only  
2 viable treatment of effluence occurs in the top  
3 five feet.

4           Q.       So it's your testimony you believe that  
5 the UPC allows those contaminants to be or enter  
6 the groundwater?

7           A.       No. I did not say that.

8           Q.       Does any information that you have heard  
9 from the testimony today or previously regarding  
10 the cement batch plant change any of your overall  
11 conclusions in this matter?

12          A.       No. The discussions of the cement batch  
13 plant and the identification of lime as a  
14 contaminant, potential contaminant on site, I  
15 believe would -- it creates a source of elevated pH  
16 for waters on the site. If there's lime lying on  
17 the land surface and rain falls on it, the pH will  
18 increase. Calcium concentrations would increase in  
19 the water that passes through that lime. However,  
20 I don't see that -- other than the pH is a  
21 regulated term in water quality, I don't believe  
22 that the pH effects on water at the land surface  
23 here would have much of an effect on groundwater pH  
24 because there's a large buffering region that the  
25 water has to infiltrate through.

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1 Q. There was some discussion about the  
2 lower evaporation rate during the winter. Assuming  
3 that is true, wouldn't that also necessarily mean  
4 there is a high evaporation rate during the summer?

5 A. Correct. On an annual cycle the  
6 evaporation rate probably looks like a sine curve  
7 with a lower amount of evapotranspiration in winter  
8 months and a higher peak in the summer months.

9 Q. Regarding evaporation, in your  
10 testimony, Answer 11 on Pages 5 and 6, which was  
11 referred to by the State, you use a term  
12 evapotranspiration which, as I understand,  
13 listening to the testimony, referred to the process  
14 by which plants pull the water up.

15 A. It's a combination of both. Both direct  
16 evaporation from the soil surface and the moisture  
17 that is transpired by the plants back into the  
18 atmosphere.

19 Q. So you considered both processes in your  
20 analysis?

21 A. I considered the overall potential  
22 evapo- transpiration, not separate.

23 Q. On the first full paragraph on Page 6 of  
24 your prefiled testimony, the third sentence, you  
25 state, "That improper functioning of a septic

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1 system could occur if natural or man-made  
2 preferential seepage path ways exist between  
3 seepage field area. In such a case, there could be  
4 rapid percolation of incompletely treated septic  
5 water downward to the groundwater table. However,  
6 no such pathways have been identified to date."  
7 Doesn't that -- doesn't your conclusion that there  
8 is some connection between surfacing groundwater,  
9 characterized as slow or weak, require a pathway  
10 from the surface to the groundwater?

11 A. The pathway for connection from the  
12 surface to the groundwater is simply the porous  
13 medium flow of water through the soils that are  
14 there. The testimony that you refer to is with  
15 reference to specific discrete pathways that would  
16 allow water to go from the leach field drain  
17 straight to the water table without passing through  
18 the intergranular flow pathway. But if you had an  
19 improperly sealed well bore directly under one of  
20 your leach field drains, then you'd have no  
21 treatment as water went straight down that well  
22 bore.

23 Q. But you have identified none of those?

24 A. We have not identified that based on the  
25 present proposed siting for the leach fields. The

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1 borings on the site appear to be hundreds of feet  
2 removed from the proposed leach field locations.

3 Q. So if I understand correctly, even if  
4 some contaminant worked its way down to the level  
5 of the sands, there is no pathway from there to  
6 avoid the sand, the additional 90 feet of  
7 filtration?

8 A. I'm sorry. I didn't understand that  
9 question.

10 Q. You say there's no pathways from beneath  
11 the --

12 A. No preferential pathway?

13 Q. No preferential pathways. So that even  
14 if contaminants reached the level below the clay  
15 layers, below the septic system, they still have to  
16 pass through the 90 feet --

17 A. That's correct. There would be about 90  
18 feet, plus or minus, of unsaturated, incompletely  
19 saturated sand that that water would leach through.

20 Q. As I have listened here, is it not more  
21 accurate to characterize your overall conclusion  
22 regarding the possibility of flow from the surface  
23 to the groundwater as leaving open the possibility,  
24 however small, of such a connection; but you have  
25 not identified any credible mechanism or pathway

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1 for that postulated connection?

