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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

E X H I B I T S

April 26, 2002 9:00 a.m.

P R O C E E D I N G S

JUDGE FARRAR: Good morning everyone. We're here to resume the hearing on the State's hydrology contention. It's a few minutes after 9:00 and the parties were conferring on some matters, but we're now ready to start. Dr. Liang, Mr. Lewis, you're still under oath.

MS. MARCO: Before we start, Staff wants to raise a small housekeeping issue. Yesterday I don't believe that the Board or the parties were informed that we do have a witness unavailability matter that if the proceeding extends beyond 2:00 p.m. on Saturday, our witness would be unavailable. But having discussed this informally with counsel for PFS and counsel for the State, that does not appear to be an issue at this time.

JUDGE FARRAR: You think we will finish?

MS. MARCO: I don't know what's in the cross-examination, but I understand that it would finish by then.

JUDGE FARRAR: If we're not finished, would the parties want to take that witness out of

order?

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

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

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

MS. MARCO: Thank you.

JUDGE FARRAR: Thank you. Mr. Nelson.

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

JUDGE FARRAR: What about 158?

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

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

MR. SILBERG: Yes, sir.

JUDGE FARRAR: Ms. Marco?

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

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

MR. NELSON: It is. I understand --

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

can draw from this for non-radiological?

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

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

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

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

MR. NELSON: Thank you.

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

MS. MARCO: Thank you.

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

JUDGE FARRAR: Go ahead, Mr. Nelson.

CROSS-EXAMINATION (Resumed)

BY MR. NELSON:

Q. Mr. Lewis, good morning.

MR. LEWIS: Good morning.

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

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

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

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

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

MR. LEWIS: I'm just only estimating,

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

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

DR. LIANG: Page 14.

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

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

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

DR. LIANG: Yes.

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

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

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

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

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

DR. LIANG: I would say so.

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

DR. LIANG: Yes, in three different samples.

Q. In your review and in arriving at your

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

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

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

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

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

MR. SILBERG: Thank you.

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

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

MR. LEWIS: No.

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

MR. SILBERG: Is that included within Exhibit 161?

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

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

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

Q. Mr. Liang, Dr. Liang --

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

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

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

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

Q. So if you have laid down, placed some

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

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

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

DR. LIANG: I would believe so, yes.

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

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

Q. The .09 inches per day --.

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

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

JUDGE FARRAR: New from dessication cracks?

MR. NELSON: Yes.

JUDGE FARRAR: I hate to interrupt you --

MR. NELSON: That's fine.

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

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

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

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

JUDGE FARRAR: Go ahead.

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

MR. LEWIS: Yes, it is.

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

MR. LEWIS: The .09?

Q. Yes.

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

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

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

Q. But if you bring those soils to the

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

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

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

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

Q. You really don't know by looking at

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

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

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

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

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

MR. LEWIS: I suppose.

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

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

evaporation rates?

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

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

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

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

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

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

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

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

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

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

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

MR. LEWIS: I'm not.

Q. Dr. Liang?

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

Q. Field capacity.

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

Q. Thank you.

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

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

MR. LEWIS: Yes, I do.

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

DR. LIANG: Yes.

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

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

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

MR. LEWIS: Yes.

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

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

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

MR. LEWIS: Of the drain field?

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

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

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

Wouldn't it be useful information to

know that there was no contamination coming from the site?

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

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

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

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

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

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

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

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

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

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

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

MR. LEWIS: No, not necessarily.

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

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

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

MR. LEWIS: Right now in the

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

MR. NELSON: I have no other questions.

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

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

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

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

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

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

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

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

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

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

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

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

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

(The Board conferred off the record.)

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

Back when I was on the Appeal Board I

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

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

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

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

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

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

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

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

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

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

But--

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

(Off the record.)

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

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

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

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

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

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

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

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

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

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

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

MR. LEWIS: Right.

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

MR. LEWIS: Earthen berm.

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

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

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

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

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

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

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

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

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

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

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

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

DR. LIANG: Similar --

JUDGE FARRAR: Are they lining their detention ponds?

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

JUDGE FARRAR: Mr. Lewis?

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

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

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

prevent that situation?

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

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

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

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

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

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

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

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

JUDGE FARRAR: Dr. Liang, anything to

add on?