2 A. I don't agree with that. I think that  
3 the seepage pathways exist there through the  
4 natural soil materials that are there. I can't  
5 prove that it is. I could propose methods to find  
6 out, but I don't think that's really a crux issue  
7 for the decisions that are being made here now.

8 Q. Why is that not a crux issue?

9 A. Because the use of septic tanks and  
10 leach fields to treat sanitary waste is a generally  
11 accepted practice. There are engineering designs  
12 and controls for the appropriate use of that. And  
13 I don't know why we would need to go and do any  
14 additional investigations on this site pertaining  
15 to that.

16 Q. So you agree, at least generally, with  
17 Mr. Lewis's statements that this is a standard  
18 sewage treatment sanitary system and it is designed  
19 in accordance with the appropriate codes?

20 A. I agree that these systems are typically  
21 used and are approved by agencies for use in waste-  
22 water treatment, as properly installed.

23 Q. In your prefiled testimony on Page 5,  
24 Answer 11, you previously stated you hadn't done  
25 any analysis or calculations to quantify the

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1 adherence to soil particles due to the various  
2 chemical interactions of potential contaminants.  
3 Is it possible for you to give a qualitative --

4 MS. MARCO: Objection. I don't see that  
5 in his testimony here. Can you point that out?

6 MR. ROSINSKI: The paragraph that  
7 starts, "The FEIS includes . . ." And then, "The  
8 fine-grained soils are expected to allow slow  
9 seepage of effluent during which many constituents  
10 would adhere to soil particles because of chemical  
11 interactions."

12 MS. MARCO: Okay. I see it.

13 JUDGE FARRAR: Go ahead.

14 A. Can you rephrase your question, please?

15 Q. Regarding those chemical interactions  
16 that you site, is it possible for you to give a  
17 qualitative characterization?

18 A. Yes. A qualitative characterization, I  
19 think, is best maybe using a concept that is  
20 actually used for the determination of that  
21 interaction. It's called the distribution  
22 coefficient, which is the ratio of the  
23 concentration of a contaminant on soil to the  
24 concentration in water. In other words, it's the  
25 partitioning between the dissolved contaminant

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1 phase and that that is bound up to a soil or  
2 mineral particle. Most metals tend to be or have  
3 partitioning coefficients of values of several to  
4 ten or tens times the concentration on the soil  
5 particles compared to what's in the dissolve phase.  
6 The consequence of that on their mobility in the  
7 environment is that it really slows down their  
8 migration in the dissolve phase because they  
9 continue to stick to the soil particle surfaces.

10 On the other hand, organic compounds are  
11 more prone to be bound up with organic soil  
12 components. Thereby, if you've got an organic  
13 material in a wastewater, you would treat it by  
14 filtering through an activated charcoal or  
15 something like that that has organic carbon.  
16 Similarly, that material, if it is in a groundwater  
17 system, would tend to attach itself to organic  
18 material in the aquifer, in the soil. Either plant  
19 detrital material, dead root materials, or other  
20 organic compounds that are in the soil.

21 Q. But for the PFS site, how would you  
22 qualitatively characterize the effectiveness or  
23 your expectation of the effectiveness of these  
24 processes?

25 A. Well, my expectation based on the amount

1 of clay and fine particles that we see at the site  
2 is that it would have a good attenuating capacity.

3 Q. Assuming, for the moment, that the  
4 nonradiological sampling to be performed of the  
5 detention pond water, should it accumulate there,  
6 is only limited to sheen observation or sheen  
7 detection for discoloring, or sheen on the water of  
8 the detention pond, would that change any of your  
9 conclusions?

10 A. I think that PFS should look very hard  
11 at materials that they have on site and the  
12 potential that any of that material gets into the  
13 environment where it may be transported to the  
14 detention pond. And when determinations on  
15 effluent characterization are made, include  
16 materials that are on site that may be present in  
17 the screening prior to discharge of any waters out  
18 of that basin.