DR. LIANG: No, I am not.

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

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

DR. LIANG: Good morning.

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

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

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

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

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

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

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

JUDGE LAM: Okay, thank you.

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

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

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

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

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

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

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

MR. LEWIS: All I can give you --

JUDGE LAM: More than moist.

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

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

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

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

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

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

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

JUDGE KLINE: Okay. Thank you.

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

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

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

MR. LEWIS: That's correct.

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

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

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

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

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

expertise?

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

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

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

have to chase it down through a sump system.

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

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

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

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

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

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

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

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

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

MR. NELSON: That's all I have.

JUDGE FARRAR: Mr. Silberg, any redirect?

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

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

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

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

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

MR. NELSON: That would be fine.

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

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

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

RICHARD H. KETELLE,

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

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.

MS. MARCO: Okay.

(A break was taken.)

DIRECT EXAMINATION

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

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

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

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

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

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

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

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

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

A. Yes. There was one other clarification

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

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

MR. KETELLE: 3 millimeters per day.

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

A. Yes, it does.

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

A. Yes, it is.

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

JUDGE FARRAR: Any objection?

MR. SILBERG: No, sir.

MR. NELSON: No objection.

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

(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^2 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 CLEARLY 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 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 5×10^{-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. <u>Basis 2: Contaminant Pathways - Retention Pond</u>

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 ~~toby~~ to 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 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.

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

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

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

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

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

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

MR. SILBERG: We have no objection.

MR. NELSON: No objection.

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

(STAFF EXHIBIT-F MARKED AND ADMITTED.)

JUDGE FARRAR: Mr. Ketelle, before we

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

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

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

MS. MARCO: That's fine.

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

(Recess taken.)

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

THE WITNESS: That is correct. In the third paragraph about halfway down where you see 1.2 x 10-6 centimeters per second?

JUDGE FARRAR: Right.

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

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

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

JUDGE FARRAR: All right.

CROSS EXAMINATION

BY MR. ROSINSKI:

Q. Good morning, Doctor. How are you?

A. Good morning.

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

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

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

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

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

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

A. Yes. I believe in general it is.

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

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

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

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

Q. Would this correction in any way change your conclusion in answer 22 of your prefiled testimony that there is a very low likelihood that activities associated with the 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?

A. No, it would not change that conclusion.

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

A. No.

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

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

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

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

CROSS-EXAMINATION

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

with them.

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

A. Right.

Q. And that has involved groundwater monitoring?

A. That's correct.

Q. Did that involve groundwater monitoring for nonradiologics?

A. Yes, it does.

Q. Both radiologics and nonradiologics?

A. That's correct.

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

A. I was here.

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

A. Yes.

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

A. Yes, I am.

Q. And you're familiar with the locations

of the septic tank drain fields?

A. As proposed at the present time.

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

A. Yes, I did.

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

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

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

A. Not for this project.

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

A. Yes, I have.

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

A. In most cases it is.

Q. Why is that the case?

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

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

A. That's correct.

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

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

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

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

A. That's correct.

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

A. That's true.

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

A. That's correct.

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

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

Q. Would you agree that the wastewater

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

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

Q. If I could refer you to page 5 of your prefiled testimony, you indicate there that at the bottom of the page, "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 the chemical interactions between the effluent and the soil."

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

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

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

the middle of the paragraph there it says, "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 tanks with the EPA" --

MR. SILBERG: You mean septic fields?

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

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

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

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

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

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

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

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

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

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

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

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

MR. KETELLE: Yes.

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

A. Yes, I have.

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

A. I do.

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

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

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

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

Q. Does moisture affect the capillary potential?

A. Yes, it does.

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

A. That's true.

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

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

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

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

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

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

A. Yes, I do.

Q. Would you explain that, please.

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

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

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

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

A. Correct.

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

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

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

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

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

A. Excess water drains by gravity.

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

A. It would probably not be.

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

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

A. I see it.

Q. "A contaminate 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." Based on your review of the soils information for the site, there is some variation in that levels, isn't there?

A. Yes, there is.

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

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

Q. So it varies depending on the site?

A. Yes, it does.

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

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

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

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

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

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

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

A. That's my understanding of the

applicant's plans.