19 Q. But would that change your overall  
20 conclusion in your prefiled testimony?

21 A. Not based on knowledge to date.

22 Q. Okay. Thank you. Nothing further.

23 JUDGE FARRAR: Any recross, Mr. Nelson?  
24  
25

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## RE CROSS EXAMINATION

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BY MR. NELSON:

Q. Mr. Ketelle, the geology here is very -- the geology underneath the ground is complex, no matter where you are. Isn't it?

A. Most of the time.

Q. And if you have a layer of sand and then a layer of clay and then a layer of sand, the layer of sand affects capillary action, doesn't it?

A. The layer of sand has its own capillary characteristics.

Q. And if it's significantly less than the clay layer, it tends to act as kind of a barrier or a break, doesn't it, to that action?

MR. SILBERG: I'm sorry? What is the barrier or break?

Q. The sand layer tends to be a barrier or a break in capillary action, if you go from a clay to a sand to a clay?

A. In a relative sense, yes. There would be a sharp contrast in the capillary pressures between the sand and the clay.

Q. If you had gravel, it would actually break that capillary action, wouldn't it?

A. Probably.

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1 Q. You indicated that if -- you were asked  
2 questions about if the contamination gets below the  
3 clayey silt into the sand, the sand pretty --  
4 pretty much gravity controls the way water works  
5 through the sand; doesn't it?

6 A. It should.

7 Q. You'd have very little upward capillary  
8 action in comparison to the gravity?

9 A. I wouldn't think at that depth you would  
10 have very much.

11 Q. Knowing what you know about soils, if  
12 you were to have domestic wastewater that was  
13 filtered through five feet of the kinds of soils  
14 that you have at the PFS site in the upper layer,  
15 knowing what you know about the soil properties and  
16 the ability to filter, would you drink that water  
17 when it came out?

18 A. I don't think I would drink wastewater  
19 that went through five feet of any soil.

20 Q. The five feet of soil is not intended to  
21 filter that water is it, to completely remove all  
22 waste materials or contaminants?

23 A. I don't know with respect to the design  
24 criteria whether the five feet is intended to  
25 completely remove the contaminants or not.

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1 Q. But based on your experience, five feet  
2 probably would not do that?

3 A. I would not expect it to be adequate.

4 Q. Lime adds TDS, doesn't it?

5 A. Correct.

6 Q. What is TDS?

7 A. Total dissolved solids.

8 Q. That is considered to be a constituent  
9 of groundwater, usually, in some amount?

10 A. That's correct.

11 Q. And if it gets high enough levels, it is  
12 considered to be a contaminants?

13 MR. SILBERG: Excuse me. The "it" is  
14 the lime or the TDS?

15 Q. The TDS.

16 A. That is a criterion in water quality  
17 standards.

18 Q. You're familiar with the term  
19 "desiccation cracks"?

20 A. Yes, I am.

21 Q. Can those cracks exist at depth?

22 A. It depends on the depositional settings  
23 for the soils and whether or not during the time  
24 that the soil column was being deposited there was  
25 drying of the soil and creation of cracks. It

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1 depends on the depth of vadose desiccation, plant  
2 root depth penetration, which can dry the soils and  
3 cause cracking even while below ground.

4 Q. If you do have even very small  
5 desiccation cracks, water could move quite quickly  
6 through the ground; couldn't it?

7 A. It depends on the interconnection of  
8 those cracks and whether or not they form a network  
9 that has no porous medium barriers between it, if  
10 you will. If cracks are not connected, they fill  
11 with water. If they are connected, water passes  
12 through them.

13 Q. If they were connected, it would be just  
14 like running water down a small pipe, a small  
15 crack?

16 A. Well, it would be like running water  
17 into a crack and you would still have surface  
18 interactions with the walls of the fracture. That  
19 is a very dominant control on groundwater cleanup,  
20 as a matter of fact. Because in a fractured  
21 material setting, the interaction between what is  
22 dissolved in the water and what is on the walls of  
23 the cracks can be very strong. And the  
24 contamination can often end up in the soil material  
25 preferentially as opposed to in the water.