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

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

Q. In the detention pond?

A. Yes.

Q. What constituents did they agree to sample for?

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

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

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

A. I heard that.

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

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

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

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

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

A. That's correct.

Q. Which materials, what types of materials?

A. No specific materials have been identified.

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

A. That is correct.

Q. If I could refer you to your prefiled testimony on page -- again on page 12, the answer to A17, you say, "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?

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

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

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

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

Q. What kinds of materials does a cement

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

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

Q. Lime?

A. Lime.

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

A. That's correct.

Q. -- slow connection?

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

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

evapotranspiration map, and ask you some questions concerning that.

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

MR. NELSON: It is a new subject.

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

(A break was taken.)

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

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

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

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

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

A. That's correct.

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

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

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

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

Q. What percentage would you put on the

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

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

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

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

Q. Do you have a range of estimate?

A. No, I don't.

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

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

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

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

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

A. That could occur.

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

A. Yes.

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

A. No.

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

A. That's my understanding.

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

evaporation is less than it would be in the summer?

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

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

A. That's correct.

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

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

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

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

MR. SILBERG: I believe so.

JUDGE FARRAR: Let's hear the question again.

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

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

MR. SILBERG: Thank you.

Q. (By Mr. Nelson) If we can turn to Page 14 of your prefiled testimony, beginning on the answer to Question 21. Part way down through the paragraph you state there that, "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." When you look at the design of a facility and evaluate the potential for groundwater contamination, you look at the water directly under the site, don't you? You don't just design it to keep it from getting 11

miles away.

A. That's right.

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

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

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

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

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

JUDGE FARRAR: Let's read it back.

(The record was read as follows:

"If we can turn to Page 14 of your prefiled testimony, beginning on the answer to Question 21. Part way down through the paragraph you state there that, '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.' when you look at the design of a facility and evaluate the potential for groundwater contamination, you look at the water directly under the site, don't you? You don't just design it to keep it from getting 11 miles away.")

A. That's correct.

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

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

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

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

A. Yes. It relates back to that question.

Q. If I could refer you to your prefiled testimony on Page 10. In the answer to Question 12 you refer to a pump test. If I can read the sentence, it says, "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." That really wasn't a pump test, was it? It was a slug test.

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

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

aquifer, doesn't it?

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

Q. So you called it a pump --

A. A pump-in.

Q. A pump-in test?

A. Instead of a pump-out test.

Q. So this was a pump-in test?

A. Correct.

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

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

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

A. That's correct.

Q. It did not determine the permeability of

the soils above that?

A. That is correct.

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

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

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

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

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

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

MR. NELSON: I believe the document is --

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

Go ahead and answer.

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

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

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

A. Yes, I have been.

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

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

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

downgradient comparison with the quality of the groundwater?

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

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

A. Correct.

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

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

JUDGE FARRAR: Read the question back, please.

(The record was read as follows:

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

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

JUDGE FARRAR: The objection is overruled.

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

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

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

Q. Is that because of expense?

A. In part.

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

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

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

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

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

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

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

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

Q. Excuse me. Maybe that was another --

A. It was another witness.

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

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

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

A. I think that's probably right.

Q. I have no other questions.

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

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

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

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

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

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

THE WITNESS: No, I'm not.

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

THE WITNESS: No, I'm not.

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

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

MR. KLINE: Define that.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

THE WITNESS: Right.

MR. KLINE: Okay.

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

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

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

vadose flow again from there.

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

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

JUDGE KLINE: Okay.

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

MR. KLINE: Right. Okay. Thank you.

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

THE WITNESS: Fourth paragraph?

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

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

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

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

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

THE WITNESS: I am afraid I can't answer

that question.

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

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

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

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

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

JUDGE LAM: Okay. Thank you.

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

THE WITNESS: Not at this site.

MR. KLINE: Roughly the --

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

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

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

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

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

THE WITNESS: Oh, yes. In the transport

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

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

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

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

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

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

THE WITNESS: Well, the oxygen that it

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

JUDGE FARRAR: Mr. --

MR. ROSINSKI: Thank you, judge.

JUDGE FARRAR: How much do --

MR. ROSINSKI: Just a couple questions.

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

JUDGE FARRAR: Yes.

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

JUDGE FARRAR: I'm sorry.