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1 Q. In your work, have you ever seen  
2 circumstances where, because of unknown geology  
3 factors, all of the sudden a contaminant shows up  
4 several hundred feet, even several miles away from  
5 where it was released?

6 MS. MARCO: Objection. I believe this  
7 is out of the scope of the redirect.

8 JUDGE FARRAR: Objection is overruled.  
9 You may answer.

10 A. I have seen that in some geologic  
11 settings. I don't think that the setting at the  
12 Skull Valley site would be typified as one where I  
13 would expect to see that occur. Places where I  
14 have seen it are typically described as bedrock  
15 sites with fractured rock and karst hydrology where  
16 groundwater flows occurs in extremely discrete  
17 features that are difficult to trace and connect.

18 Q. You have indicated that there is a  
19 variation as you look at the bore holes between  
20 different layers and angles and locations of  
21 different parts of the formation?

22 A. Yes. There is availability there.

23 Q. It is very difficult to know exactly how  
24 water would go down through the ground or  
25 horizontally? You would almost have to cut a slice

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1 across it and identify all the little pieces before  
2 you would know that, wouldn't you?

3 A. It would take --

4 MS. MARCO: I believe that is confusing.  
5 I don't understand what you mean by "cutting  
6 slices" into it. Can you restate that?

7 Q. Did you understand the question?

8 A. I did.

9 MS. MARCO: I would like to have the  
10 question restated for the clarity of the record.

11 MR. NELSON: Would you read the  
12 question? The witness said he understood the  
13 question.

14 MS. MARCO: I don't believe that is the  
15 overall criteria. We have to make sure that the  
16 record is clear, not just for our witness and for  
17 this exchange but for later on.

18 JUDGE FARRAR: Let's read it.

19 (The record was read as follows:

20 "It is very difficult to know exactly how water  
21 would go down through the ground or horizontally?  
22 You would almost have to cut a slice across it and  
23 identify all the little pieces before you would  
24 know that, wouldn't you?")

25 JUDGE FARRAR: Mr. Nelson, what did you

1 mean by "slice across it"?

2 MR. NELSON: A cross section of the  
3 geology to see what was there.

4 JUDGE FARRAR: I think that clarifies  
5 it. You may answer.

6 A. To determine exactly what path a tracer  
7 molecule in water would follow through a layered  
8 soil structure would require a great deal of data.  
9 To understand whether or not water can pass through  
10 a layered soil material or not does not require as  
11 much as understanding exact particle tracks through  
12 that volume.

13 Q. With respect to septic tank drain  
14 fields, you said you have done some reading. To  
15 your knowledge they are not designed or intended in  
16 any way to deal with chemicals or hazardous  
17 materials?

18 A. To my knowledge that would not be  
19 acceptable waste in a leach field.

20 Q. When you have materials in the ground  
21 that were either filtering or I guess we have heard  
22 the term filtering or being absorbed or reacting,  
23 once that has taken place -- there is a specific  
24 capacity for the soils to do that, is there not?

25 A. There is.

1 Q. And once you reach that capacity, you no  
2 longer have that action occurring. It is not a  
3 renewal process.

4 A. That's true. The processes of transport  
5 retardation, the slowing down of these contaminants  
6 in the liquid stream is -- it's like a  
7 chromatograph where you just slow the motion down.  
8 You don't totally stop it, in most cases. Some  
9 materials will bind permanently to soil and they  
10 won't re-dissolve. However, others, most materials  
11 will continue to migrate extremely slowly for  
12 years.

13 Q. I have no other questions.

14 JUDGE FARRAR: Does that latest exchange  
15 prompt any need for further questions?

16 MR. ROSINSKI: We have a couple  
17 questions if we may, Judge.

18 JUDGE FARRAR: Ms. Marco, you have none  
19 at this point?

20 MS. MARCO: We don't.

21 JUDGE FARRAR: Maybe this will be our  
22 last go-around.

23 FURTHER RECROSS EXAMINATION

24 BY MR. ROSINSKI:

25 Q. Mr. Ketelle, would you expect that the

1 wetting of the desiccation cracks by any flow that  
2 may enter them would cause them to close because of  
3 the swelling of --

4 A. Yes, it could. Desiccation cracks could  
5 close back up upon rewetting of the soil.

6 Q. Because that's how they were formed; by  
7 water?

8 A. Right.

9 Q. Also, would you expect soil that is  
10 carried, any soil particle that is carried in the  
11 flow into these cracks to act to plug these cracks?

12 A. It would more likely prop the crack open  
13 than close it, because soils that are prone to  
14 desiccation cracking are usually very fine in grain  
15 size themselves; and a particle that would move  
16 into it is more likely to be a silt or sand  
17 particle which would not necessarily seal it or  
18 plug it.

19 Q. But eventually if enough flow went  
20 through there and enough particles entered it, it  
21 would fill with those particles?

22 A. It could, yes.

23 Q. Thank you.

24 JUDGE FARRAR: That doesn't trigger any  
25 need by anybody for further questions?

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1                   Mr. Ketelle, we thank you for your  
2 testimony, and you were excused temporarily. Is it  
3 possible we would need him by phone tomorrow or by  
4 phone later?

5                   THE WITNESS: I will be here until 2:00  
6 tomorrow. I have a 4:55 airplane. So I can be  
7 here until about 2:00 tomorrow.

8                   MR. SILBERG: Can we go off the record?

9                   JUDGE FARRAR: Yes.

10                   (A break was taken.)

11                   JUDGE FARRAR: We are back on the record  
12 at five to 1:00. The parties have been consulting  
13 during a rather lengthy break. Mr. Silberg?

14                   MR. SILBERG: Yes. The State and the  
15 Applicant have, for the past several weeks, been  
16 discussing the possibilities of settling this  
17 contention. We believe that we have just come to  
18 an agreement of the minds. What we'd like to do is  
19 put on the record the general terms. We have not  
20 reduced all of this to writing, although much of it  
21 has been reduced to writing. And the general  
22 concept would be that there will be a settlement  
23 agreement between the Applicant and the State that  
24 reflects certain commitments with respect to  
25 groundwater monitoring.

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1                   The State will withdraw the contention,  
2                   as has been the case with other contentions that  
3                   have been settled. The general structure of the  
4                   settlement agreement is that we will install, on a  
5                   phase basis, an upgradient monitoring well as each  
6                   phase is built. That upgradient well will be  
7                   sampled on at least a quarterly basis for a series  
8                   of potential pollutants and water quality items.  
9                   That upgradient sampling may be discontinued if  
10                  none of these analytes are detected after eight  
11                  quarters.

12                  Private Fuel Storage will install a  
13                  series of downgradient monitoring wells, again on a  
14                  phased basis. Those wells and the location of  
15                  those wells will be specified in the agreement.  
16                  And they will be or that location may be adjusted  
17                  as necessary once groundwater flow direction has  
18                  been determined. As the site is expanded,  
19                  additional downgradient monitoring wells will be  
20                  installed, as well as an up- gradient monitoring  
21                  well. The standards for construction of those  
22                  wells is specified. The nature of the sampling to  
23                  be performed downgradient is also specified, as is  
24                  the rate of sampling.

25                  There is a recognition that once wells

1 are included within the security zone, that  
2 sampling shall be reduced in order to stay within  
3 the allowed requirements for radiation exposure.  
4 In the event elevated levels of these contaminants  
5 are determined through the sampling process, there  
6 will be an assessment, an investigation and  
7 assessment of those elevated levels.

8 If there should be problems with the  
9 septic drain field, there will be an agreement that  
10 we will assess and correct those problems, should  
11 they occur. There is an agreement that data  
12 collected through the sampling program shall be  
13 provided through the Skull Valley Band to the state  
14 of Utah. And I guess finally there will be a  
15 statement in there that nothing in here deals with  
16 the question of whose jurisdiction applies to the  
17 activities on the site. So there's no concession  
18 one way or the other that any of this would confer  
19 or not confer jurisdiction on the state of Utah.