MS. MARCO: So it's my turn.

JUDGE FARRAR: Right.

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

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

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

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

finish him today? Is that of benefit to him?

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

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

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

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

MS. MARCO: Yes. Sure.

JUDGE FARRAR: Go ahead.

REDIRECT EXAMINATION

BY MS. MARCO:

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

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

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

A. Yes.

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

A. No.

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

A. Yes.

Q. And what was the reason for that?

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

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

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

in my experience.

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

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

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

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

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

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

Q. On Page 5 of your testimony, I believe a question came up regarding fine-grained -- in the sentence is says, "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." And would you need a site-specific test to make that assertion?

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

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

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

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

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

depending on evapotranspiration stresses on the moisture content.

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

A. No.

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

A. No.

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

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

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

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

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

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

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

Q. And your basis for that conclusion?

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

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

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

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

A. Probably.

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

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

Q. Do the sands filter?

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

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

Q. Okay. Hold on one second, please.

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

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

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

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

MS. MARCO: Darn.

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

MR. ROSINSKI: Thank you, Judge.

RECROSS EXAMINATION

BY MR. ROSINSKI:

Q. Referring back to the questions from

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

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

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

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

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

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

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

A. No. I did not say that.

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

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

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

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

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

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

Q. So you considered both processes in your analysis?

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

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

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

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

Q. But you have identified none of those?

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

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

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

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

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

A. No preferential pathway?

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

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

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

for that postulated connection?

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

Q. Why is that not a crux issue?

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

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

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

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

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

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

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

MS. MARCO: Okay. I see it.

JUDGE FARRAR: Go ahead.

A. Can you rephrase your question, please?

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

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

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

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

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

A. Well, my expectation based on the amount

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

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

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

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

A. Not based on knowledge to date.

Q. Okay. Thank you. Nothing further.

JUDGE FARRAR: Any recross, Mr. Nelson?

RECROSS EXAMINATION

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.

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

A. It should.

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

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

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

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

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

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

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

A. I would not expect it to be adequate.

Q. Lime adds TDS, doesn't it?

A. Correct.

Q. What is TDS?

A. Total dissolved solids.

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

A. That's correct.

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

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

Q. The TDS.

A. That is a criterion in water quality standards.

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

A. Yes, I am.

Q. Can those cracks exist at depth?

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

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

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

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

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

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

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

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

JUDGE FARRAR: Objection is overruled. You may answer.

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

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

A. Yes. There is availability there.

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

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

A. It would take --

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

Q. Did you understand the question?

A. I did.

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

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

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

JUDGE FARRAR: Let's read it.

(The record was read as follows:

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

JUDGE FARRAR: Mr. Nelson, what did you

mean by "slice across it"?

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

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

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

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

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

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

A. There is.

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

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

Q. I have no other questions.

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

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

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

MS. MARCO: We don't.

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

FURTHER RECROSS EXAMINATION

BY MR. ROSINSKI:

Q. Mr. Ketelle, would you expect that the

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

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

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

A. Right.

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

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

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

A. It could, yes.

Q. Thank you.

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

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

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

MR. SILBERG: Can we go off the record?

JUDGE FARRAR: Yes.

(A break was taken.)

JUDGE FARRAR: We are back on the record at five to 1:00. The parties have been consulting during a rather lengthy break. Mr. Silberg?

MR. SILBERG: Yes. The State and the Applicant have, for the past several weeks, been discussing the possibilities of settling this contention. We believe that we have just come to an agreement of the minds. What we'd like to do is put on the record the general terms. We have not reduced all of this to writing, although much of it has been reduced to writing. And the general concept would be that there will be a settlement agreement between the Applicant and the State that reflects certain commitments with respect to groundwater monitoring.

The State will withdraw the contention, as has been the case with other contentions that have been settled. The general structure of the settlement agreement is that we will install, on a phase basis, an upgradient monitoring well as each phase is built. That upgradient well will be sampled on at least a quarterly basis for a series of potential pollutants and water quality items. That upgradient sampling may be discontinued if none of these analytes are detected after eight quarters.