20 MR. NELSON: You want to address the  
21 permeability on the detention pond?

22 MR. SILBERG: Okay. We will also  
23 include a provision that says the subsurface  
24 materials and the pad area, which in another  
25 contention will be discussed at length, the soil

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1 cement, will have at least the permeability of the  
2 materials that line or comprise the detention pond.

3 MR. NELSON: I believe the  
4 representation was that it was .09 inches per day  
5 was what they were going to use the natural soils  
6 to put in a layer that is at least that permeable  
7 and it will have a cover of soils to protect  
8 against the frost heave in that part of it.

9 And then I believe there was one part  
10 that we discussed. There will be sampling of any  
11 water in the retention pond for not only  
12 radiologics but also any of the materials that they  
13 have on site in significant quantities. We don't  
14 want just the can of pesticide spray, but anything  
15 they have on site in significant quantities.

16 I believe that's where we are. And I  
17 know that it's not been reduced to writing and we  
18 run some risk, but hopefully we can get this put  
19 into writing and it will resolve this contention.

20 JUDGE FARRAR: Before I say anything  
21 about it, does the Staff have any or were you  
22 involved in the negotiations?

23 MS. MARCO: Your Honor, Staff was not  
24 involved in those negotiations. It does sound like  
25 each of these provisions go in the more

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1 conservative direction toward environmental  
2 impacts. That being the case, I would generally  
3 tend to agree with that because it goes beyond what  
4 the Staff had in as its mitigation measures and  
5 with respect to the final environmental impact  
6 statement. And it does not look like it would  
7 impose any sort of work on the Staff that we would  
8 have to look and see what we would need to do with  
9 respect to it.

10 JUDGE FARRAR: I appreciate that, Ms.  
11 Marco. And again, the Board wants to compliment  
12 you two gentlemen and your clients for coming to  
13 what sounds, as Ms. Marco described, like an  
14 agreement that will advance environmental  
15 protection, serve the interests of the people of  
16 the state, and you still have to put it in writing  
17 but it sounds like that should not be too  
18 formidable a task. If it proves to be too  
19 formidable a task, call on us and we will resume  
20 the hearing. But I think, from knowing you  
21 gentlemen and your clients, that this should work  
22 out and we appreciate the effort you have put in to  
23 make it happen.

24 We thank all the witnesses. Sometimes  
25 the parties can't settle until the witnesses say

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1 their piece. Mr. Ostler, you didn't get to  
2 testify.

3 MR. OSTLER: I don't feel offended.

4 MR. SILBERG: We didn't get the pleasure  
5 of cross-examining.

6 JUDGE FARRAR: But I'm sure that the  
7 fact that your testimony was in there influenced  
8 everybody. So even though you didn't get to take  
9 the stand --

10 JUDGE LAM: I had a question waiting for  
11 you, Mr. Ostler.

12 MR. OSTLER: I'm sure you did.

13 JUDGE FARRAR: Now, the question on the  
14 limited appearances tonight. Do you want me to  
15 mention or not mention this? What I had planned to  
16 say -- are you a member of the press?

17 MR. SILBERG: No, she's not.

18 MR. NELSON: She is from our office.

19 JUDGE FARRAR: What I intended to say  
20 was that we were in hearings in Salt Lake City.

21 MR. SILBERG: I think that's adequate.

22 MR. NELSON: That would be better.

23 JUDGE FARRAR: Okay. I will say that.  
24 Then we will not resume tomorrow.

25 MR. SILBERG: One question. Can we go

1 off the record?

2 JUDGE FARRAR:

3 (Discussion off the record.)

4 JUDGE FARRAR: Then we will have no  
5 session here tomorrow and we will, as originally  
6 contemplated, we will start the seismic hearings  
7 back at the Sheraton at nine o'clock Monday  
8 morning. And thank you all for your contributions  
9 you have made litigating and now resolving this  
10 issue.

11

12 (The proceeding was concluded

13 for the day at 1:10 p.m.)

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**CERTIFICATE**

This is to certify that the attached proceedings  
before the United States Nuclear Regulatory Commission  
in the matter of:

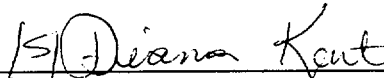
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Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

were held as herein appears, and that this is the  
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