Private Fuel Storage will install a series of downgradient monitoring wells, again on a phased basis. Those wells and the location of those wells will be specified in the agreement. And they will be or that location may be adjusted as necessary once groundwater flow direction has been determined. As the site is expanded, additional downgradient monitoring wells will be installed, as well as an up- gradient monitoring well. The standards for construction of those wells is specified. The nature of the sampling to be performed downgradient is also specified, as is the rate of sampling.

There is a recognition that once wells

are included within the security zone, that sampling shall be reduced in order to stay within the allowed requirements for radiation exposure. In the event elevated levels of these contaminants are determined through the sampling process, there will be an assessment, an investigation and assessment of those elevated levels.

If there should be problems with the septic drain field, there will be an agreement that we will assess and correct those problems, should they occur. There is an agreement that data collected through the sampling program shall be provided through the Skull Valley Band to the state of Utah. And I guess finally there will be a statement in there that nothing in here deals with the question of whose jurisdiction applies to the activities on the site. So there's no concession one way or the other that any of this would confer or not confer jurisdiction on the state of Utah.

MR. NELSON: You want to address the permeability on the detention pond?

MR. SILBERG: Okay. We will also include a provision that says the subsurface materials and the pad area, which in another contention will be discussed at length, the soil

cement, will have at least the permeability of the materials that line or comprise the detention pond.

MR. NELSON: I believe the representation was that it was .09 inches per day was what they were going to use the natural soils to put in a layer that is at least that permeable and it will have a cover of soils to protect against the frost heave in that part of it.

And then I believe there was one part that we discussed. There will be sampling of any water in the retention pond for not only radiologics but also any of the materials that they have on site in significant quantities. We don't want just the can of pesticide spray, but anything they have on site in significant quantities.

I believe that's where we are. And I know that it's not been reduced to writing and we run some risk, but hopefully we can get this put into writing and it will resolve this contention.

JUDGE FARRAR: Before I say anything about it, does the Staff have any or were you involved in the negotiations?

MS. MARCO: Your Honor, Staff was not involved in those negotiations. It does sound like each of these provisions go in the more

conservative direction toward environmental impacts. That being the case, I would generally tend to agree with that because it goes beyond what the Staff had in as its mitigation measures and with respect to the final environmental impact statement. And it does not look like it would impose any sort of work on the Staff that we would have to look and see what we would need to do with respect to it.

JUDGE FARRAR: I appreciate that, Ms. Marco. And again, the Board wants to compliment you two gentlemen and your clients for coming to what sounds, as Ms. Marco described, like an agreement that will advance environmental protection, serve the interests of the people of the state, and you still have to put it in writing but it sounds like that should not be too formidable a task. If it proves to be too formidable a task, call on us and we will resume the hearing. But I think, from knowing you gentlemen and your clients, that this should work out and we appreciate the effort you have put in to make it happen.

We thank all the witnesses. Sometimes the parties can't settle until the witnesses say

their piece. Mr. Ostler, you didn't get to testify.

MR. OSTLER: I don't feel offended.

MR. SILBERG: We didn't get the pleasure of cross-examining.

JUDGE FARRAR: But I'm sure that the fact that your testimony was in there influenced everybody. So even though you didn't get to take the stand --

JUDGE LAM: I had a question waiting for you, Mr. Ostler.

MR. OSTLER: I'm sure you did.

JUDGE FARRAR: Now, the question on the limited appearances tonight. Do you want me to mention or not mention this? What I had planned to say -- are you a member of the press?

MR. SILBERG: No, she's not.

MR. NELSON: She is from our office.

JUDGE FARRAR: What I intended to say was that we were in hearings in Salt Lake City.

MR. SILBERG: I think that's adequate.

MR. NELSON: That would be better.

JUDGE FARRAR: Okay. I will say that. Then we will not resume tomorrow.

MR. SILBERG: One question. Can we go

off the record?

JUDGE FARRAR:

(Discussion off the record.)

JUDGE FARRAR: Then we will have no session here tomorrow and we will, as originally contemplated, we will start the seismic hearings back at the Sheraton at nine o'clock Monday morning. And thank you all for your contributions you have made litigating and now resolving this issue.

(The proceeding was concluded for the day at 1:10 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Private Fuel Storage, LLC

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 original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

/s/ Diana Kent

Diana Kent
Official Reporter
Neal R. Gross & Co., Inc.